RAILROAD RESEARCH INFORMATION SERVICE

SPECIAL BIBLIOGRAPHY: SAFETY-RELATED TECHNOLOGY

March 1973

RRIS

DEPARTMENT OF TRANSPORTATION ★ UNITED STATES OF AMERICA ★

National Research Council ● National Academy of Sciences

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BACKGROUND

The Railroad Research Information Service (RRIS) is being developed within the Division of Engineering of the National Research Council under contract to the Federal Railroad Administration of the U.S. Department of Transportation.

The scope of RRIS includes information on the planning, building, maintenance, and operation of rail transportation systems. A primary objective is to acquire and select information that will be timely and useful to all those who have need for railroad research information. Two types of information are stored in the RRIS file: resumes of ongoing and recently completed projects, and abstracts of reports and articles that are within the RRIS scope and objectives.

In addition to acquisition and selection, RRIS work includes the classification, indexing, storage, retrieval, and dissemination of resumes and abstracts. Operational concepts and procedures are parallel to those of other transportation research information services within the National Research Council, namely the Highway Research Information Service (HRIS) and the Maritime Research Information (MRIS).

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Railroad Research Information Service

SPECIAL BIBLIOGRAPHY:

SAFETY-RELATED TECHNOLOGY

This publication contains 1,929 abstracts of journal articles and research reports provided to RRIS by the Federal Railroad Administration. These abstracts are primarily in the subject areas of Track Structure, Train-Track Dynamics, and Vehicles and Components.

RRIS Publication No. 73S1

Railroad Research Information Service

National Research Council

National Academy of Sciences ● National Academy of Engineering

Washington, D.C. March 1973

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Where no availability is specified, it is suggested that the user consult an established transportation library.

Copies of research reports referred to in this publication are NOT available from the Railroad Research Information Service.

RRIS Publication No. 73S1

Special Bibliography:
Safety-Related Technology

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at no charge, while supply lasts, from:

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Contents

Foreword

This special bibliography makes available to the railroad research community a collection of abstracts, gathered by the Federal Railroad Administration, of reports and articles on Track Structure, Train-Track Dynamics, and Vehicle and Component Design.

The material in this special bibliography differs in several ways from that which will appear in the RRIS Bulletin to be issued on a regular basis in the future. The RRIS Bulletin will cover railroad research information on a current basis and with the aim of including material over the full range of RRIS subject areas. The material in this special bibliography, however, focuses on three subject areas of critical importance to railroad safety: Track Structure, Train-Track Dynamics, and Vehicle and Component Design. Also, this special bibliography abstracts research reports and articles on completed projects only, whereas the RRIS Bulletin will include a section on ongoing research and development. It is expected that the first regular issue of the RRIS Bulletin will be published in the summer of 1973.

Abstract Content

Abstracts are listed according to an eight-digit code. The first two digits are used to place the abstracts in the proper subject areas according to the RRIS classification scheme as listed on page viii. These first two digits appear at the top of the pages in the Abstracts section of this publication. The last six digits are used to arrange the abstracts within a subject area. In general there are gaps between the numbers of successive abstracts. The title of the document is given immediately after the six-digit reference number. The other elements are as defined in the following paragraphs.

AUTHOR: Surname and initials of the author and coauthors of the report, along with their organizational affiliations, if given.

PUBLICATION SOURCE: Name of the source publication, together with the name and address of the publisher. Where appropriate, the name and address of the corporate author is given.

PUBLICATION DATA: Data that further identify the publication and provide bibliographic information such as the report type, the report number, and the number of pages, figures, tables, references, and appendixes in the report.

SUPPLEMENTARY NOTES: Additional information pertaining to the document.

ABSTRACT: A description or condensation of the information in the source document. Abstracts contain details about the important elements of the document. Abstracts prepared by the author of the report are identified by the word "author" at the end of the abstract.

AVAILABILITY: Information required for the user to obtain a copy of the source document. This information includes the name and address to which the user should write, the document number, and the price. See page ii for information regarding publications available from NTIS.

Sample Abstract

Reference number →	039112
Title →	STUDY OF NEW TRACK STRUCTURE DESIGNS
Author →	Bhatia, GS, Romualdi, JP, Thiers, GR
Publication source →	Carnegie-Mellon University, Transportation Research Institute, Pittsburgh, Pennsylvania
Publication data →	Mar. 1968, 103 pp
Supplementary notes →	Contract C-222-66
Abstract →	The effect of an abrupt change in elastic foundation properties upon the motion of a high speed vehicle is detailed in this study. Limiting allowable accelerations are chosen as the criteria for riding quality. The study indicates that there is a likelihood of encountering a variety of elastic soil combinations which can seriously deteriorate the riding qualities of a rail vehicle on conventional track. As remedial measures, two alternatives are considered to improve the quality of ride; one by improving the rigidity of the track structure by means of providing a track structure utilizing narrow vertical walls embedded in the subsoil, and the other by carefully compacting the foundation soil to minimize local variations. A study is also made to evaluate the relative economics of the alternatives. (Author)
Availability →	TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO: National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia, 22151: Repr PC, $6.40: Microfiche, $0.95 PB-179401

RRIS Classification Scheme

01	Track and Structures
02	Train-Track Dynamics
03	Vehicles and Components
04	Propulsion Systems
05	Braking Systems
06	Signals, Control, and Communications
07	Human Factors
08	Rail-Highway Grade Crossings
09	Materials Science
10	Environmental Protection
11	Advanced Systems
12	Safety

20	Freight Transport Demand Analysis
21	Freight Operations
22	Logistics and Physical Distribution
23	Passenger Operations
24	Industry Structure and Company Management
25	Government Policy, Planning, and Regulation
26	Bibliography and Documentation

Definitions and Abbreviations

AAR	Association of American Railroads
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
DOT	Department of Transportation (U.S.)
EI	Engineering Index
Fig	Figures
FRA	Federal Railroad Administration
IEEE	Institute of Electrical and Electronic Engineers
Microfiche	A negative resulting from photoreduction of original document requiring special equipment for reading
N	Number of the serial publication
NAE	National Academy of Engineering
NAS	National Academy of Sciences
NRC	National Research Council
NTIS	National Technical Information Service (formerly the Clearinghouse for Federal Scientific and Technical Information)
PB	Prefix identifying an NTIS accession number
Phot	Photographs
Ref	References
Repr PC	Reproduced paper copy of original document
RPI	Railway Progress Institute
Rpt	Report
Req Price	Price on Request
Tab	Tables
UIC	International Union of Railways
UMTA	Urban Mass Transportation Administration

030512
TEST CAR PROGRAM SECOND PROGRESS REPORT

Hurley, FJ, Melpar Incorporated
Goeser, JN, Melpar Incorporated
Koch, BR, Melpar Incorporated
McConnell, PJ, Melpar Incorporated

Federal Railroad Administration, 400 7th Street, SW, Washington, D.C., 20590

FRA-RT-71-48, Prog Rpt, 6812-6907, Sept. 1970, 177 pp, 50 Fig, 2 Tab, 13 Phot, 4 App

Developments such as a new signal conditioner for the gauge sensors, a magnetic pulser for improved speed and distance measurement, and new sensor configurations were aimed at increasing the accuracy and reliability of track measurements. Improvements in overall system performance results from the development of special-purpose calibration devices, modifications to existing electronic circuitry, a more extensive use of selective filtering, and use of accelerometers which withstood the rough environment. Data processing techniques and displays were also modified to make better use of the data being collected and to present it in a convenient form for operating personnel. The design and development of an onboard digital data acquisition system is a distinct technological innovation with the ultimate purpose of improving the performance of the existing track geometry measurement system. Research during this period was conducted to provide data as input to other independent studies. These included data-collection runs to support the joint D.O.T./C&O-B&O RR Program, validation runs to verify the General Electric Pantograph-catenary simulation model and the Melpar rail car simulation model, track survey runs, ride quality studies, and Southern rail car roll oscillation studies.

033070
SHEAR STRENGTH OF ROCKS IN-SITU ALONG WEAK PLANES–CASE OF SCHIST, MUDSTONE AND GRANITE

Kobayashi, Y, Japanese National Railways
Iizuka, A, Japanese National Railways
Kumagai, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp7-8

The strength of a rock in-situ essentially differs from that of a rock specimen of laboratory size. It was presumed that the rock in situ is weaker than the rock specimen of laboratory size, since the former contains many weak planes, and the experiments were prepared mainly to obtain the shear strength of the rock in situ along a weak plane.

033072
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN

Satoh, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp39-41

The article discusses problems of railway track structure for high speed trains. The topics include axial pressure of long welded rail, rail welding, the ignition of creosoted bridge sleepers, the impact coefficient of steel bridges, and a rail defect inspection car.

033075
PROPANE GAS PRESSURE WELDING OF RAILS

Aoyama, S, Japanese National Railways
Kawashima, M, Japanese National Railways
Hiruma, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 3, Quart Rpt, Sept. 1966, p23

For practical development of propane gas pressure welding of rails with propane-oxygen flame, the heating burner and gas system were developed; the standard work procedure was formulated resulting in fully reliable welds.

033078
DATA HANDLING MACHINE FOR THE NO. 2 TRACK INSPECTION CAR OF THE NEW TOKAIDO LINE

Nakamura, I, Japanese National Railways
Wada, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 3, Quart Rpt, Sept. 1966, pp47-50, 5 Ref

To make some maintenance plans from the results of measurement of track irregularities, some statistical treatment of data becomes necessary. For this purpose a high performance electronic data handling machine was installed to the No. 1 track inspection car of the new Tokaido Line. In the case of periodical maintenance of the No. 1 track inspection car, the No. 2 inspection car is to be used.

033081
STUDY ON THE TALUS DISASTER OF RAILWAY CUTTING–STATISTICAL ANALYSIS OF THE QUESTIONNAIRE ON DISASTER OF RAILWAY

Takahashi, H, Japanese National Railways
Shimizu, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 4, Quart Rpt, Dec. 1966, pp20-24, 1 Ref

Talus disasters by typhoon or heavy rainfall come up to a half of the annual total number of disasters in JNR, and thus prevention of talus disaster is the most important problem for the operation of railway, as well as a social and economical problem. Since it is a very substantial subject, the strength of talus against precipitation and the effect of protection works of talus would be estimated by measurable quantities.

033091
STRESSES AT RAIL JOINTS AS INFLUENCED BY BOLT HOLES

Koyama, K, Japanese National Railways
Sasaki, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Sept. 1960, pp45-49

The failures of rails caused by bolt holes of joints (end breaks) have recently come to occupy the majority of rail breaks. In order to prevent such breaks it was customary to reduce the diameter of the bolt holes or to keep the holes away from the rail ends. The present writers conducted experiments upon joints of the structure actually used for 50 kg/m rails, bolts of different diameters, rails with bolt holes of different intervals and fishplates with bolt holes of different

diameters and different intervals with an aim of ascertaining what type of a fish joint is the most durable.

033093
EXPERIMENTAL STUDIES OF CONCRETE-PAVED RAILWAY TRACK

Hoshino, Y, Japanese National Railways
Sato, Y, Japanese National Railways
Miura, I, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Quart Rpt, Sept. 1960, p68

A concrete-paved railway track is proposed as a tentative plan to make a radical change in the construction of track that can cope with excessive traffic volume presently imposed on major lines of the Japanese National Railways and with super-high speed expected on the projected new Tokaido line. A tentative track 10m long was laid within the premises. Various kinds of strength tests and measurements were carried out on the track to explore the possibilities of adopting such a track in the future.

033109
SOME DATA ON DAMAGE TO MANGANESE STEEL CROSSING IN SERVICE

Ooi, I, Japanese National Laboratory
Kimata, N, Japanese National Laboratory

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 3, Quart Rpt, Sept. 1970, pp167-168

The failure of manganese steel crossings because of tranverse cracks at head and tail ends is investigated. The cracks tend to re-occur even though corrective welding has been attempted. Failure tends to occur after 100 million tons are carried, repair welding is not adequate. Suggested cause is insufficient design strength or incomplete removal of cavities in repair welds.

033116
DEVELOPMENT AND USE OF A TRACK QUALITY INDEX

Crane, LS, Southern Railway
Sullivan, JH
Kaelin, CR, Southern Railway

American Society of Mechanical Engineers Trans (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Jan. 1969, pp1-10

Discusses the factors used to make up the track quality index. These are the items which are measured by the Southern Railway's track inspection car. The factors measured include gauge, twist, surface, superelevation, and alignment. The measurement of these factors is an aid in scheduling and controlling track maintenance.

033124
LABORATORY EXPERIMENTS ON SOIL STABILIZATION WITH PORTLAND CEMENT AND LIGNIN

Nagai, S
Imai, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 1, Quart Rpt, Sept. 1961, pp24-29

Roadbed stabilization of whatever sort might be a quick preventive against outbreaks of weak subgrade conditions. The change of dry density and unconfined compressive strength with time and the effect of difference in curing methods were observed on soil specimens compacted with Portland cement and lignin. The effect of additional lignin content in the mixed soil is not fully recognized both for clay and Kanto loam. In general the maximum strength is obtained near the optimum moisture content, which should be thought highly of in stabilization works.

033125
TWO DIMENSIONAL PHOTOELASTIC EXPERIMENTS ON SEVERAL RAIL SECTIONS

Miyairi, M, Japanese National Railways
Sasaki, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 3, Quart Rpt, Sept. 1961, pp30-33

To decrease the fracture of rail, to improve the profile of rail section is as important as to improve material and maintenance of rail. Concerning the rail section design for the New Tokaido Trunk Line, improvement of profile of PS 50 kg and ASCE 37 kg rail has been attempted by the Railway Technical Research Institute, JNR, with cooperation of the Bureau of Construction. As a part of this study, the stress distributions of several positions in profiles of the newly designed rail, PS 50 kg rail, ASCE 37 kg rail, and typical rails in America and Europe were measured by two-dimensional photoelastic experiments.

033126
EXPERIMENTS ON LOCAL STRESSES OF RAILS IN PRINCIPAL USE IN SEVERAL COUNTRIES

Sasaki, N Kakisawa, M

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 3, Quart Rpt, Sept. 1961, pp34-39

There is room for improvement in the current JNR standards for rail section with respect to their effectiveness as beam members and also to their pattern of distributed local stress. The project of the new Tokaido trunk line construction now being pushed forward has prompted JNR to the renewed design of its rail section from various angles since 1958. Laboratory and field tests were conducted for contributing to a better design to the two tentatively designed rail sections of 67 kg/m for the new trunk line and to the current 50 kg/m one, as well as to the five sections of imported rails.

033127
RAILS OF NEWLY DESIGNED SECTIONS

Sasaki, N

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 4, Quart Rpt, Dec. 1961, pp32-37

Rail section should be reformed and anti-corrosion measures taken to prevent rail fractures. Discussion of factors considered to improve rail characteristics include fundamental studies, disadvantages of current rail, specifications of new rail sections—50N, 40N, and T50 for Tokaido Trunk line.

033134
ANTICIPATION OF BEHAVIOR AND ESTIMATION OF FAILURE OF CUT SLOPES UNDER RAINFALL

Saito, M
Uezawa, H, Japanese National Railways
Imai, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 1, Quart Rpt, Mar. 1969, pp13-19, 2 Ref

The most uncertain factor in the slope failure is to porewater pressure developing in the slope. In the case of cuttings or natural slopes, the soil composition and the seepage path of rain water are too complicated for analysis using a simplified model. Results show that the rise in water table is proportional to the amount of rainfall and the drop in water table may be regarded as a function of only the water table at a given time point. From this it follows that the water table observation can reveal the water level fluctuation characteristic and that the critical rainfall can be estimated through stability analysis of slope.

033137
DEVELOPMENT OF NEW RAILWAY TRACK STRUCTURES

Satoh, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 2, Quart Rpt, June 1969, pp62-70, 6 Ref

In contrast to the existing standard track structure with ballast and cross-sleepers, partially or wholly modified structures will here be called the new track structures. Ballasted track deflects and subsides under repeated passage of trains over it and loses the levelness of the running path. The volume of maintenance work increases in proportion to the speed-up and the frequency of train operation. The aim of first applying it to tunnel section and elevated track and ultimately extending the application to the common track sections, the concrete slab type track has been developed. Proposal-discussion-design-partial test-full scale model-overall test-improved design-application to revenue line.

033138
THE DESIGN OF 60 KG RAIL AND FISH-PLATE

Watanabe, K
Sugiyama, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 2, Quart Rpt, June 1969, pp71-72

A new type rail for a trunk line has been designed. The weight of this rail is 60.8 kg/m. The process of designing this rail and the fish-plate is described. This rail is head free type in cross section.

033139
A STUDY ON FILLING VOIDS UNDER RAILWAY TRACK STRUCTURE

Harada, Y, Japanese National Railways
Sugiyama, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 2, Quart Rpt, June 1969, pp73-79

Usefulness of the grouting method for filling voids under railway track structure is recognized. Selection and development of filling materials are discussed. Laboratory and field tests of resin grout, cement grout and cement-asphalt grout are described. Satisfactory results of execution using these filling materials are reported.

033140
AUTOMATIC SUBMERGED-SLAG WELDING OF RAILS (REPORT 3)

Oi, I, Japanese National Railways
Hakamada, S, Japanese National Railways
Muramoto, T

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 3, Quart Rpt, Sept. 1969

Article details the specifications for a prototype rail welding car as developed to weld long rails in the field. Extracted from a larger article which discusses technique of welding rails and tests for weld failure.

033141
RESEARCH ON FORECASTING THE TIME OF OCCURRENCE OF SLOPE FAILURE

Saito, M

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 3, Quart Rpt, Sept. 1969, pp135-142

Full-scale experiments have shown that slope surface strain measurement is the most promising means of forecasting the time of slope failure. For this purpose, creep-rupture characteristics of soil must be known. The author proposes a method of forecasting the time of occurrence of slope failure, i.e., rough estimation from steady-state strain rate in the secondary creep range and precise estimation from optional strain rate in the tertiary creep range.

033142
EXPERIMENTS ON SLOPE FAILURE AND ITS PREVENTION BY DRAINAGE FOR SANDY EMBANKMENTS UNDER ARTIFICIAL RAINFALL

Saito, M
Uezawa, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 3, Quart Rpt, Sept. 1969, pp142-148, 2 Ref

Slope failure experiments on sandy embankments were carried out under artificial rainfall to predict the slope failure and prevent it. Experiments have revealed that the failure is caused by the rise of the pore water pressure in the impermeable layer. An effective preventive measure for the slope failure is to make drainage work to keep the slope surface far from the level of water table and the most effective one will be laying a drainage blanket over the impermeable layer.

033144
STABILIZATION OF SOFT SUBSOILS (REPORT 1)—COMPARISON OF STATIC AND DYNAMIC BEHAVIORS OF SOFT SUBSOILS TREATED IN DIFFERENT METHODS

Watanabe, S, Japanese National Railways
Komine, T, Japanese National Railways
Nasu, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 4, Quart Rpt, Dec. 1969, pp191-195

A series of test embankments were built in order to find whichever stabilization method is most effective against the very compressible aluvial deposit along the line. This is the report concerning the first test embankment, in which sand-replacement method and preloading and berm construction method were compared with non-treated one. It was found that both the methods tested were remarkably effective in reduction of fill deformation under running trains, and the base failure in the deposit might be approximated to the mid-point circle failure.

033145
A NEW METHOD FOR PROTECTION OF SPIKE-HOLE OF WOODEN SLEEPER–CARTRIDGE METHOD

Shimizu, K, Japanese National Railways
Kakekawa, H, Japanese National Railways
Okayasu, T

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 4, Quart Rpt, Dec. 1969, pp196-197

To prevent the degradation of spike-holes a newly developed practical method was tested by inserting a chemicals-containing cartridge into the spike-hole of wooden sleeper before driving spikes. Spike-holes can be effectively protected from fungal decay and mechanical wear using this cartridge method, so that service life of wooden sleepers could be prolonged.

033146
STUDIES ON CORROSION FATIGUE BY POTENTIAL MEASUREMENT

Kose, Y, Japanese National Railways
Ogawa, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp3-6, 3 Ref

Using specimens made of mild steel (SS-41), fatigue tests were carried out both in air and in the corrosive medium of 1 N sodium sulfate solution acidified to pH 2.2. During fatigue testing, the corrosion potential of a specimen was recorded by a vibrating reed electrometer and the rate of corrosion was determined by colorimetry of total iron in waste solution. The results of potential measurement show that under alternating stress, the potential decreases after keeping a constant value for some hours. By the wet-dry stage fatigue tests, it is confirmed that the period until potential decreases accords with the so-called "Incubation Period", that is concentrated stress at the bottom of corrosion pits just reaches a fatigue limit, with initiation of potential decrease. In the end, the incubation period can be known by potential measurement, and by repetition of a few wet fatigue tests. A curve of stress concentration which rises with numbers of stress cycles under an acidic environment can be traced.

033147
GAS-SHIELDED ARC WELDING OF HIGH-MANGANESE STEEL RAILS

Ando, S, Japanese National Railways
Uchida, A, Japanese National Railways
Kimata, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp11-17

In the present study the aim was to realize automation of the welding of manganese crossings which has been conventionally executed by manual arc welding process, thereby sharply raising the welding efficiency and obtaining sound welds with good mechanical properties and free from welding defects. As a basic step to automatic welding of manganese crossings, the case of automatic welding of cast high-manganese steel rails is treated here.

033148
STRENGTHENING THE FILL SLOPE BY THERMAL TREATMENT

Nishio, K, Japanese National Railways
Yamada, G, Japanese National Railways
Moriyama, S, Japanese National Railways
Owaki, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp22-27

The economy that might be obtained through thermal treatment of cohesive soil depends widely upon the burning method employed. From the practical point of view the burning device and the amount of fuel consumption come into question. In order to put this method to practical use the technical problems, such as the boring method for burning hole and the burning method, must be made clear and the effective range of the physical and mechanical property of soil by burning must be determined. A field experiment, therefore, was carried out for the purpose of the development of the burning device and the confirmation of the effective range of the strengthening soil by burning.

033149
STRENGTH AND IMPREGNABILITY OF HOMALIUM SPP. AS RAILROAD SLEEPER

Shimizu, K, Japanese National Railways
Matsumura, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp33-37

Mechanical properties and impregnability of the Homalium spp. wood were studied. Also, its natural durability and performance as sleepers were examined. The conclusions obtained are as follows: 1. The Homalium spp. is one of the strongest woods used as railway sleepers in JNR, except the bending impact strength. 2. The natural anti-decay durability of the Homalium spp. wood is low, so the sleepers should be treated with creosote oil in Japan. 3. Both the sap—and heart-wood of the Homalium spp. can be easily impregnated by the Bethell process.

033153
GLUED RAIL JOINT FOR INSULATION BY DRY METHOD

Umekubo, S, Japanese National Railways
Sekiguchi, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp60-61, 1 Ref

In 1964 the glued rail joint for insulation by wet method was completed. Since then the dry method has been developed which can be applied to the glued rail joint for insulation, especially considering its strength and workability. The glued rail joint for insulation was made by dry method using the epoxyresin-polyester cloth-pre-preg. The workability for assembling was better than that of the wet method. The bending strength of the glued rail joint for insulation was over 50 t and the longitudinal tensile strength was 100 t. The service test has been performed by laying two glued rail joints in the operating track.

033154
ON THE FIRE RETARDANT TREATMENTS OF CREOSOTED SLEEPERS

Shimizu, K, Japanese National Railways
Yoshida, H, Japanese National Railways
Kawamura, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, Quart Rpt, June 1967, pp81-83

In an attempt to increase the fire retardant performance of creosoted sleepers, the use of fire retarding coating materials was investigated. In this study, the ignition and burning of sawdusts, creosoted and uncreosoted wood specimens, and the effects of coating materials made for trial, and the burning behavior of testing sleepers set in site were tested. The results obtained show that the chemicals made for trial are able to reduce the risk of fire of creosoted sleepers.

033159
SOFT SUBSOIL EXPLORATION AT THE KOISE RIVER VALLEY ON THE JOBAN LINE–COMPARISON OF EFFECT OF TREATMENTS FOR SOFT SUBSOILS

Muromachi, T, Japanese National Railways
Komine, T, Japanese National Railways
Yasuda, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 3, Quart Rpt, Sept. 1967, pp153-156

According to the subsurface investigations, the Koise river valley consists of a very soft upper peat layer and also of very weak lower marine clay strata, the total depth amounting to 20 meters. When the subsurface conditions are unfavorable like here, several treatment methods for weak subsoils have so far been adopted so as to make the newly constructed embankments stable, though the effectiveness of the method is a great problem. Therefore, in order to ascertain the relative effectiveness of each treatment method, the experimental embankment was planned and for the purpose the present site where the subsoil conditions are most unsuitable was chosen. The experimental embankment consists of three sections, "Composer" "Cardboard Drain" and non-treated, and the effectiveness of the two stabilization methods was evaluated by comparing directly the measured data with those of non-treated.

033160
DISPLACEMENT OF ADJACENT ROADWAY AND GROUND SURFACE DURING CONSTRUCTION PERIOD OF OPEN CAISSON

Muromachi, T, Japanese National Railways
Komine, T, Japanese National Railways
Yasuda, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 3, Quart Rpt, Sept. 1967, pp157-160

As the open caisson pier foundation was to be constructed very close to the existing roadway of embankment of weak strata in recent double tracking work on Chuoh line, observation of displacement was carried out to judge the degree of danger for running a train during construction period. According to the results of observation it was confirmed that the protection method by sheet piling was very effective and in this case the displacements or strains were too small to disturb the track or to interrupt the traffic.

033164
EXPERIMENTAL STUDY OF NEW-TYPE TRACK–TRACK LAID ON CONCRETE SLAB WITH ADJUSTING BLOCK

Tsumenaga, T, Japanese National Railways
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Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 3, Quart Rpt, Sept. 1967, p182

The experiment consists of static and dynamic loading tests. Through these tests the safety factor of the concrete slab and the pedestals for the operating traffic load, the vibrational characteristics of the track and the durability of the adjusting blocks, and the fastening devices were examined. The results of the experiment have shown that the new track will be used under operating traffic load.

033165
AUTOMATIC SUBMERGED-SLAG WELDING OF RAILS (REPORT 2)

Oi, I, Japanese National Railways
Muramoto, T, Japanese National Railways
Hakamata, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 4, Quart Rpt, Dec. 1967, pp205-209

A new method of automatic fusion welding of rail has been developed. The rail base is welded with the submerged arc welding process, then the area above the web with the electroslag welding process. This method assures good quality of welded joint, high productivity and applicability to the field conditions. Preheating and postheating are not necessary. The process of welding, countermeasures for prevention of welding defects and test results on welded joint are described.

033166
NEW RAILWAY TRACK STRUCTURES

Satoh, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 4, Quart Rpt, Dec. 1967, pp215-217

Examples of new track structures ever tried in the world are reviewed and some examples being carried out in the JNR laboratory are commented in this paper.

033167
INTEGRAL TYPE MEASURING EQUIPMENT FOR SUPERELEVATION

Kishimoto, S, Japanese National Railways
Takeshita, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 4, Quart Rpt, Dec. 1967, pp221-225, 2 Ref

In measuring superelevation with track inspection car a gyrostabilizer is generally used. The gyrostabilizer is considerably expensive and needs electric power source. So, for a simple mechanical type track inspection car, it is difficult to mount a measuring equipment for superelevation using a gyrostabilizer. A new mechanical integral type measuring equipment which enables measuring the superelevation from twist of track has been made. The equipment needs no source of electric power. The frequency characteristics of the equipment is fairy good for ordinary superelevation, the accuray of mechanical parts being about 10 percent.

033169
STRENGTH OF EMBANKMENT SLOPES UNDER ARTIFICIAL RAINFALL ON THE NEW TOKAIDO LINE

Yasuda, Y, Japanese National Railways
Saito, M, Japanese National Railways
Uezawa, H, Japanese National Railways
Menjo, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968, pp74-79

For the purpose of determining the stability to slope failure of the embankment of the new Tokaido line under rainfall, the porewater pressure, i.e., the pressure developed by the water collecting in the voids between soil particles was measured at the test sites around 314,200 km point from Tokyo under artificial rainfall. The tests were carried out in three series. Under artificial rainfall, the pore water pressure was measured at different levels in the slope. The pressure reached a maximum at the slope shoulder, which was found to be caused by the presence of a highly compacted layer underneath. In the last series of test, drain pipes were driven in five rows at different levels of the slope and their effects were checked.

033175
FIELD TEST OF CORROSION PREVENTED RAILS ON THEIR ENDURANCE LIMIT TO RAIL END FRACTURE

Takihara, M, Japanese National Railways
Tomita, K, Japanese National Railways
Takeuchi, Y, Japanese National Railways
Tsuyuki, S, Japanese National Railways
Hirose, S, Japanese National Railways
Kose, Y, Japanese National Railways
Sato, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 1, Quart Rpt, Mar. 1968, pp17-20, 1 Ref

In order to prevent rail end fracture by corrosion fatigue cracking, various measures for prevention of corrosion were examined by field tests. In the preliminary test, 25 measures for prevention of corrosion were examined in tunnels under steam traction. Considering the test results, 4 measures were selected for life test. The most remarkable result of life test was as follows: In the tunnel, in which the mean life of non-treated rail was only 3 years, that of shot-peened rail covered with zinc metalicon was elongated up to 5 or 6 years.

033178
GERMINATIVE CONDITIONS OF SEEDS AND RHIZOMES FOR THE EROSION CONTROL WITH GRASSES

Kobashi, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 1, Quart Rpt, Mar. 1968, pp41-43

This report consists of five parts as follows: (1) grass species for the erosion control seeding, (2) water conditions for germination of grass seeds, (3) temperature conditions for germination of grass seeds, (4) drought resistance of rhizomes of Japanese lawn grass, (5) effects of chemical materials for erosion control on seed germination.

033180
RAILWAY TRACK

Matsubara, K

Japanese Railway Engineering (Japan Railway Engineers' Association, P.O. Box 605 Tokyo Central, Tokyo, Japan)

Vol. 4, No. 1, Quart Rpt, Mar. 1963, pp25-29

Discusses factors involved in track construction where PC sleepers are used, double elastic fastening, and continuous rail. The factors to be considered in bridge and tunnels where expansions of rail, structure must be considered is also discussed. The design and construction of a movable nose rail turnout for high speed operation is explained. The use of modern methods is the laying of PC sleepers and continuous welded rail is also outlined.

033181
TRACK STRUCTURE FOR HIGH-SPEED TRAFFIC

Hojo, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Oct. 1963, pp2-6

Special Issue

Results of tests of factors related to a speed test of equipment at 200 km/h are studied with effects of ordinary track, track on a solid bed (without ballast) an expansion and insulated joint, a PC sleeper, deformation of loamy embankment, ground vibration and finally, train wind force. The second section is devoted to thermit welding of various types of rail and standards to be followed.

033182
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN OPERATION

Hirakawa, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Nov. 1962, pp2-4

Special Issue

The aspects of rail structure for high speed operations are discussed. The drop test for rails, chemical and mechanical properties of rail steel, rail fastenings, PC railway ties (sleepers), grading of ballast, ballast agitation by train wind, and finally, the effects of loading and repeated water sprinkling on railroad embankments are discussed.

033183
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN

Hoshino, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Nov. 1961, pp4-14

Special Issue

Examines the specifications of rail, fastenings, ballast vs. precoated with asphalt ballast, subgrade construction, longitudinal forces present when welded rail used on a bridge, transition curves and PC ties to be used on the New Tokaido Line. Results of tests of the above under high speed conditions are also discussed.

033184
COMPARISON OF QUALITY OF RAILS BETWEEN MANUFACTURED BY LD PROCESS AND BY OIL PROCESS (REPORT 1)

Ito, A, Japanese National Railways
Kurihara, R, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt, Dec. 1968, pp185-186

The influences of manufacturing process (LD process and OH process) of rail steel on the quality of 50 N-type rails were studied. Concerning the chemical composition, mechanical properties and microstructures of as-rolled rails, it was found that LD steel rail was as good as OH steel rail and the former was superior to the latter in some respects.

033185
ARC WELDING OF AUSTENITIC MANGANESE STEEL RAIL TO CARBON STEEL RAIL—IN CASE OF WELDING WITH COVERED ELECTRODE

Ando, S, Japanese National Railways
Kimata, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt, Dec. 1968, pp186-191, 2 Ref

This study is to establish the procedure to weld manganese crossing and carbon steel rail together which has been thought to be very difficult due to the difference of their metallurgical properties and others. The authors paid special attention to the procedure to join them by manual arc welding after buttering the groove face of carbon steel rail. Various fundamental experiments were performed to select electrodes for buttering and joining, and welding conditions. Based on the results obtained, austenitic manganese steel rail and carbon steel rail were welded together, and the welded rails were subjected to bending test, drop-weight test and so forth. The results show that considerably reliable welds are obtained in case the authors' proposal is adopted.

033189
MECHANISM OF EARTHQUAKE DAMAGE TO EMBANKMENTS AND SLOPES

Kobayashi, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp131-133, 4 Ref

The paper deals with possible mechanism of earthquake damage to embankments and slopes due to past destructive earthquakes in Japan. A formula on sliding of a mass during an earthquake by Newmark seems to be applicable with a little modification to many examples of the damage. Factors which may influence the stability of embankments or slopes during an earthquake are investigated.

033191
RESEARCH ON REASONABLE EMBANKMENT CONSTRUCTION (FIRST PROGRESS REPORT)

Uezawa, H, Japanese National Railways
Watanabe, S, Japanese National Railways
Saito, M, Japanese National Railways
Miyako, J, Japanese National Railways
Muromachi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp139-150

Various problems involved in railway fill construction were attacked in many respects. Several methods of soft subsoil stabilization were compared with each other with particular reference to prevention of base failure, acceleration of settlement, and reduction of excessive vibration. Also, subsidence and slope failure of newly built embankments were investigated.

033192
TEST ON REPAIR OF RAIL SLIP DAMAGE THROUGH HEATING CORRECTION (REPORT 1)

Takahashi, T, Japanese National Railways
Aoyama, S, Japanese National Railways
Kodama, J, Japanese National Railways
Hiruma, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp182-183

Tests were made to establish the possibility of heating the top and web of a slip-damaged rail and correcting it as laid in the track without replacing it with a new one. The results proved the feasibility of this rail correction method.

033194
GROWTH RESPONSE TO DEHYDRATION IN GERMINATING PERIOD OF GRASSES

Kobashi, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 2, June 1964

Erosion control has become important owing to the recent increase of new railroad construction. The erosion control methods with grasses must relate to speedy mechanized earthwork at present. Many new methods to satisfy this demand are being developed, and in any case of these methods, slopes are covered with grasses of foreign origin. Troubled with slope erosion by heavy rainfall before the grass cover is completed, it is finally necessary to stimulate the germination of seeds and growth in early stage. The study was carried out to make clear the growth response to dehydration in germination period of grasses.

033198
FATIGUE STRENGTH TESTS ON RAILS

Yamanaka, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 2, Quart Rpt, June 1964, pp44-50

Fatigue strength data on rails have seldom been published. Japanese National Railways, in connection with the adoption of long rails (0.5, 1.0, 1.5 or 2.0 km) and speed-up of train operation, is vigorously pushing fatigue strength investigations as well as qualitative study of rails. Soundness of the welded rail is hard to evaluate through a mere external inspection; therefore, nondestructive testing methods such as ultrasonic, magnetic detection and mechanical methods such as static bending, repeated drop weight should be coupled with it. Present demand is to secure a sound welded rail in the field through fatigue strength comparison between the base metal of rail and the welded joint.

033202
PREVENTION OF DERAILMENT OF GOODS WAGONS ON DISTORTED TRACKS–STATISTICAL ENQUIRY RELATION TO THE PERMISSIBLE TRACK TWIST

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 2, Question B55, Intrm Rpt, June 1965, 47pp

The study of the permissible wheel load deviations and of the resultant characteristics for the goods wagons requires an exact knowledge of the existing track "twists". A statistical inquiry was made on the lines of the DB, the SNCF and the PKP. The inquiry has principally dealt with continuous measurements of existing track twists, related to a basis of 5.00 m (wheelbase of the recording coach), and a length of 1,820 km of track on the DB, 1,805 km on the SNCF and 1,955 km on the PKP has been examined. In each case, the measurements were made on tracks of all categories. The present report gives an account of the results of these measurements-each classified in "ranges of twist" of 1 degree/00-for twists exceeding 4 degrees/00. A statistical analysis, which is based on the assumption of a critical value of twist of 7 degrees/00, related to a base of 5.00 m, has been appended to the present report. This statistical analysis indicates, for the actual state of maintenance of the tracks and for a wagon running an average distance of 1,000 km, the probability of encountering at least "a" twists greater than the above mentioned limit. It also shows the possible reduction in risk to be expected through the application of special measures with regard to track maintenance and vehicle design. The following possibilities have been studied: a) stricter control of accident twists of dangerous magnitude; b) extention of the maintenance regulations for track category 2 to the lower categories of track; c) improving the adaption possibilities of the vehicles to track twists.

033211
LATERAL STABILITY OF RAILS, ESPECIALLY OF LONG WELDED RAILS

Klaren, JW
Loach, JC, British Railways

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 1, Question D14, Intrm Rpt, Apr. 1965, 82pp

This report discusses the results of a questionnaire to determine the state-of-the-art of welded rail. Includes discussion of the history of the uses of long welded rail, and of tests to determine the characteristics of such rail under varying climatic conditions. Report also covers track buckling tests at Karlsrule and London in the late 1950's and includes a chapter on the characteristics of track incorporating long-welded rail. Various theories on the stability of long welded rail are covered briefly, and an extensive bibliography is included.

033212
THE PRINCIPAL RAIL DEFECTS, INTERIM REPORT NO. 3 (CHAPTERS I-IV)

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 3, Intrm Rpt, Mar. 1962, 57pp

A listing of principal rail defects which includes the description, causes, consequences and remedies for each. Those included are: vertical longitudinal splitting, laps, shelling of heattreated rails, gauge corner shelling, star cracking of fish bolt holes, progressive transverse cracking in rail heads, horizontal cracking of rail head and transverse fractures at longitudinal fissures. Included at the end of each unit are a number of photographs of each flaw.

033213
QUALITY OF RAILS AND MEANS OF GUARANTEEING IT

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 3, Question D45, Intrm Rpt, Mar. 1952, 96pp, 12 Ref

This report represents a collection of documentary leaflets covering principal rail defects. In a leaflet on star cracking in fishbolt holes, discussion includes causes, propagation, detection and remedies. Photographic evidence of defect is presented. A second document covers progressive transverse cracking in rail heads and includes origin of cracks, detection and remedies. Numerous photographs illustrate this defect. A final section deals with transverse fractures at longitudinal fissures at the foot of rails. Again, specific fractures are illustrated photographically.

033214
QUALITY OF RAILS AND MEANS OF GUARANTEEING IT. TESTS WITH APPARATUS FOR THE CONTINUOUS EXAMINATION OF RAILS IN THE TRACK

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 6, Question D45, Intrm Rpt, Oct. 1963, 20pp

Report discusses the use of high speed rail inspection equipment, the ways in which joint operation of such vehicles would be practical. The amount of track to be inspected, the frequency of inspection and geographic considerations are determinants of the practicality of joint ownership and operation. Also a comparison of the Teledetector, the Spema, and the DB ultra-sonic rail fault coach is made over identical track. A discussion of rail flaws and their classification is included.

033215
QUALITY OF RAILS AND MEANS OF GUARANTEEING IT; EXAMINATION OF THOMAS STEEL RAILS OF THE THIRD SERIES OF TESTS BY MEANS OF THE RALUS ULTRASONIC PROCEDURE; DOCUMENTARY REPORTS OF IRSID AND BAM

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 10, Nov. 1967, 18pp

The investigation of the quality of steel rails and the means of guaranteeing it has been entrusted to the D 45 Specialists Committee at the request of the 7th UIC Commission. Two series of tests have already been made within the scope of this work. A third series of tests was then carried out on rails having shown a 'good' performance in the track and on those having shown a 'bad' performance, these performances being defined beforehand according to some accurate criteria. The definition tests and the special tests on the Thomas steel rails of this series have been dealt with in Interim Report No. 9. As many as possible of the Thomas steel rail samples of the third series of test have been examined by means of the RALUS ultrasonic equipment, developed by IRSID and designed for the automatic industrial ultrasonic inspection of the rail head. The results of this examination have been dealt with in this report (RP 10), which also contains a documentary report by IRSID on the RALUS method and one by BAM on the investigation of rails for non-metallic inclusions.

033216
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS; THEORETICAL STUDY AND PRINCIPLES

International Union of Railways, Office for Research and

Experiments, Utrecht, Netherlands

Rpt 1, Intrm Rpt, Mar. 1964, 21pp, 3 Ref

The present Interim Report No. 1 deals with the second part of the Programme of Work i.e. "Theoretical study and guiding principles" for the design of switches and crossings. Taking as a basis the three general requirements (2.1) i.e. safety from derailment, steadiness of travel on switches (so far as comfort is concerned), and economy-the Interim Report deals with conditions arising from the requirements of the Permanent Way and Operating Departments as well as the running of vehicles. A distinction is made between the geometrical (2.21) and the kinematic and dynamic conditions (2.22). The section entitled "Kinematic and Dynamic Conditions" (2.22) deals with speeds on the diverging track, with lateral forces and accelerations and with the pulling of switches, the choice of these various conditions being made for economic maintenance of the switch and crossing work. The section 2.30 deals with the principles of the construction of switches and crossings. The document gives a range of speeds (2.40) recommended for turnouts in standard 54 and 60 kg/m rails.

033218
UPPER STRUCTURE OF RAILWAY TRACK UNDER SUPER-HIGH-SPEED TRAINS

Satoh, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Sept. 1968, pp168-169

The possibility of constructing railway track for operating rolling stock of wheel-set type at super-high speed up to 350 km/h upon its rails is discussed from the viewpoint of the bearing strength of track for train operation and maintenance for track irregularities.

033220
WEED CONTROL ON RAILWAYS

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Vol. 10, No. 4, Dec. 1969, pp241-242

Experiments of total weed control on railway are described. There are weed control with herbicides applied in a liquid either as a solution or a suspension, and weed control with granular herbicides. It is concluded that 1) granule gives similar control to liquid formulation containing the same chemical composition, and 2) Hyver X 0.46 g/m square, Tribac 3.0 g/m square (with liquid), Dezorate S 62.5 g/m square, Borocil 5.7 g/m square and Tribac 20 15 g/m square (with granule) show very good for all vegetation control for railway use.

033226
STUDY OF GLUED RAIL JOINT–AN EXAMPLE OF PLASTICS USED IN THE TRACK

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Vol. 5, No. 3, Quart Rpt, Sept. 1964, pp45-46

According to the recent development of plastics, rationalization of the track construction has been tried by using their great strength. Glued joint is one for which many countries make great efforts, and also it is used in the track at present. In this report the authors describe detailed examination of adhesives to be used in the track in the present stage and results of preliminary experiments on glued joint.

033227
EROSION CONTROL TEST OF EMBANKMENT SLOPE WITH ARTIFICIAL RAINFALL

Saito, M, Japanese National Railways
Uezawa, H, Japanese National Railways
Kobashi, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 1, Quart Rpt, Mar. 1964, pp17-18

Soils constituting the embankment consist of sandy weathered granite susceptible to erosion. Grass covering is an effective method for slope erosion control, but it takes a long time to cover the slope totally. It is more effective to protect slopes against erosion by strengthening the face or shoulder of slope and distributing the runoff water all over the slope surface. Several protecting methods against soil erosion were tried on an embankment slope, where erosion control tests were made with artificial rain.

033228
DEFORMATION OF SOFT PEAT FOUNDATION UNDER EMBANKMENT–FROM THE OBSERVATION RESULTS AT NOBA

Muromachi, T, Japanese National Railways
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Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 1, Quart Rpt, Mar. 1964, pp19-20

Areas ranked as extremely soft foundation, mainly consisting of peat or peaty soils, where the construction of a stable embankment may be impossible if any special method of stabilization of soft foundation soils is not introduced. Some areas embankments have been replaced by elevated bridges or other structures, while in other areas embankments are now under construction on stabilized foundation soils. Among these, the method of sand drain well has been widely in use, but it seems that this method may not be necessarily effective for every soil type.

033230
LIGNIN SULFONATE AS SOIL STABILIZER–GELATION OF LIGNIN SULFONATE SOLUTION

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Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 1, Quart Rpt, Mar. 1964, pp21-22

The use of lignin sulfonate to be used as a soil stabilizer is discussed. The addition of metallic salts accelerate gelatin, while the final gel hardness is dependent upon the composition, water content, and lignin sulfate-potassium bichromate ratio.

033252
ON THE ULTRASONIC RAIL INSPECTION CAR

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Vol. 4, No. 3, Quart Rpt, Sept. 1963, pp53-55

Seventy percent of rail failures are located in the joint areas starting from the bolt hole, but these defects could not be found out by the electro-magnetic method. The new ultrasonic rail flaw detector car was designed and manufactured by the Railway Technical Research Institute, Japanese National Railways. Results of the tests are summarized as follows: (1) up to a test speed of 35 km/h records are satisfactory, (2) at a higher speed than that the recording of joint areas becomes unreliable, (3) jumping tendency of probe was avoided by elongation of shoes and water supply devices, (4) a revolving type searching unit has been manufactured and a test is now continuously being carried out.

033253
A SURVEY ON SLOPE FAILURES

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Matsunami, T, Japanese National Railways
Muranaka, A, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 4, Quart Rpt, Dec. 1963, pp31-34

Of the disasters caused to the railway structures of JNR, the disaster caused by the failure of slope accounts for 30 percent in the number of occurrence and 35 percent in damage. The countermeasure against the disaster by slope failure occupies an important portion of the disaster prevention plan for the railway structures. As to the maintenance of railway structures, it is also important to know what are the factors influencing the slope failures.

033254
DURABILITY TESTS ON TRACK COMPONENTS

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Takenaka, S, Japanese National Railways
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Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 4, Quart Rpt, Dec. 1963, pp49-50

Use of a Vibrogile is found the most simplified and effective method for determining the durabilities of various track components such as the fastenings, ties, pads, etc. It was felt necessary to perform durability tests on the fastenings and other components, using a hydraulic fatigue testing machine which can apply a repeated pressure of constant magnitude with accuracy, though without any vibration, and thereby supplement the Vibrogile testing. Thus, the durability tests were carried out on the fastenings for the existing line and the new Tokaido trunk line, using both the testing machines.

033257
DROP TEST OF RAILS

Satoh, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 2, Quart Rpt, June 1962, pp32-37

The newly designed 50 T rail was adopted for the New Tokaido Trunk Line, and 50 N and 40 N rails were also adopted in place of PS 50 and ASCE 37 rails which had been used for more than 40 years. Concerning the test standards for these new rails, the drop test standard was studied and is reported in this paper. Property of rail strain was studied in the test performed according to the Japanese Industrial Standards with the test machine at the Fuji Steel Co. When a drop weight touches the rail, strain in every part undergoes a change instantly. In the beginning, strain oscillates, and when the domain of plastic deformation is reached, it grows smoothly to the maximum value in the elapse of 7/1000 seconds, then it reduces and turns sharply in 13/1000 seconds, and there after it returns to zero lines.

033259
NEW SHAPE OF TRANSITION CURVE IN HIGH-SPEED RAILWAY TRACK AND ITS ALIGNING

Taya, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 2, Quart Rpt, June 1962, pp38-45

The quantity called "Track Irregularities" is usually used as basic data and technical inferences are made from it. From the viewpoint of safety and comfort of traveling, we are requested to decrease the track irregularity especially with regard to high speed railway track. Must first of all grasp the essential meaning of "Track Irregularity" and consequently the next two quantities clearly: (i) difference between geometrically practicable shape and the actual shape of railway track. (ii) difference between physically rational shape and geometrically practicable shape of railway track. These two items are almost self-evident for the straight railway track, but for the curved railway track, especially transition curve, there are many problems yet to be solved.

033260
SOIL-CEMENT AS APPLIED TO SUBGRADE STABILIZATION OF RAILROADS

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Vol. 3, No. 3, Quart Rpt, Sept. 1962, pp20-25

The consistency of subgrade soil has a certain bearing on its tendency toward mud-pumping phenomenon. It may be considered as a most effective means of preventing puddly subgrade conditions to lower the plasticity of subgrade soil. Sand substitution for soft subgrade material has been so far resorted to on a nation-wide scale. It has been experimentally known that the plasticity of soil materially decreases when Portland cement or chemicals of some kinds are mixed with it. Such chemical process may, therefore, be turned to advantage in providing against mud pumping phenomenon of subgrade.

033261
DESIGN OF TRACK INSPECTION CAR

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Vol. 3, No. 4, Quart Rpt, Dec. 1962, pp56-61, 2 Ref

An efficient method of detecting the defects of track is desired. A new track inspection car has already been reported. It registers the following values during high-speed runs (up to 100 km/h), being equipped with an electronic data processing machine: (1) curvature (right rail), (2) curvature (left rail), (3) unevenness (right rail), (4) unevenness (left rail), (5) width of gauge, (6) superelevation, (7) twist of the track, (8) rolling of the body, (9) vertical acceleration of the body, (10) horizontal acceleration of the body.

033264
RUNNING SAFETY OF RUSSEL SNOWPLOW FOR DOUBLE TRACK (REPORT 2)

Matsui, S, Japanese National Railways
Koyama, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 1, Quart Rpt, Mar. 1962, pp32-39

The Russel snowplow used for clearance of double track in JNR has a single edged front to push the snow toward one side; consequently, lateral wheel thrust on rail may become considerably high under some conditions. Actually derailment has been of frequent occurrence during operation. In order to secure efficient operation of the snowplow without loss of running safely, a study has been made of the relation between wheel reaction and plowing conditions.

033267
SPECIAL ACCOUNTS SUMMING UP THE REPORTS ON THE QUESTIONS FOR DISCUSSION AT THE EIGHTEENTH SESSION OF THE INTERNATIONAL RAILWAY CONGRESS ASSOCIATION (MUNICH, 1962)

Thille, A, French National Railways

Rail International (International Railway Congress Association, 12-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 39, No. 6, June 1962, pp888-924

The data and opinions are set out in the following five chapters: (1) Effect of locomotives and rolling stock on the track; (2) Track alignment points and crossings; (3) Gauges; distances between running lines, obstructions; (4) Equipment and ballasting of present day high-speed tracks; track renewal conditions. (5) Safety of trains and staff on high speed lines; control of these lines; measures taken concerning the quality of track; increase in maintenance costs due to increased maximum speeds.

033268
THE STABILITY OF LONG WELDED RAILS

Bartlett, DL, British Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 38, No. 10, Oct. 1961, pp679-708

A report of British Railways testing of long welded railroad track. Testing program to determine the stability of welded rails by tests for buckling, torsional resistance, lateral moment of resistance and lateral ballast resistance. Conclusions that track can buckle but factors controling stability are torsional resistance of fastenings, sleeper spacing, ballast resistance.

033273
ADAPTATION OF THE METHODS OF LAYING, ALIGNING AND MAINTAINING THE PERMANENT WAY TO CARRY TRAFFIC AT VERY HIGH SPEEDS (120 km/h AND MORE): a) ON THE STRAIGHT: b) ON CURVES: SO FAR AS THEY AFFECT SAFETY AND TAKING INTO ACCOUNT THE TYPE OF ROLLING STOCK USED

Thille, M, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvran, 1000 Brussels, Belgium)

Vol. 39, No. 41962, pp492-725

The following topics are discussed: effects of rolling stock on track, layout of lines; points and crossings, loading gauges; distances between running lines, equipment, ballast and track renewal of high speed lines, and finally safety of trains, staff and inspection processes of high speed lines. Appendices include answers related to railway technology from responding members.

033275
NO MORE TROUBLE WITH INSULATED JOINTS

Krofges, P, HTL, Cologne

Eisenbahningenieur (Dr Arthur Tetzlaff-Verlag, Niddastrasse 64, Frankfurt am Main, West Germany)

No. 12, Dec. 1963, pp360

Discusses the problems of insulated joints and problems caused by low and high temperatures. Suggests the way to cope with the problem is by using the "Schmitz" insulated joint which has an insulated joint with steel fish plates attached by adhesive and high tensile prestressed fish bolts. After a development of 5 years duration 1,000 joints were replaced in this fashion with excellent service some for more than four years of use.

033276
FROM THE INSULATED RAIL JOINT TO THE INSULATED ADHESIVE JOINT. FOR THE CONSTRUCTION ENGINEER'S EXPERT GUIDANCE

Eisenbahn-Praxis (Transpress VEB Verlag fuer Verkehrswesen, Franzosische Strasse 13-14, 108 Berlin, East Germany)

No. 31965, pp2-5

Defines a rail joint and the requirements of insulating materials which are part of the construction. Further discusses the criterion of rail expansion which is continuous rail in stress. Finally, discusses the procedures, materials of producing the "S" type insulated adhesive joint and the insulated steel fish plate M joint.

033277
TESTS WITH REGARD TO IMPROVING THE INSULATION OF STRESSED CONCRETE SLEEPERS BY MEANS OF EPOXY RESIN

Deutsche Eisenbahntechnik (VEB Verlag Technik, Oranienburgerstrasse 13-14, 7 Berlin 102, East Germany)

No. 5, May 1964, pp226-228

Discusses the problems involved in the transition from beechwood to prestressed concrete sleepers as related to insulation qualities. As a means to make concrete sleepers good insulators by developing an insulating epoxy which would be used to treat the wooden dowels which insulate the rail from the sleepers. Projected tests call for 40,000 sleepers to be tested at some future date.

033278
PLASTICS IN TRACK CONSTRUCTION

Knauthe, C, German Federal Railways

Deutsche Eisenbahntechnik (VEB Verlag Technik, Oranienburgerstrasse 13-14, 7 Berlin 102, East Germany)

No. 3, Mar. 1964, pp134-138

Discusses the factors in the use of flat fishplates with epoxy joints. Includes tests of static characteristics, tensile tests, pulsation tests and deflection tests between bolted and epoxical joints. In addition, in service tests along with comparisons of initial cost of material, labor and upkeep. Plus, projected cost-savings analysis for five years is included.

033279
PLASTICS IN TRACK CONSTRUCTION

Knauthe, C, German Federal Railways

Eisenbahntechnik (Bohmann Verlag, Canovagasse 5, A-1010 Vienna, Austria)

No. 2-3-, 51964

Discusses new problems of Gapless tracks, concrete sleepers and the placement of insulated joints as necessary to the operation of automatic block systems. The use of Miramid Fish plates, and epoxy cemented joints is described and discussed. The epoxy cemented joints include those without and those with flat fish plates.

033281
APPLICATION OF POLYMER MATERIALS TO BALLASTLESS TRACK STRUCTURE–PERFORMANCE TESTS FOR RUBBER MATS USED IN OPEN-BED, SLAB-TYPE TRACK STRUCTURE

Usami, T, Japanese National Railways
Sawada, T, Japanese National Railways
Kobayashi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

JNR is making large-scale trials with several new forms of ballastless track. One of these is of an open-bed, slab type, and consists of reinforced concrete supporting beds fixed at certain intervals on a concrete floor, rubber mats each placed at predetermined positions on the supporting beds, a series of prefabricated, well-finished reinforced concrete slabs resting on the rubber mats, and standard flat-bottom rails laid directly on the slabs. The open-bed, slab type tracks were laid tentatively in 1966 and are now still in service.

033298
THIRTEENTH PROGRESS REPORT OF THE COOPERATIVE INVESTIGATION OF FAILURES OF RAILROAD RAILS IN SERVICE AND THEIR PREVENTION

Cramer, RE, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 48, pp809-818

Since control cooling of railroad rails came into general use at all rail mills in 1936, a procedure has been established to study and properly classify all failures reported as transverse fissures in control cooled rails. It has been found that several of the reported transverse fissures are wrongly classified; however in a few cases such failures have been found to develop from defects other than shatter cracks, the usual cause of transverse fissures. Investigations have also been made of end-hardened rails in service. New methods of end-hardening rails are now being developed at several rail mills. Some laboratory tests have been made of these end-hardened rails and other tests are planned. A few control cooled rails developed transverse fissures or compound fissures from porosity, but no rails failed during this period from improper control cooling or shatter cracks. The detail fractures from shelly spots and head checks had mostly been incorrectly classified as transverse fissures while the web and base failures were sent to the laboratory for special investigation of each failure. Porosity is a newly recognized cause of transverse fissures which have been found in control cooled rails. No fissures from porosity have been found in rails from the three mills which do not reheat their blooms. This is rather strong evidence that the overheating of the blooms is the cause of the porosity. Rail fissures and porosity are illustrated in several photographs.

033299
FATIGUE TESTS OF RAIL WEBS

Jensen, RS, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 48, pp804-808

The study of the fatigue strength of rail webs has been continued. Tests were made on T-shaped specimens cut from the web of a 112-lb RE rail, under a range of stress which simulated as nearly as possible stress conditions encountered in service, namely, a bending stress ranging from a maximum compressive stress at the surface to a tensile stress 20 percent as great. Since the fatigue failures were in compression, the cracks progressed very slowly, and the criterion of failure was taken to be the number of cycles when the crack could be first detected. Eight T-shaped specimens were cut from the same piece of 112-lb rail and were shot peened. Tests indicated that shot peening raised the endurance limit approximately 32 percent over that for the unstamped specimens with the surface as rolled. To get some measure of the reduction in fatigue strength resulting from corrosion, it was suggested that fatigue specimens be cut from a corroded or rusty rail and tested in the same manner to determine the amount of weakening due to a rusty, pitted surface. A short piece of very rusty rail was obtained from which specimens were cut for these tests. The curve for these date indicates an endurance limit of 57,000 psi at 10 million cycles, or a reduction of slightly less than 3-1/2 percent below that for the non-corroded specimens. To observe the effect of water corrosion on fatigue strength, several specimens were tested with tap water dripping continually on them. The fatigue curve shows an endurance limit of 56,000 psi at 40 million cycles, which is approximately the same as for the rusty rail specimens.

033300
STRESS MEASUREMENTS ON 131-LB RE RAIL IN TANGENT AND IN A 6-DEG. CURVE UNDER REGULAR TRAFFIC–NORFOLK AND WESTERN RAILWAY–1945

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 48, pp768-804

Stresses were measured under regular traffic in the upper and lower web fillets, in the upper portion of the web and along the top outer edges of the base of 131-lb RE rail in tangent track and in a 6-deg curve. Stress measurements were also made on the supporting tie plates. It was concluded that the range of stress measured in the 131-lb RE rail in tangent track and in the outer rail of the 6-deg curve under regular traffic on the N. and W. Ry. did not exceed the endurance limit of rail steel at any of the positions at which gages were located. On the inner rail of the 6-deg curve at the upper web fillet and upper portion of the web on the gage side, occasional localized compressive stresses are considerably above the endurance limit of rail steel. On the inner rail of the 6-deg curve at the lower outer web fillet and along the top of the outer edge of the base of rail directly over the bearing on new rolled crown tie plates, the ranges of measured stress are considerably above the endurance limit of rail steel, and their frequency of occurrence is high under locomotive and tender wheels. At the same rail positions directly over the wider bearing on worn rolled crown tie plates, the range of stress is well within the endurance limit. One driving axle of the heavy locomotives running at low speed often produces an applied wheel load as high as 60,000 lb. on the inner rail and about 20,000 lb on the outer rail of the 6-deg curve.

033301
FIFTH PROGRESS REPORT OF THE SHELLY RAIL STUDIES AT THE UNVERSITY OF ILLINOIS

Cramer, RE, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 48, pp756-766

Several specimens of alloy steel were received for rolling-load tests to study their resistance to shelling. The chemical analyses, Brinell hardness and some physical tests of these steels, are given in Table 1. The heat-treated specimens were short lengths of rails and very little materials is available for physical tests until the rolling-load tests have been completed. Photographs of the shelling cracks for some specimens are shown. Heat-treated low alloy rails were much superior to any other specimens and compare very favorably with the 3-percent chromium rails and heat-treated carbon steel rails. The 3-percent chromium rail stood up to 5,000,000 cycles and the laboratory heat-treated carbon steel rolled 4,560,000 cycles before complete failure. The two tests made on the silico-manganese spring steel rails were discouraging as these specimens developed a brittle type of fracture after only 983,000 cycles and 657,000 cycles, respectively. Photographs of both of these failures are shown. The rolling-load tests of the as-rolled alloy steels were also discouraging as the best of these ran approximately one million cycles in the cradle-type rolling machine. These alloy steels could, or course, be heat-treated to produce physical properties which would give much better rolling-load tests.

033302
DEVELOPMENT AND CHARACTERISTICS OF FRACTURES UNDER ENGINE BURNS IN RAIL TOGETHER WITH INVESTIGATIONS AS TO THE EFFECTIVENESS OF WELDING UP ENGINE BURNS BY OXYACETYLENE OR ELECTRIC METHODS

Akers, JB Armstrong, JE Barnes, WC

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 48, pp734-750

This is a progress report covering rolling-load tests and metallurgical investigations on engine-burned rails. In summary: a driver burn of a rail causes extreme hardness because of the development of a martensitic structure. This constituent develops from the process causing the burn, namely, (a) friction heating and (b) rapid quenching. The martensite transformation apparently creates quench cracks because of the volume change. The quench cracks greatly reduce the fatigue resistance and the rail may fail in a shorter time. Attention should be given in the repair of driver burns by welding, to removing parent metal containing quenching cracks beyond each end of the burned area in addition to the burned metal, before weld metal is applied. Study should also be given to means of making the weld to obtain a minimum of oxide inclusions. Numerous photographs document engine burns and quench cracks in rail.

033303
FIFTH PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Alleman, NJ, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 481947, pp714-729

This is a report on the tests of joint bar failures and it gives consideration to the revision of design and specifications. Observations of tests are: Joint bars for 131-lb RE rail subjected to a wheel load increased in proportion to the increased section modulus of the bars, thus giving equivalent bending stress, render approximately the same joint bar life as the 112-lb bars. The cyclic life of the 131-K14 36-in. bars tested was somewhat longer than that of 24-in. bars of the same type. Top surface bearing at the rail end is wider on TR bars with the 11/16-in. fillet radius than on 112-lb headfree bars with 3/8-in. fillet radius. The average cyclic life of TR bars greater than that found with 112-B34 bars. Rolling-load tests on one lot of 112-B34 bars show an increase of cyclic life resulting from shot-peening. Variations in hardness from bar to bar of the same heat may result from variations in quenching temperature. Surface decarburization usually found on joint bars is readily detected in the Rockwell Test.

033304
EXPLANATION TO ACCOMPANY LETTER BALLOT ON ADOPTION OF REVISIONS OF THE 112-lb AND 131-lb RE RAIL SECTIONS AND JOINT BARS

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 48, pp658-671

Report discusses the revisions recommended for 112 lb RE rail and joint bars, especially the proportions, design of upper web and fillet, lower web, fillet and base flanges and the head contour. The design of the joint bar for this rail is explained along with factors relating to the new design. Finally, revisions of 131 lb RE rail, 133 lb RE rail and respective joint bars is covered along with descriptions.

033305
RECOMMENDATIONS ON NUMBER AND PLACING OF ANTI-CREEPERS FOR VARIOUS CONDITIONS

Martin, EE Adams, LL Aker, JC

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 481947, pp619-634

The rail creepage measurements were made from reference stakes set at 1/8-mile intervals. Considering the performance of the anchorage methods in respect to holding the rail against creepage and maintenance of line and gage during the test period. Test sections have shown equally good results. Some local condition in section G-2 probably caused the larger westward movement of the south rail. Methods H and I of the arrangements initially installed, have shown superior performance throughout the 33-month test, and with only 8 and 10 anchors, respectively. The problem of anchoring rail in track carrying traffic in both directions is considerably different from that on tracks with traffic in only one direction. In a majority of the miles in this test the south and north rails have moved in opposite directions. It therefore seems logical to anchor the rail to resist creepage in both directions. Further, for the best conditions of maintenance, staggered anchoring seems undesirable because of the excessive tie skewing and the adverse affect on the line and gage of the track. Also, for greater efficiency in resisting the rail movement immediately, the rail anchors should be boxed. However, an adequate number of anchors should be used to arrest creepage in both directions and to avoid having the anchor ties churn and lose their trmping. To obtain maximum rail restraint with the minimum number of anchors they should be spaced evenly throughout each half panel, as in most of the methods where consecutive ties were anchored the resistance of one crub of ballast proved to be insufficient to hold the anchored tie in place.

033307
EXPERIENCE WITH CORRUGATED RAILS IN AUSTRALIA

Cowdery, GE, New South Wales Railways

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 46, pp37-56

Article discusses the problems of rail corrugation in Australia. A case study is included which covers rail corrugation of the New South Wales Railways. The unique conditions present are analyzed and the probable contributors to corrugation are mentioned and discussed. Finally, American engineers analyze the conclusions and make suggestions and offer critiques.

033308
TENTH PROGRESS REPORT OF THE JOINT INVESTIGATION OF FISSURES IN RAILROAD RAILS

Moore, HF, Illinois University
Jensen, RS, Illinois University
Cramer, RE, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 45, pp481-502

Report discusses the field testing of end hardened rails for batter and resulting weeping cracks which developed and were repaired by welding. A series of rails from Carey Ohio (C&O) were examined for weeping cracks and the rails in which they developed were compared as to air and water quenched end hardened rail. The last section discusses control cooled rails which failed in service. Eleven illustrations show the types of failure.

033309
SECOND PROGRESS REPORT OF THE SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 45, pp462-469

The laboratory studies of the cause and prevention of shelling of rail surfaces are carried on in cooperation with the AREA Committee on Rail, Assignment 11-Investigate causes of shelly spots and head checks in rail surfaces for the purpose of developing measures for their prevention. Low strength of the steel, as indicated by low Brinell hardness, seems to be a significant factor in the development of shelly spots on rails. No defects were found in the metal of these rails which might have contributed to the development of shelling. It was also found that the shelling on these rails developed differently from that described as starting internally in last year's report on shelly rails. Several photographs are presented to illustrate the shelling that occurred. The rolling-load tests to compare the flow of various kinds of rail steels under laboratory controlled conditions, described in the 1942 report, have been continued, and the results are now complete on 21 specimens. Eight rails have changed less than one hundredth of an inch and a ninth rail was only slightly over this value. In contrast to these rails are 12 rails which changed in profile over two hundredths of an inch. It will be noted that all the rails except two which changed in profile over two hundredths of an inch were below 300 in Brinell hardness.

033310
INVESTIGATE RECENT DEVELOPMENTS AFFECTING RAIL SECTIONS

Bronson, CB Barnes, WC Bryant, CB

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 45, pp470-479

This assignment is concerned principally with an investigation of stresses in the web of the 112-lb RE rail section, undertaken because of failures developing the web member. New and improved scientific instruments and equipment have made it possible to conduct explorations obtain data far beyond anything previously attempted. Concurrently with the field studies, mathematical analyses and laboratory studies are being made. The occurrence of web failures in rail in track is an indication of the extent to which web stresses developed in service exceed the capacity of the rail steel. It will be noted that the rate of failure occurrence for any of the rails shown is quite small.

033311
INVESTIGATE CAUSES OF SHELLY SPOTS AND HEAD CHECKS IN RAIL SURFACES FOR THE PURPOSE OF DEVELOPING MEASURES FOR THEIR PREVENTION

Hewes, FS, American Railway Engineering Association

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 45, pp446-462

As the subcommittee investigates this subject more fully, it has been found that shelling is a much more serious and wide spread condition than was first realized, and while the shelly condition may be visible in some cases, in many others fractures of the rail may occur without the defect becoming noticeably visible on the surface of the head; therefore, it is doubly important that a solution be found. In addition to a study of rail-steel compositions, heat treatments, wheel and rail contacts and pressure, the subcommittee may turn to a study of mill practices as a possible cause of shelly steel, or it may finally resort to a consideration of larger diameter wheels or lighter loads on the wheels. If the answer lies in some special composition of rail steel or in heat treatment, the investigation must enbrace a study of the possibility that the new chemistry or heat treatment may give rise to some other types of defects or that they may lead to excessive difficulties or expense in production. While this assignment covers both shelling and head checking, very little mention has so far been made of the latter. At one time the subcommittee was of the opinion that one solution would cover both defects, but recent developments indicate that this may not be true. This report covers shelling only.

033312
SECOND PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Alleman, NJ, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 451944, pp434-445

Discusses the results of rolling load tests on joint bars. Details of test equipment, specimens, are discussed as well as table illustrating the test program of cantilever bending moment. Brinell hardness readings, wheel load position, design, bolt tension, bar reflectors and spring actions. Finally, a short report in the development and characteristics of the fractures which are formed beneath wheel bars in rail.

033315
STRESS MEASUREMENTS IN THE WEB OF RAIL ON THE DENVER AND RIO GRANDE WESTERN

Magee, GM, Association of American Railroads
Cress, EE, Association of American Railroads

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 441943

Progress on stress measurement in rail located in curved and tangent situations was measured, and reported. The vertical web stresses under different locomotives is included, and the varying speeds are listed. A comparison of stresses between 112 lb and 115 lb rail as well as 112 lb and 131 lb rail is included in the discussion.

033316
FIELD TESTS FOR BATTER OF END-HARDENED RAILS IN SERVICE ON THE CHESAPEAKE AND OHIO RAILWAY

Jensen, RS, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 44, II1943, pp611-621

A series of reports are presented for various aspects of rail, including field tests for batter of end-hardened rail, examination of rail for weeping cracks, control cooled rail with in-service failure and comparison of drop and bend tests.

033317
INVESTIGATE CAUSES OF SHELLY SPOTS AND HEAD CHECKS IN RAIL SURFACES FOR THE PURPOSE OF DEVELOPING MEASURES FOR THEIR PREVENTION

Hewes, FS Armstrong, SE Barnes, WC

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 441945, pp597-610

This subcommittee began its investigation with a field inspection on two heavy coal carrying railroads where the rail conditions are unusually severe. Committee has taken up its assignment under the three topical headings: shelling, head cracks and flaking, rating them as to relative importance in the order named. Flaking is not as serious as shelling or head checking as a cause of failures in rails. Seven rail flaws are illustrated.

033318
FIELD TESTS FOR BATTER OF END-HARDENED RAILS IN SERVICE ON THE CHESAPEAKE AND OHIO RAILROAD

Jensen, R Alleman, NJ

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 43, I1942, pp607-640, 5 Ref

Progress report which discusses the measurement of batter and hardness, testing of cracked and hardened rails with "weeping cracks", and a summary of these rails. Photos illustrate the weeping and shatter cracks found. Recommended practice for the controlled cooling of rails as a means to avoid or to minimize the formation of shatter cracks. A comparative study of control cooled and Brunorized rails—with the results of controlled cooled rails having reduced fissures and more improvements with improved insulation at the mills. Finally, a study and comparison of the drop and bend tests to determine rail quality and acceptability.

033319
INVESTIGATE JOINT BAR FAILURES AND GIVE CONSIDERATION TO THE REVISION OF DESIGN AND SPECIFICATIONS

McBrian, R Akers, JB Alexander, WT

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 431942, pp602-603

Rolling load tests have been conducted more or less continuously for two years with this machine and valuable information has been reported in the various committee reports. This information has dealt with fatigue life of joint bars, wear, stresses, effect of bolt tension, effect of abnormal conditions of joint bar fit, behavior of various designs of bars, etc. The following tests to be made on the rolling-load machine: (a) effect of "cocked" position of bars, (b) effect of design of bars, (c) effect of bolt tension on rail end breakage, (d) determination of fatigue strength of joint bars. Observational measurements were made during the year and the traffic carried over this test and the resultant joint bar wear are not yet sufficient to justify definite conclusions. Careful examination was made of all joint bars removed for evidence of cracks. One bar made of rail steel was found to have two small cracks on the top fishing surface.

033320
SPECIAL COMMITTEE ON STRESSES IN RAILROAD TRACK. SEVENTH PROGRESS REPORT

Talbot, AN Bronson, CB Burton, WJ

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Since 1914 this committee has conducted analytical and experimental investigations on the action of railroad track under the loads of locomotives and cars running at various speeds and for a variety of conditions. The tests herein reported were made to obtain information on the action of various types of rail joints in track when subjected to the loads of locomotives and cars at speeds up to 90 miles per hour. Testing equipment enabled tests to be made accurately and expeditiously in a way that had not been accomplished before. Tests were undertaken particularly to obtain information on the action of different forms of rail joints in track under the traffic of locomotives and cars running at various speeds and to learn the magnitude of the bending moments developed in the joint bars as compared with those developed in the full rail away from a joint. It was also desired to learn if possible how speed of train affects these various matters. To serve as a basis of comparison, the stresses and moments and depressions of the full rail in the same track under the action of the same locomotive and cars were needed. Tests were conducted at Elkton, Md. The test site was on a 14-min. curve to the right with superelevation of 1-1/2 in. Ahead of and behind this curve the compound curve became 33 min. The total curve extended over a distance of about a mile.

033321
MANUFACTURE AND TEST OF TRIAL PC TIES FOR FROST-HEAVE SECTIONS

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Railway Technical Research Institute (Japanese National

Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 3, Quart Rpt, Sept. 1966, pp35-36

The intensity of frost heave varies depending on the soil components or the weather and accordingly the distribution of reaction differs from tie to tie. The main objective of the present test is to know the changes of supporting conditions for ties through measurement of the bending moment produced in them by the train load. Though the changes due to frost heaving and thawing could be definitely noted, there were observed no remarkable phenomenon as initially feared of ties being supported only at midpoint; they were seemingly supported more often at both ends as the result of frost heaving.

033322
ON THE LIFE OF RAIL

Sato, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp28-31

Annual trend of rail failures of the Japanese National Railways in recent years amounted to 5264 in 1963. There are included in rail failures the numbers of broken rails, cracked rails and defective rails all together, they do not always cause interference to train operation. It is known from the figures that end break ranks the first and amounts to more than 60 percent. The number of end breaks is divided into two parts, namely in tunnels and out of tunnels. End breaks in tunnels are more frequent for their track length and the rails in tunnel have shorter life than the ones out of tunnels, due to unfavorable conditions of corrosion in tunnels of our country. End breaks almost occur as results of rail fatigue by train loads. Stress induced on rail varies in magnitude according to train speed, wheel load, lateral force and position of wheel contact on rail, and the stress distribution was found in many measurements to be a normal distribution or its combination in most cases.

033324
SEVENTH PROGRESS REPORT OF THE JOINT INVESTIGATION OF FISSURES IN RAILROAD RAILS

Moore, HF, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 421941, pp681-751, 15 Ref

The development of detector cars made possible the detection of many fissures before rail fracture had occurred, but it did not touch the problem of prevention of fissures. A "rolling-load" testing machine was designed and built which subjected a specimen of rail to repeated cycles of wheel load and bending moment. Before testing in this machine an etch test to detect the presence of shatter cracks was made on the rail from which the specimen was cut. Rolling-load tests showed the following results: Only shatter-cracked rails developed fissures, but not all shatter-cracked rails developed fissures. It is the complex stresses directly under a wheel load which cause cracks to develop into fissures. Bending moment tends to cause fissures to take a transverse direction, and accelerates their spread. No greater wheel load was required to start a fissure in a heavy rail than in a lighter rail. The minimum wheel load which started a fissure in the rolling-load tests was 40,000 lb. The wheel load necessary to start a fissure, the theoretical shearing stress in the zone where shatter cracks are located, the fatigue strength of rail steel, and the weakening effect of minute cracks (shown by fatigue tests of specimens) form a coherent picture of the mechanism of fissure formation and spread. The solution of the problem of preventing shatter cracks in rails was attacked by making tests of specimens from rails cooled in air and also controlled cooled. A large amount of study has been given to the problem of finding a nondestructive test which could be used to detect shatter cracks in new rails. Shatter cracks are so minute that changes, due to these shatter cracks, in properties or structure of metal around them, are masked by other variations in the metal. Unfinished work of the investigation relating to fissures includes formulation of proposed standards for control cooling of rails and for bend tests for acceptance of rails. Numerous photographs detail rail defects of the type described.

033325
INVESTIGATE JOINT BAR FAILURES AND GIVE CONSIDERATION TO THE REVISION OF DESIGN AND SPECIFICATIONS

McBrian, R Akers, JB Armstrong, JE

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 421941, pp666-679

This assignment to investigate joint bar failures, included the study of cracks which may or may not lead to ultimate breakage. The two most common types of cracking are illustrated in Figures 1 and 2, namely, (1) fatigue cracks originating in the spike slot, and (2) fatigue cracks originating at the upper contact surface of the bar. To study possible means of eliminating the cracking of joint bars, tests in track and tests in the laboratory are being conducted along the following lines. 1. Resistance to cracking by improving the physical properties. 2. Photoelastic studies as to effect of design and bolt tension. 3. Fatigue tests, using full size bars of various design in assembled joints. 4. Observations as to the effect of saw swelling of the rail end.

033326
SECOND PROGRESS REPORT–JOINT INVESTIGATION OF CONTINUOUS WELDED RAIL

Moore, HF, Illinois University
Thomas, HR, Illinois University
Cramer, RE, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 401940, pp737-755

Report of committee on welded rail includes a brief resume of past research and then continues into the present research area. The first covered is the testing of welded rail joints under repeated wheel load. The procedure, the endurance limit and fractures developed are included. A comparison between welds and joint bars was included. Metallographic tests of the welds are included and such tests as hardness, etching and metallographic examination of the welds are also included. Mechanical tests of the welded joints were also part of the test sequence. A complete comparison of the test are indicative of metal qualities rather than joints, and that the quality of metal is important to the joint strength as weld outline, cracks and other stress raisers in the joint.

033327
AN INVESTIGATION OF RAIL-TO-CONCRETE FASTENERS

Hsu, TC, Portland Cement Association
Hanson, NW, Portland Cement Association

Portland Cement Association, Old Orchard Road, Skokie, Illinois, 60076

Bulletin D146, Res Rpt, 22pp, 9 Ref

Prestressed concrete railraod ties are being increasingly used. This investigation deals with the rail-to-concrete fasteners for concrete ties, bridge decks, and tunnel linings. For spring-clip fasteners in concrete ties, three methods of electrical insulation were studied. These fasteners were subjected to tie-wear tests, longitudinal-slip tests and electrical-resistance tests. The anchors used were also subjected to pullout tests. For fasteners in bridges and tunnels, three different fasteners were tested under repeated loading. In addition, the "second-cast" method of construction was studied.

033330
TESTS WITH ASPHALT-TREATED BALLAST ON THE SOBU LINE

Satoh, Y, Japanese National Railways
Hirata, G, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt

Discussion of testing of asphalt treated ballast of several types as a means to reduce track destruction. Results suggest that the asphalt treated ballast was more stable but there were problems in the use of a tie-tamper because ballast does not move freely. When loose ties are replaced, small crushed stones are required underneath. In addition, it is suggested that where renewal of the track in conjunction with ballast renewal of asphalt treated ballast, better results may be expected.

033331
ELECTRONIC EQUIPMENT TO ESTIMATE THE STANDARD DEVIATION OF TRACK IRREGULARITES

Nakamura, I, Japanese National Railways
Wada, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 3, Quart Rpt, Sept. 1965, pp27-28, 3 Ref

Discusses the data processing equipment used in a track inspection car of the JNR New Tokaido Line. This car uses the less expensive less complex system than that used in the MAYA 341. The car under discussion uses mechanical type equipment to inspect track for irregularities, changes because of slack, cant, etc.

033332
LIGNIN SULFONATE AS SOIL STABILIZER–FUNGAL RESISTANCE TEST

Akahane, M, Japanese National Railways
Kawamura, H, Japanese National Railways
Yagi, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Quart Rpt, Dec. 1964, pp16-17

Chromium-lignin gel, which is prepared by adding potassium bichromate and several metallic salts into calcium-lignin sulfonate solution (which is produced from pulp wast liquor), can be used as soil stabilizer. This report shows the results of an experiment examining whether the soil treated with this chemical be infected by soil fungi.

033333
SOIL STABILIZATION BY ASPHALT EMULSION PRELIMINARY EXPERIMENTS

Akahane, M, Japanese National Railways
Yano, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 4, Quart Rpt, Dec. 1965, p 18

Discusses means used to stabilize soils, especially since the use of asphalt materials contain too much water to compact soils. The use of cement and lignin sulfonate and the relation to soil particle size was studied. However, the differences in soils is related to the final result. Lignin compounds work well in dry sods, while Portland cement works well in wet soils though aging will result in loss of strength.

033334
HOW TO RELIEVE THE SOFT SUBGRADE

Miyako, J, Japanese National Railways
Takeshita, S, Japanese National Railways
Otani, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt

Examines the phenomenon of "mud-pumping" and experiments with various materials to stabilize soils to stop or reduce this action. Plastic films, chemical stabilization are examined as two approaches. Results show that soft PVC settled more than ferro-lime stabilization, while the traditional sand replacement settled most of all.

033335
LIGNIN SULFONATE AS SOIL STABILIZER

Akahane, M, Japanese National Railways
Kurosawa, A, Japanese National Railways
Yano, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 2, Quart Rpt1965, pp31-33

Soil stabilization by chemicals has recently been studied widely in agricultural and civil engineering field. Lignin sulfonate is believed to be effective as a chemical stabilizer of soil, because of its property that combines soil particles tight and water proof, being gelated by bichromate. Gelation conditions from lignin sulfonate solution, properties of gel fromed, and then properties of stabilized sandy soil or Kanto loam by chromium lignin gel were investigated.

033339
STRENGTH OF VARIOUS TYPES OF EYE BOLTS FOR SWITCH STANDS

Magee, GM, Association of American Railroads

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

Test results, AAR Research Center for Canadian Pacific Railway.

Report discusses test of eye bolts in railraod switches. First, tests were made of stress, range of tension and compression in operation. A total of three switches were used to determine actual conditions. Then a series of tests were conducted with eye bolts with different thread patterns, different diameters, metallurgies, hot or cold rolled threads, heat treatments and cold working. Tests simulated conditions of eye bolt in switch operation. Results of testing and recommended eye bolt size, metallurgy and thread type is included.

033347
ELECTRONIC DATA HANDLING MACHINE FOR TRACK INSPECTION CAR

Nakamura, I, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 5, No. 2, No. 15, June 1962, pp18-22, 1 Ref

The record of the track inspection car is used in two ways. One is to find out remarkable irregularities and another is to afford data for making up maintenance plans. For the former purpose the record itself is enough but for the latter purpose some extraction of information from the record is needed. Formerly, manual data reduction was executed. Though the process of data reduction is very simple, it requires enormous man-hour. By the accomplishment of the new track inspection car, we can measure more than 500 km in a day. This new system can be said to be reliable enough and has been in operation since April, 1961, for the inspection of track covering more than 20,000 km all over the country.

033348
MAXIMUM VALUE OF TRACK IRREGULARITY

Hiroi, I, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 5, No. 3, No. 16, Sept. 1962, pp16-24

To know maximum values of track irregularities in a certain length of track is necessary for those who maintain track for the safety of traffic and for those who are in charge of maintenance of way. States of track irregularities are represented by the following indexes: P: Index of track irregularity (probability exceeding plus or minus 3 mm) m: Mean value of track irregularities sampled at random sigma: Standard deviation of track irregularities sampled at random. If the mutal relation between the maximum value of irregularity and the irregularity index is ascertained, it will be very useful.

033350
PROTECTION OF RAIL JOINTS FROM CORROSION TO PREVENT RAIL END BREAKS

Kose, Y, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 6, No. 3, No. 22, Sept. 1963, pp1-13

Many parts of the railway track including the rails are made of carbon steel. Carbon steel excels in strength but is prone to be corroded. Rail end breaks are considered as fatigue destruction caused by corrosion. Since stress and corrosion act at the same time, cracking is developed easily. It is because the fatigue strength of a rail decreases sharply in acid environments, that end breaks are more liable to occur in non-electrified sections than in electrified sections. Since corrosion has much to do with end breaks of rails in tunnels, the application of a proper protective method prevents end breaks of rails.

033351
RESIDUAL STRESSES IN THE RAIL

Yasojima, Y, Tokyo University
Machi,, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 8, No. 1, No. 261965, pp1-11, 1 Ref

When rail fasteners are loosened, the rail bends because of the accumulations of deformations caused by stress, workhardening or unevenness of stress. The resultant bend of a rail is the result of the nature of the rail as in the differences between a common or quenched rail. Residual stresses in rail tend to decrease which finally lead to rail deformation as a result of the loss of equilibrium of the forces.

033352
ON THE RAIL CREEPAGE

Ono, K, Kanazawa University

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 4, No. 4, No. 13, Dec. 1961, pp20-28

Paper describes studies on the processes and the causes of the rail creepage. Measured the rail creepage under traffics in relation to the kind of cars and the temperature of the rails, and found that the rail creepage occurred distinctly only under bogie cars, the sum of the rail creepages gradually increased when the temperature of the rail was varying. Concluded that the rail creeps by the movement of the deflection of the rail under wheels and by the elongation or the contraction of the rail, which is caused generally by the passage of the traffic as a result of releasement of the pressure or the tension in the rail.

033353
LABORATORY INVESTIGATION OF RAILROAD BALLAST

Okabe, Z, Osaka City University, Japan

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 4, No. 4, Dec. 1961, pp1-19

Japanese National Railways installed a new type vibrosir in the yard of Yodogawa freight station in Osaka City for the purpose of investigating railroad ballast, a series of laboratory experiments has been carried out in regard to behaviors of ballast and sub-ballast in a model track. Confirmed by these tests that under dynamic loading the settlement of tie is mostly affected by the ballast acceleration and amount of settlement can be minimized by increasing the ballast depth or by using suitable sub-ballast. Broken stone ballast should be used for main line track operating heavy and high speed traffic. Sand sub-ballast has a merit of reducing the ballast acceleration and tie settlement but coarse slag sub-ballast is far superior to sand sub-ballast in case of heavy dynamic loading.

033355
EXPERIMENTALLY DESIGNED NEW TURNOUT WITH MOVABLE NOSE RAIL

Tomonaga, K, Japanese National Railways
Kurokochi, H, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 4, No. 2, No. 11, June 1961, pp1-8

Discusses the needs for new turnout design for smooth operation of high speed rolling stock. The two new types of turnout are discussed including the design and the benefit to operation of equipment.

033357
HOW TO PREVENT RAIL FAILURES WHICH CAUSE TRAFFIC DISTURBANCE

Ito, A, Japanese National Railways
Kurihara, R, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 8, No. 2, No. 27, pp1-16, 2 Ref

Discusses the types of rail failure and the causes. Includes tables which illustrate various types of failure, the frequency and month by month break down of failure. Conclusions include recommendations for rail inspection and means to control the quality of rail steel to minimize break down.

033358
SHELLING OF RAILS EXPERIENCED IN JAPANESE RAILWAYS

Ito, A, Japanese National Railways
Kurihara, R, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 8, No. 2, No. 27, pp17-32

In some local lines of the Japanese National Railways and in major privately owned railways and subways in the Kanto and Kansai districts, rail failures caused by shelling of rails are showing signs of increasing. AREA Committee for Rail Shelling says that in curved tracks, if the rail heads and wheel flanges are lubricated, the incidence of shelling increases, but if lubrication is stopped, head checks, flaking and shelling conspicuously decreased. Rate of progress of the fatigue caused by contact should be made to balance with the rate of the progress of the wear. Allowing some wear to arise and also preventing for large plastic flow to occur, such failure may be prevented.

033359
ABSTRACT FROM REPORT OF COMMITTEE FOR "QUALITY OF RAILS AND MEANS OF IMPROVING IT"

Takahara, K, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 9, No. 2, No. 321966, pp19-26

Studies concerning means to improve the quality of the material of rails, undertaken in 1960 by the Committee for "Quality of Rails and Means of Improving it" under the guidance of Dr. Tokushichi Mishima, an authority on iron and steel metallurgy and chairman of the committee, were finished in fiscal 1965. Report of the committee is divided into five parts: (1) The outline of the results of researches; (2) The investigation of rail failures caused by manufacturing defects; (3) Prevention of rail failures caused by manufacturing defects; (4) Means to strengthen rail ends; (5) Studies of the chemical composition of rails; (6) Problems for the future and general remarks.

033360
TRACK FOR JAPAN's 210 KM/H TRAINS

Matsubara, K, Japan Transportation Consultants, Incorporated

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 11, No. 3-4, Nos. 40-41, 67pp

Detailed report of high speed operation. Details of maintenance of the right of way are discussed. The main features of the system are outlined, track cross sections and construction are further examined. The planning, organization and personnel of the maintenance operation are further discussed. The use of high speed inspection vehicles and their operation is included. Finally, protective devices against earthquake, rain and snow damage are mentioned and studied in detail.

033361
NEW SANYO LINE 1. NEW SANYO LINE 2. THE ADJUSTABLE BALLASTLESS TRACK APPENDIX TRACK FOR HIGH-SPEED RAILWAYS IN THE WORLD

Matsubara, K, Japan Transportation Consultants, Incorporated

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 12, No. 1-2, No. 42-43, pp1-98

The publication discusses three major topics. First, the plan of the New Sanyo Line, its description, and aspects of the planning of the extension of the line are discussed in detail. The second section considers the design of an adjustable ballastless track which will be used on part of the New Sanyo. The problems of design and engineering are discussed. The third part is a series of appendices which compare maintenance processes and controls of the railroads of the major countries of the world.

033362
THE LONG WELDED RAILS

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31967, pp31-34

Article deals with the techniques used to mechanize the laying of long rails with welded joints. Subjects considered include the method of laying the new rail, the removal of the rail from the trains, the organization of such a train how it is unloaded and reloaded. The flash welding plant used, is described, along with its operation.

033366
ROLLING LABORATORIES OF S.N.C.F. THE NEW CATENARIES INSPECTION COACH OPERATED BY THE FIXED INSTALLATIONS DEPARTMENT, S.N.C.F. TESTS COACH S. 445, S. 510, S. 512, S. 513–DYNAMOMETRIC RECORDING COACH

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 11964, pp39-59

Discusses a number of mobile units used by the S.N.C.F. for such purposes as inspection of power lines and relationship to pantographs, pressure, movement and acceleration, tests of air and electro-braking systems. Measurements of noise levels as related to passenger comfort and a dynamometer coach. The details of each type of test unit are discussed and described individually.

033377
THE "RALUS" METHOD FOR RAIL INSPECTION BY MEANS OF ULTRASONIC PROBE

French Rail News (Federation des Industries Ferroviaires, 12 rue

Bixio, 75007 Paris, France)

No. 11970, pp9-10

Shrinkage of a rail is not due to vertical wear but to diverse cause divided into two main categories:—Defects in rail fabrication;—Shrinkage due to use, for example the lateral wear at chamfer, or damage to the surface by slipping. Though the diminution of shrinkages in the second category is the affair of the user, the first category concerns the rail makers and the S.N.C.F. jointly. The study and development of the RALUS method provide an efficient means of checking the metallurgical quality of rails. A tool which will enable it to follow up the quality of production and to detect any anomalies before rails are laid on the track.

033378
THE STABILITY OF TRACKS LAID WITH LONG WELDED RAILS

Prud'Homme, MA, French National Railways
Janin, MG, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1969, pp601-620, 34 Ref

A study of the behavior of track under traffic situation. Factors considered are axle loading, pliability of the formation, mechanical characteristic of the rail, temperature, type of sleepers and fastenings. Included is a study of the deformation of the track in its plane which initiates a differential equation of variable and non-linear coefficients. Recommendations for the requirements of 250 km/h plus 300 km/h systems are included at the end.

033379
THE STABILITY OF TRACKS LAID WITH LONG WELDED RAILS

Prud'Homme, MA, French National Railways
Janin, MG, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Aug. 1969, pp459-487, 1 Ref

Primarily devoted to the stability of non-loaded track under thermic stresses. Tracks as compared include wooden sleeper construction opposed to pot sleepers. (2 concrete blocks joined by a steel tiebar). The qualities of stabilized and nonstabilized track are further considered under the headings of wooden and pot sleeper.

033381
SHOP MANUFACTURE OF GLUED INSULATED RAIL JOINTS

Volker, A

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Sept. 1966, pp1411-413

Discusses the means to construct glued insulated rail joints. The methods of joining rail in the shop are discussed, though the process may be performed in the field. Costs of construction are detailed and a plan of the plant are included.

033383
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN OPERATION

Hojoh, T, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Mar. 1965

Discussion of factors related to track structure for high speed operation. Running tests include running stability over a ruptured rail, dynamic effects of wheel flat, dynamic stresses of prestressed concrete ties, behavior of embankments under high speed traffic loads, and measurements of train wind. Additionally, comparative studies of welded rails, wooden sleepers, and a test vehicle to be used for high speed track inspection are discussed.

033384
ELECTRONIC DATA HANDLING MACHINE FOR TRACK INSPECTION CAR

Nakamura, I, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1963, pp412-415, 1 Ref

Discusses the use of a track inspection car which is used to locate irregularities in the track system, and to gather data for making up maintenance plans. The car is able to measure more than 500 km per day. Formerly, the data was reduced manually. However, one day's gathering occupied 5 people for one month. Consequently, a data processing system was installed in the car with a resultant less variance than in manual data handling.

033385
EXPERIMENTALLY DESIGNED NEW TURNOUT WITH MOVABLE NOSE RAIL

Tomonaga, K, Japanese National Railways
Kurokochi, H, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Mar. 1962, pp467-473

Discusses the problems involved in switch design for high speed operation. Previously, switch designs functioned satisfactorily, but the transition from rail to rail was not smooth which resulted in a rough transition and damage to the rail. Two new types were designed, which were less complex, eliminating guide grooves, guard rail, and irregularities in the gauge line of a turnout.

033388
WORK-HARDENING BOLT HOLES IN RAIL ENDS

Wise, S, British Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1960, pp863-865

Causes of rail failure occurring at holes near the rail head are discussed. These are radial or star cracking caused by high shear stress in the web aggravated by presence of fish bolt holes. Stresses are caused by locomotives with small driving wheels. Improvement in rail resistance is the result of work hardening the surface of the holes. Accomplished by drilling undersize holes, and broaching or drifting with a spherical tool.

033393
ASPHALT-COATED BALLAST. POTENTIAL BENEFITS SPUR FURTHER TESTS

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1960, pp845-850

Earlier tests have suggested that definite savings in maintenance costs are possible through the use of asphalt-impregnated ballast. Some of the test sections will be located on track laid with continuous welded rail, with 78-feet and 117-feet rails, and with tight joints as well as with conventional joints. The A.R.E.A. Roadway and Ballast committee concluded that asphalt-treated ballast is practical and beneficial. It also concluded that the economic life of this test section was seven years, because the section labor required during the last three years of the test period was in excess of that for the entire division on a permile basis.

033395
PROTECTING THE TRACK FORMATION BY MEANS OF PVC FOILS

Tyc, P, Hochschule fur Verkehrsesen, Prague

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1962, pp1344-350

Description of the use of PVC foils to protect track formation against surface water. The foil is placed between the ballast and the subgrade. Thus far, the PVC foil has succeeded as protection against surface water. Preferable system when the bearing capacity of the subgrade is reduced by inadequate surface drainage or with certain types of stone which deteriorate. The PVC does not work with water percolating from beneath.

033396
RATE OF RUNNING UP CANT ON RAILWAY CURVES AS APPLICABLE TO DIFFERENT GAUGES

Dickshit, G, Government of India

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

To correct for centrifugal force and its effect upon rolling stock, it is a practice to elevate or to cant the outer rail of a curve. To avoid the abrupt transition from a tangent to a curve, a transition curve may be introduced. This article discusses the amount of cant which is necessary to balance the centrifugal force, and the cant which is necessary in the transition curve to make up the deficiency for a smooth transition.

033397
DETERMINING THE DEPTH OF THE BALLAST

Milosevic, B, Railway High School, Belgrade

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

It is possible to have a more rational approach to the problems than that currently adopted as regards determining the depth of ballast. The depth of ballast need not necessarily be constant over the whole line, but should in fact vary as a function of the kind of terrain constituting the formation and its load carrying capacity. It is therefore on the basis of the load carrying capacity that the depth of ballast capable of transmitting the rolling loads should be determined.

033398
SUPERIMPOSITION OF HORIZONTAL CURVES ON VERTICAL CURVES

Ganpati, KB, Advanced Permanent Way Training School

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Aug. 1963, pp523-528

The rate of change in grade as recommended by Wellington is no longer applicable to modern rolling stock with low train resistance. Neither are long vertical curves needed since it is more economical to use train brakes to prevent the crowding of cars when descending. When high speeds and vertical curves are present, an increase in the equilibrium superelevation to a maximum of 12 percent is recommended.

033399
FASTENING THE RAIL

French Rail News (Federation des Industries Ferroviaires, 12 rue Bixio, 75007 Paris, France) N2, 1967, pp 23-24

French type of doubly-resilient rail fastening features vertical holding of the rail between two components of well defined resiliency: 1. Grooved sleeper (tie) pad in rubber, positioned under the rail. 2. A spring-temper steel leaf type clip, the bearing of which is exerted on the rail by means of bolt (in concrete or steel tie) or screw fastening in wooden tie. Advantages of these fastenings are shown as extending into the economics, as retightening is extended to every four to six years, as against the yearly maintenance required with rigid fastenings, and the reduction of the number of tie screw reconditionings required.

033402
HIGH SPEED RUNNING AND RELATED TRACK PROBLEMS

Prud'Homme, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21966, pp83-92, 1 Ref

High-speed running does not set any track-make-up problems. The conventional type is quite suitable. Strengthening the track is not a must, neither from the angle of safety nor that of fatigue. Strengthening, which could be useful on the lines carrying both dense fast traffic and numerous slow heavy trains, could be carried out simply at the time of the scheduled renewals. The layout problem is more difficult. On certain important lines on the S.N.C.F. there are sufficiently long sections where the radii are over the minima indicated above. Consequently, scheduled service traffic at 200 km/h could be envisaged on these sections in a not too far distant future.

033409
THE RAIL

Lebrun, F, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

1967, pp3-10

Catalogue - Track Equipment

Article on rail is descriptive, highlighting the development of appropriate specifications for the necessary requirements of resilience and strength. Rails in the process of manufacture are subject to continuous ultrasonic testing by an instrument called the RALUS. Rails in service are tested regularly by an electro-magnetic system for detection of fatigue faults. The elimination of joints has further improved rail life in track and the choice of the proper weight and profile of rail for the service to be imposed needs to be considered.

033410
BOUTET PROCESS FOR WELDING RAIL JOINTS

French Railway Techniques (Federation des Industriels

Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

1967, pp11-16

Boutet welding process for rail joints, which uses the "alumino-thermie", has been advanced to a three piece mold, which permits the welding of joints, even over the ties without moving them aside, and the use of a small portable machine for making the molds. This makes possible the speedier welding of joints at the rate of a joint per man-hour or less. Technical advantages of being able to center accurately all parts of the mold around the joint, and the practical elimination of any bead under the flange. Limited preheating welding (a rapid process) has been developed to minimize the effect of rail movement during the welding preparations. The elimination of the bead has made possible a high quality joint, highly resistant to the drop and fatigue tests.

033411
THE SLEEPER (WOOD, STEEL OR CONCRETE)

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

1967, pp17-18

The Purpose of Sleepers: transmission of loads from rail to ballast; maintaining correct gauge; angling the rail (1/20). Subjected to a whole lot of complex actions: vertical and horizontal efforts exerted by the rail flange on the upper surface of the sleeper; contact with the ballast, exerted on a narrow area at rail level, alternate dynamic bending at the centre part due to the passing traffic. It may happen that the sleeper is not correctly bedded, and there is a float of a few millimeters so that the passing traffic bangs the sleeper on to ballast.

033414
END-HARDENED RAIL

Katayama, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt1968, pp17-19

Rail joints are the most vulnerable spots in the track structure and many manhours are spent on their maintenance. These parts are subjected to repeated impacts which are far larger than those inflicted to the other parts of the track. Moreover, the rails with joint holes bored in the web are structurally weak. Since the quality at the end of the rail, in spite of these weak conditions, is the same as the other part, the rail end has been apt to suffer a battering and rail joint depression. Because of progress in the rail welding technique and the improvement in the quality of the rail fastenings, the rails have come to be increasingly welded to "long rails". Standard length rails are expected to continue in use in considerable quantities. Strengthening the rail ends through production of rail steels with less non-metallic inclusions and heat treatment of rail ends to making them a better impact resistant structure was taken up as a research project.

033416
STRENGTHENING OF TRACK STRUCTURES

Kitaoka, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, Quart Rpt, June 1967, pp36-38

On the JNR, the passing tonnage has nearly doubled and the average train speed has increased approximately 20 percent, in the last 30 years. Increasing traffic, coupled with unfavourable conditions such as a shortened train interval for maintenance due to increased frequency of train operation and a decrease of manpower for maintenance, it becomes very difficult to keep the track in good condition to meet the increased traffic. Necessity of strengthening the track structures to cope with such trends and overcome these unfavourable conditions, is stressed.

033417
HIGH SPEED TRACK INSPECTION CAR

Hiroi, I, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 4, Quart Rpt, Dec. 1966, pp40-41

The high speed track inspection car serves to check efficiently the important factors of track condition such as track irregularity under train load, train vibration etc. It is effectively utilized to perform periodic track inspection based on JNR maintenance rules, as well as other testing and research; the maximum measuring speed is 120 km/h on the narrow-gauge lines and 160 km/h on the New Tokaido Line.

033419
TURNOUT WITH NOSE RAIL MOVABLE CROSSING

Kurokochi, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 4, Quart Rpt, Dec. 1965, pp16-19

For the New Tokaido Line the Japanese National Railways required that the turnout at stations should allow passing trains the same maximum speed of 200 km/h as they use on the rest of the line. It is necessary to have a special turnout which would minimize the wheel shock to the turnout structure, both vertically and laterally. Worked out was a turnout with a nose rail movable crossing having welded joints, skew joints, no guard rail, and no guiding flangeway of wing rail. Several types of such turnouts having nose rail movable crossings have been experimentally designed in JNR beginning in 1960. Experience of service so far made suggests no troublesome problem concerning track maintenance. Furthermore this new turnout needs only a little maintenance labor.

033421
DATA HANDLING OF HIGH-SPEED TRACK INSPECTION CAR

Nakamura, I, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 3, Quart Rpt, Sept. 1963, pp37-38

Measurement records made from the high-speed track inspection car are for two purposes, one of them is to defect and locate large track irregularities for preparation of the data necessary for spot maintenance. The other purpose is to give an overall information on the track irregularities found within a certain distance, as this helps service and maintenance planning. For the second purpose, however, records must be sorted, classified and processed statistically. The machine operation shows more stability than that of manual work and this is because the machine has no personal error. The machine has been employed officially since April 1961 and the inspection data over 40,000 km throughout Japan has been already handled. Therefore savings of man-power, cost and time to date have been very large.

033424
STATISTICAL TENDENCY IN CUTTING SLOPE FAILURES

Takahashi, H, Japanese National Railways
Matsunami, T, Japanese National Railways
Shimizu, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 4, Quart Rpt, Dec. 1964, pp23-24

The present paper is concerned with the result of statistical analysis tried to clarify the causes of the cutting slope failures. The data are obtained from 162 sheets of replies to a questionnaire on cutting slope failure submitted in 1963 to the Civil Engineering Division in the Construction and Maintenance Department, JNR. The failures occurred mostly on unprotected cutting slope and were caused by rainfall. Less than half of them led to suspension of traffic during more than 1 hour, comparatively shorter than expected, and in 65 percent of them the amount of debris was less than 50 m cubic. The failures occurred mostly on unprotected slopes.

033425
TRACK INSPECTION CAR FOR NEW TOKAIDO LINE

Nakamura, I, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt

New ideas have been incorporated in the design and manufacture of a new track inspection car for use on the New Tokaido Line, which has performed well so far. Items to be measured are: (1) uneveness, left, (2) unevenness, right, (3) variation of uneveness, left, (4) variation of uneveness, right, (5) twist of track, (6) track gauge, (7) alignment, left, (8) alignment, right, (9) variation of alignment, left, (10) variation of alignment, right, (11) cross level, (12) rolling of car body, (13) vertical acceleration of car body, (14) lateral acceleration of car body, (15) lateral thrust, left, (16) lateral thrust, right, (17) wheel load, left, (18) wheel load, right, (19) lateral thrust/wheel load, left, and (20) lateral thrust/wheel load, right. Systems are designed for accurate and sensitive measurement at speeds up to 200 km/h. The frequency response is within plus or minus 2 percent up to 50 cycles and within plus or minus 10 percent up to 70 cycles, and the linearity plus or minus 0.3 mm.

033426
TURNOUT FOR N TYPE RAIL

Chujo, R

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 2, Quart Rpt, June 1963, pp27-28

At present, there are about 58,000 sets of ordinary turnouts. Most of them, however are of antiquated designs, being based on designs worked out as early as 1925. As they have become inadequate, under the present train load conditions, from the points of track maintenance and train operation, JNR has been doing its best to improve them. Yet such improvements have been only partial; no systematic overall improvement has been made yet. But extensive research work to design turnouts capable of allowing high speed train operation has been done in the last 10 years, and has enabled us to understand, theoretically, how turnouts can be improved. So, JNR is pushing forward design and development of improved turnouts which can meet all possible requirements placed on them under present and expected future train loads, paying at the same time, attention to make them interchangeable with existing turnouts. Marked improvements are expected, not only in maintenance efficiency but also in transportation capacity, with the introduction and full-scale use of these new turnouts designed for N type rails.

033428
MECHANIZED MAINTENANCE OF TRACK ON THE JNR

Ijichi, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Quart Rpt, Sept. 1960, pp24-26

The Japanese National Railways are making continuous efforts to mechanize track maintenance work in line with the policy towards general modernization of operation. Emphasis is laid on the wider employment of small-sized equipment which will allow a train to pass or which can easily be taken out of the track when a train is coming. So-called overall track renewal using heavy equipment is carried out where an interval of 3 or 4 hours is available between midnight and 4 o'clock in the morning as in the case of the electric multiple unit train lines in and around Tokyo and Osaka. This method is also used on some trunk lines, such as the Tokaido Line in cases where sufficient work time is available by blocking one side of the double track. Outlined are the principal kinds of maintenance work in which such equipment is used, and the measuring devices.

033429
HIGH SPEED TRACK INSPECTION CAR

Hayakawa, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

No. 2, Quart Rpt, Mar. 1960

The primary requirement for a rational control of track maintenance is to know the state of the track exactly. A high speed track inspection car of a new type was completed last year. In view of the high speed operation during which the measurement is made, arrangements have been made to take all records electrically. Accuracy of records is quite good even at a speed of 120 km/h.

033430
THE STRENGTH OF FISH-BOLTS

Umekubo, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 2, Quart Rpt, June 1965, pp23-26

A report on performance of hardened and non-hardened fish bolts, also bending-free bolts are included. Tests included the use of Vibrogir to determine the effect of vibration in the loosening of a rail-fish plate and bolt unit. Under the equivalent of a passage of 85 million tons, no looseness because of nut turning was found.

033431
A 101 TYPE RAIL FASTENING DEVICE (THE NEW TOKAIDO LINE STANDARD TYPE) FOR P.S. CONCRETE SLEEPER

Minemura, Y, Japanese National Railways
Ichikawa, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 41964

Numerous variations of rail fastening devices have been tentatively fabricated for the new Tokaido line. As the final prototype, the rail fastening device, which was originally developed for 50 kg

PS rail, has been modified for application to the new Tokaido line 50 kg T rails. Statical characteristic test and lateral fatigue test were conducted on the tentative product and the results were checked with the anticipated values. The most suitable plastics and compound materials were sought for spring support and the durability of fastening parts was confirmed. The results suggest that a spring clip in the setting area will present no trouble. In this type of fastening, where a hexagonal bolt is screwed into the insert plug embedded in the concrete itself, special care should be taken in designing, so that the bending moment may not directly act on the bolt. There will be no practical trouble with this device, provided the above point is fully attended to.

033433
GLUED RAIL JOINT FOR INSULATION

Hojo, T, Japanese National Railways
Umekubo, S, Japanese National Railways
Sekiguchi, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 3, Quart Rpt, Sept. 1965, pp29-33

To develop the new type rail joint for insulation having not only sufficient vertical rigidity but also sufficient strength to be able to bear the axial force due to temperature variation in a long welded rail, the following study has been undertaken. Rail and fishplates of the joint are glued with a high-polymer adhesive. This type of rail joint will not only make maintenance of the track easy but also make riding quality good.

033436
PROBLEM OF INCREASE OF SPEED, AS FACED BY THE RAILWAYS IN DEVELOPING COUNTRIES

Joseph, TV, Indian Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

May 1968, pp591-609, 16 Ref

The immediate problem, in many of the developing countries, is not that of attaining very high speeds, but is that of reaching moderately high speeds. The economic conditions in these countries require that such increase of speeds should not entail any appreciable additional capital investment nor should it result in an increase in the maintenance and operating costs. The Indian Railways have undertaken investigations, research and studies with a view to achieve moderately high speeds on their "broad gauge" and "metre gauge" railway systems. The results of these studies are discussed.

033437
GENERAL PROCEEDINGS OF THE TECHNICAL MEETINGS

International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium

Dec. 1966, pp1534-552

19th Session.

Present trends in the methods of maintenance and renewal of the permanent way, with particular reference to: a) the influence of track design thereon having regard to the demand for higher speeds; b) organization of the employment of labour and of mechanical equipment; c) costs; d) safety measures for staff and trains and their effect on operational requirements.

033438
SPECIAL ACCOUNTS SUMMING UP THE REPORTS ON THE QUESTIONS FOR DISCUSSION AT THE NINETEENTH SESSION OF THE INTERNATIONAL RAILWAY CONGRESS ASSOCIATION (PARIS, 1966)

Alias, J, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 43, No. 6, June 1966, pp1037-056

Present trends in the methods of maintenance and renewal of the permanent way, with particular reference to: a) the specifications. Observations of tests are: Joint bars for demand for higher speeds; b) organization of the employment of labour and of mechanical equipment; c) costs; d) safety measures for staff and trains and their effect on operational requirements.

033441
DESIGN AND MAINTENANCE OF HIGH-SPEED PERMANENT WAY IN THE U.S.S.R.

Troyitzky, LF, Ministry of Railways, USSR

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Aug. 1968, pp837-853

The track on high-speed lines is subject to special criteria. A high level of design including the use of long welded rail sections, temperature-stressed concrete sleepers is required. Maintenance requirements are severe. Of vital importance is the control of track in the horizontal plane. The wear of rails and the permissible magnitude of corrugations, etc., are strictly limited. Great attention in the U.S.S.R. is paid to the increasing of speeds of trains since a comparatively small increase in maintenance gives a considerable economy in railway stock, reduces the cost of freight and passenger services, increases railway capacity. Experience, maintenance, design and labour problems are discussed.

033443
CALCULATION OF THE LONGITUDINAL STRESSES, ACCORDING TO VARIATIONS IN THE TEMPERATURE, IN A SECTION OF LINE LAID WITH LONG WELDED RAILS

Teodoresco, CC, Polytechnical Institute of Bucarest

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 44, No. 10, Sept. 1967

A comparison of these various hypotheses and their simplified diagrams, shows that the elastic behaviour of the ballast has a great influence upon the distribution of the reactions which start in the sleepers as a result of a variation in the temperature. Seeing that all the sleepers have elastic displacements, we can no longer speak about the fixed part or "respiration length". If concerned with large plastic deformations, the length will be found to be smaller than that taken for the rigid behaviour of the ballast. The exponential distribution, corresponding to the elastoplastic behaviour of the ballast is the closest to reality.

033446
DETERMINING THE INCREASE IN BALLAST DENSITY UNDER TRAFFIC BY MEANS OF THE GAMMA ABSORPTION METHOD

Birmann, F, German Federal Railways
Cabos, P, German Federal Railways

Rail International (International Railway Congress Association,

17-21 rue de Louvrain, 1000 Brussels, Belgium)

Mar. 1967, pp229-249, 9 Ref

The increase of running speeds on main lines to 140 km/h or 160 km/h and the increase of axle loads of motive power units and goods wagons, the question has been studied for some years whether the undoubtedly higher maintenance cost to be incurred for the permanent way could be reduced by special measures. The mechanical compaction of ballast between sleepers will repay after 2-1/2 years because the extension of the interval between track overhauls will also entail a reduction in the number of tamping machines required.

033723
DEFORMATION OF RAILWAY TRACK UNDER HIGH-SPEED TRAIN–MEASUREMENTS ON THE TEST-RUN SECTION OF THE NEW TOKAIDO LINE

Satoh, Y, Japanese National Railways
Toyoda, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 2, Quart Rpt, June 1966, pp20-23

In designing the new Tokaido line, many tests through actual operations of trains at high speed were conducted in parallel with model experiments, laboratory tests and theoretical analyses. Major items of measurement on the ground were rail deflections, rail stress, stress on fastening device, track vibration acceleration and sleeper stress. Major measured items on the car were wheel side thrust, wheel load, bogie stress, car body vibration, axle box vibration and similar forces.

033728
ON THE LATERAL STRENGTH OF RAILWAY TRACK

Sato, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 1, Quart Rpt, Mar. 1961, pp56-58

Various deformations taking place in the track due to the lateral force of rolling-stock are theoretically and experimentally analyzed; the critical value of lateral force to destroy the track is proposed; and the results of application of research data are summarized. It is found that the rails in the track may be regarded as supported on three kinds of springs, and these springs are related to the rail pressure under wheel weight. The three springs include first, a spring due to transverse deformation in the wood sleeper near the rail base, or a transverse spring of elastic rail fastening; second, a spring due to the lateral displacement of sleepers in the ballast; and third, a spring due to reaction of a wood sleeper to the inclination of rail by twisting, or a spring of elastic rail fastening to rail inclination. Thus, the track deformations under lateral forces might be regarded as the deflection and twisting of rails supported by these springs.

033729
RAILWAY TRACK STRUCTURE FOR HIGH-SPEED TRAIN OPERATION

Hojoh, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt, Aug. 1964, pp3-8

Special Issue.

Discusses the results of testing of structure and materials for high speed operation. Tests of ruptured rail, effect of flat wheel on the track, stresses of PC ties, behavior of high embankment with high speed traffic are considered. Additionally, the testing of Japanese rail as welded by German and French methods and equipment. The use of wooden sleepers (ties) in the construction of the New Tokaido Line is also detailed. Finally, the design and use of a high speed track inspection car is discussed.

033730
TRACK STRUCTURE

Hoshino, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt, Apr. 1960, pp20-23

Special Issue.

Discusses the relationship between track structure, train speed, gross tonnage and the relationship to construction and maintenance. The cumulative effects of speed and weight to the destruction of the track is discussed and possible structural solutions and maintenance solutions are offered.

033733
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS; FACTORS AFFECTING THE CONSTRUCTION OF SWITCHES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rept 2, Intrm Rpt, June 1966, 26pp, 4 Ref

The present interim report—Document No. 2—deals with the 3rd part of the Programme of Work "Conception of Switches". Based upon the three fundamental requirements of safety from derailment, steady riding of vehicles and economy in construction and maintenance, the interim report examines particularly the incidence of high speeds and heavy axles in the negotiation of switches. The calculations and the measurements taken to this end, are developed in two appendices where a study is made on bogie coaches for an analysis of accelerations in respect of comfort and on a V60 diesel shunting locomotive of the DB 25,000 series electric locomotive of the SNCF for an analysis of forces causing wear and fatigue. The reduction in basic components, the simplification of machining and increased life in service, with a choice of assemblies and materials which should ensure minimum maintenance cost while retaining the maximum traffic availability, are sought in the choice of "pose" (3-20) and "Construction" (3-30).

033739
ADAPTATION OF THE METHODS OF LAYING, ALIGNING AND MAINTAINING THE PERMANENT WAY TO CARRY TRAFFIC AT VERY HIGH SPEEDS (120 KM/H AND MORE): A) ON THE STRAIGHT; B) ON CURVES; SO FAR AS THEY AFFECT SAFETY AND TAKING INTO ACCOUNT THE TYPE OF ROLLING STOCK USED

Matsubara, K, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Dec. 1961, pp960-1039

A report on the results of a questionnaire which was sent to 36 railways. The questions deal with the manner in which the railways are dealing with the laying, aligning, and maintenance of railroads where traffic at speeds in excess of 120 km/h. The conclusions of the report include a general view of the elements of maintenance of the permanent way as practices on an international scale.

033848
THE TRACK

Prud-Homme, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21970, pp67-79

Stresses caused to the track by future trains intended to operate at a maximum speed of 300 km/h will remain within acceptable limits for the orthodox type of track and comfort will be excellent without the necessity of maintaining a quality of track better than that already achieved on our present high-speed lines. The laying of concrete slab track is not justified neither from the technical or economic point of view.

033852
GENERAL CONSIDERATIONS CONCERNING THE DESIGN OF CHANGE-OF-GRADIENT POINTS

Henker, H

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1965, pp410-429, 7 Ref

Discusses the engineering aspects of changes necessary in change of gradient points in railroad tracks to increase maximum rail speed. Vertical transition curves for change of gradient points date to early days of railways. Only recently have factors of geometry, dynamics of the vehicles been considered. The earlier determination was done empirically without practical equipment consideration.

033854
TRACK GEOMETRY AND DESIGN OF THE PERMANENT WAY OF HIGH-SPEED LINES

Birmann, F, German Federal Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1969, pp393-428, 34 Ref

The increase in maximum speed envisaged by many railway administrations makes exacting demands on the permanent way. In the following, the resulting problems associated with the railway track are discussed mainly on the basis of theoretical considerations and on the strength of the results of experimental research carried out by the German Federal Railway (D.B.) at speeds of 200 km/h. The resulting conclusions are also applied to even higher speeds. Comparisons are made with similar developments abroad.

033858
SOME PROBLEMS ABOUT TRACK AND MAINTENANCE OF WAY UNDER HIGH-SPEED TRAIN OPERATION

Ban, Y, Japanese National Railways
Murayama, H, Japanese National Railways
Satou, Y, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Feb. 1968

The railway is bound to offer speedier and more pleasant services. As the result, it is intensely desired that the future maximum train speed be advanced from the present 140-160 km/h or so to 200-250 km/h. It then becomes necessary to carefully examine such items as the effect on track and its maintenance of high speed train operation; what sort of measures will be necessary in order to ensure safety in such train operation as well as excellent riding quality and the most economical track structure and maintenance system thereof, taking into consideration both the initial and maintenance costs.

033859
TRACK BED AND TRACK MAINTENANCE ON HIGH-SPEED TRACKS. EARLY EXPERIENCE FROM THE HIGH-SPEED RUNS BETWEEN MUNICH AND AUGSBURG AT THE TIME OF THE INTERNATIONAL TRANSPORT EXHIBITION

Henn, W, German Federal Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

July 1967, pp513-525, 10 Ref

Remarks concerning alignment, design and maintenance condition of the permanent way on the high-speed section between Munich and Augsburg are followed by a discussion of test run results, with special reference to the relationships between track bed faults and vehicle accelerations at high speeds. The technical problems associated with high-speed tracks and their maintenance have been largely clarified.

033861
"HIGH-SPEEDS" SYMPOSIUM

Birmann, F, German Federal Railway

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Apr. 1968, pp391-460

Theoretical and experimental solutions of track problems for high speeds, especially in regard to the design of curves and transition curves, track laying and maintenance tolerances as well as dynamic stability. Conclusions are given as regards the design of tracks and points.

033862
HOW HIGH CAN TRAIN SPEED BE INCREASED?

Matsudaira, T, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Jan. 1967, pp93-99

Discusses the factors which influence the maximum speed for railroad operations. Factors of wave formation, adhesion, vibrational disturbance, track curvature, are among those discussed. The limits of present track wheel system, linear motor-wheel system, linear-motor and air cushion and gas turbine air cushion are discussed and compared as to their limits within the speed spectrum.

037203
THE RAILS ON THE GERMAN FEDERATED RAILWAYS

Doll, A

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

No. 10, Oct. 1967, pp 341-350, 10 Fig, 4 Tab

With the introduction in Germany of greater train loads and higher operating speeds, it was necessary to replace earlier rail, known as S49 with heavier rail, designated S54. Its usage is on main lines at operating speeds of 140 km/hr and tonnage in excess of 30,-000 gross tons per day. Another rail, S64, is used where axle loads are in the range of 30 to 35 tons and in tunnels on German railways. Rail breakages are compared for the various rail. Qualities and properties of the steel are discussed and theoretical stress lines in the rail sections are depicted. The shape of the rail head on the newer designs was changed to provide improved contact with the profile of the wheel tread. Specific costs of rail replacements on the German Railways are given for the various rail designs.

037204
STRESSES IN RAIL HEADS–COMPARISON BETWEEN THEORY AND EXPERIENCE

Eisenmann, J

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

No. 10, Oct. 1967, pp 355-361, 17 Fig, 4 Ref

This article describes the latest investigations into the problems of rail loading and stresses. Laboratory experiments with a plastic model of a rail are described, with the results charted. These are related to the tests and experience of the German Railways in their investigations of rail failures and damage. Charts are included which show the relations of the shearing stresses in the rail head to the wheel diameter and axle loading, the stresses increasing as the wheel diameter decreases or as the axle load increases.

037210
TRACK IRREGULARITIES: JNR STUDIES IN SEARCH OF NEW TOLERANCES FOR TRACK MAINTENANCE

Kitaoka, H

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 17, No. 3, Sept. 1966, pp 10-13, 1 Fig, 4 Tab, 1 Phot

This article reviews JNR efforts to modernize track maintenance operations and standards. The primary thrust of JNR concerns was the strengthening of track structure and mechanization and modernization of the track maintenance program. Discussion covers: safety factors against derailment, irregularities of longitudinal level vs vertical car vibration, crosslevel vs car rolling, track alignment vs lateral car vibration, track irregularity under load vs track irregularity under no load. Several specific field tests are described. New tolerances for track irregularities are being prepared according to the following ideas: (1) The maintenance standards for stability against car derailment will be established on the basis of running stability of freight cars. (2) Standards for riding comfort will be established according to the speed of the highest-class passenger trains. (3) Cost of maintenance works will be taken into consideration. (4) Track irregularities to be taken up for consideration will include distortion in track in addition to the conventional 4 items of irregularities, i.e. irregularities in track gauge, cross level, longitudinal level and alignment. (5) Static irregularities and dynamic irregularities will be used side by side.

037214
THE TOLERANCE OF TRACK LONGITUDINAL LEVEL IRREGULARITY DETERMINED BY RIDING QUALITY

Sato, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Mar. 1967, pp 43-48, 13 Fig, 1 Ref

This investigation was concerned with the vertical vibration of bogie car which was caused by track longitudinal level irregularity. It delineated the characteristics of the longitudinal level irregularity which can occur on track and proposed a method to determine the tolerance of longitudinal level irregularity from the view point of riding quality. In addition, the study examined the relation between the riding quality, the car structure and condition, the running speed and the measuring method of track longitudinal level irregularity

037217
TRACK LOADING FUNDAMENTALS–2 DETERMINATION OF RAIL SECTION

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Jan. 1957, pp 103-107, 5 Fig, 1 Tab, 3 Ref

Various factors affecting rail stress are examined. The contribution of train speed, traction, and wheel spacing in producing rail stress are considered. Rail lift and sleeper spacing are also discussed in relation to rail stress.

037218
TRACK LOADING FUNDAMENTALS–3 DETERMINATION OF BALLAST DEPTH

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Feb. 1957, 5 pp, 5 Fig, 2 Tab, 1 Ref

This article discusses Zimmermann loads, distribution of pressure on ballast, sleeper strength, sleeper support factors, ballast elasticity, ballast voids, and drainage as factors influencing the determination of ballast depth.

037219
TRACK LOADING FUNDAMENTALS–4 CURVED TRACK AND LATERAL STRENGTH

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Feb. 1957, pp 220-221, 1 Fig, 4 Ref

Various factors affecting the design of curves are examined. These include ballast depth, flange forces exerted on curves, lateral strength of curved track, and track slewing. It is pointed out that the lateral strength of track depend chiefly on sleeper spacing, quality and depth of ballast and quality of roadbed. Track slewing can be retarded by using heavier rail to maintain alignment, laying stone ballast, reducing sleeper spacing, or by using metal sleepers selectively on curves.

037221
TRACK LOADING FUNDAMENTALS–6 TRACK DESIGN RELATED TO BRIDGE LOADING

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Mar. 1957, pp 335-336, 1 Fig, 5 Tab

Track design is discussed in terms of its relationship to bridge loading. Wheel loads are computed for various British-Unit bridge loadings. It is shown how track can be designed in accordance with B.U. loading, whereby rail section and ballast depth for given sleeper sizes and spacings can be determined to carry vehicles at the speed for which the bridges were designed.

037226
ALLOWABLE LIMIT OF LATERAL PRESSURE ON RAILWAY TRACK

Railway Technical Research Institute

Engineering Interchange for Railroad Advancement (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 15, No. 1, Mar. 1964, pp 29-32, 8 Fig, 2 Tab

Track destruction caused by lateral pressure takes place in three ways. These are horizontal track alignments sharply distorted, spikes pulled out of place or rail fastening devices fractured, and spikes laterally shifted or lateral supports of rail fastening devices fractured. Three kinds of tests were conducted: the first test was to measure the strength of spikes for sleepers sampled out of the test sections, the second test to measure pressure on several spikes under the lateral pressure and wheel load imparted to the rails by a lateral pressure test car, and the third test to measure the shift of spikes on all sleepers in the test sections after conducting a loading run by the lateral pressure test car. Based on the distribution of the lateral pressure caused by rolling stock and that of strength of spikes, the permissible limit of lateral force has been established at the level at which 1% of the spikes are stressed to their proportionality limits.

037227
NEW SYSTEM OF TRACK MAINTENANCE

Shibata, M

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 2, June 1961, pp 3-5, 7 Fig, 2 Tab

A new track maintenance system is described for high-volume train traffic which hopefully will result in reduced maintenance costs. Features of both new and old systems are compared.

037228
ECONOMICS OF TRACK IMPROVEMENT ATTENDANT ON SPEED-UP

Yamamoto, H

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 1, Mar. 1962, pp 6-8, 3 Fig, 3 Tab

This article discusses some of the factors involved in determining the maximum speed of trains in the context of achieving maximum economic benefit at minimum risk of safety and minimum maintenance. Train speed is examined in terms of its effect on (1) strength of track structure; (2) fatigue of track; (3) strength for lateral thrust; (4) safety against derailment; (5) ride comfort index and vibrations of car.

037229
WELDED RAIL JOINT FRACTURES AND THEIR EFFECT ON 200 KM/H OPERATION

Matsubara, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 15, No. 3, Sept. 1964, pp 21-24, 8 Fig, 4 Phot

JNR conducted a series of tests to determine the effect of broken welded rail joints on trains running at high speed. A rail gap of 20 to approximately 30 mm was employed since this was considered the likely amount just after a rail fracture in winter on the New Tokaido Line. The train used for this test consisted of six 2-axle bogie type electric rail-cars with an axle-load of 15 tons. Items measured included: rail deflection, rail stress, stess on the fastening device, track vibration acceleration and sleeper stress and the like; most of these were measured using wire strain gauges. On-the-rolling-stock measurements included: wheel side thrust, wheel load, bogie stress, car body vibration, axle box vibration and similar forces. The results of the test indicate that train operation on the New Tokaido Line is judged as completely safe from the point of view of possible broken welded rail joints, in that even the lateral discrepancy of ends of the broken rails and wheel side thrust at the train passing the broken point were found to be less than 1/2 of respective maximum limits for safe train operation, and values for car body vibration and other items were also found to be sufficiently small.

037230
STATISTICAL CONTROL OF TRACK MAINTENANCE

Onogi, J

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, June 1960, pp 3-5, 4 Fig, 2 Phot

The subject of this paper concerns a method of control of maintenance of track making use of statistics and probability theory. The control of track maintenance should be handled on the basis of probability or statistics, while observing the phenomena from the rules of mechanics. A few examples of statistical treatment are given.

037238
THE TREATMENT OF UNSTABLE SLOPES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, July 1964, pp 610-612, 2 Fig, 4 Phot, 1 Ref

This article describes a systematic technique used by British Railways to stabilize embankments. It involves a combination of determining the slip plane followed by grouting, reinforcement and/or draining. The slip surface is ascertained by inserting 1/2 in inside dia polythene tubes, which distorts at the slip surface, into a hole driven with a 1-1/2 in. dia steel pipe. The polythene tube is plumbed with a short steel mandrel on the end of a measuring cord to determine the depth of the distortion or slip surface. Aerated sand cement 3:1 grouting is injected in predetermined amounts at 5 feet centers in rows 15 feet apart at 1-1/2 feet (super 3)/min. Overall costs are about 7 pounds/point. Drainage for cutting slopes is accomplished using a lateral interceptor drain, whereas adjacent to the slip a counterfort is preferred.

037239
WEATHER AND SITE EFFECTS ON RAIL TEMPERATURES

Richards, J, London Transport Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, June 1964, pp 505-512, 6 Fig, 3 Tab, 5 Phot, 5 Ref, 2 App

The effective operation of de-icing baths installed on open sections of the London Transport Board system is dependent on advance warning of icing risk so that they can be switched on before traffic ceases at night. When these baths were installed there was a lack of information on the relationship between weather and rail temperature, and led to an investigation to provide this information. It was decided to try to relate rail temperature to air temperature. Analysis of the data provided by the chart records was carried out in a variety of ways, according to the particular information desired. The maximum and minimum values of rail temperature or air temperature was plotted so as to show seasonal trends; diurnal variations of rail temperature at different times of the year, were studied; and the extent to which rail temperatures fall below air temperatures is of interest in connection with icing risk forecasts. The results of some such analyses are discussed.

037241
RAIL FASTENINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Feb. 1964, pp 111-113, 10 Fig, 4 Phot

This survey of rail fastening hardware for use with timber or concrete sleepers describes and compares commonly used baseplates, elastic spike fastenings, single spikes or stud-screws, baseplate type fastenings and rail seat pads.

037244
PERMANENT WAY TECHNIQUES ON THE NETHERLANDS RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Nov. 1965, pp 865-866, 9 Phot

The use of block sleepers with steel tie-bars and universal type of spring fastening by Netherland Railways is described in terms of track resistance to longitudinal and transverse displacement. Epoxy resins are used to bond the steel tube cross ties in the concrete blocks, and a DE (Deenik and Eisses) spring clip is the common rail fastening.

037247
RAIL FAILURE DETECTION IN THE UNITED STATES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Aug. 1965, pp 665-666, 1 Fig, 4 Tab

The major components of inductance, residual magnetic, and ultrasonic instruments for detection of flaws in rails are described. The Association of American Railroads report for 1964 correlated the drastic reduction in service failures due to transverse defects with the success in controlled cooling of the rails during manufacture, although the number of failures detected using the above NDT methods remained fairly constant. It was concluded that the $400,000 cost of the flaw detection services was well worth while in the USA, but could not be justified in the United Kingdom due to the use of different steel for the rails.

037248
TRAINING IN THE ULTRASONIC DETECTION OF FLAWS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Aug. 1965, p 627, 3 Phot

Special training courses have been instituted at Derby for British Railways staff in ultrasonic detection of flaws and arc welding of metals. The ultrasonic school consists of a three week course for operators and an appreciation course of four days for supervisory staff. Student operators spend 12 days on practical training and three days in lectures on acoustic principles. Audiovisual aids and experimental demonstrations are used during the instruction. The welding school runs appreciation courses lasting five days, which qualifies the students to inspect and accept welded fabrications for the British Railways Board.

037249
TRACK STRESS RESEARCH

Gelson, WE, Railway Department, India
Blackwood, FA, Railway Department, India

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Feb. 1940, pp 254-255, 1 Ref

The purpose of this work was (1) to verify the speed allowance formula, (2) to investigate the increment of stress over and above the static effect under normal conditions from track defects, (3) to investigate the conditions of support at rail joints, (4) to investigate the stability of ballast, and (5) to investigate the effects on rails and sleepers of the lateral forces set up by the hunting movement of locomotives. In regard to (1) and (2) it was found that experimental static deflections and stresses are in reasonably close agreement with calculated values. In regard to (3), it was concluded that stronger fishplates are needed to facilitate maintenance and rail joints of inadequate strength are the cause of much of the impact effect. Increasing the number of sleepers will reduce this impact effect. In regard to (4), the shape of the sleeper was found experimentally to have no noticeable influence on its deflection under a given load, but stress distribution between the sleepers and subsoil requires investigation. In regard to (5), further investigation on curved track was recommended to confirm the consideration that design to rolling stock to reduce nosing on the sharper main-line curves would reduce the secondary stresses and thus offset the increased stress due to centrifugal effects.

037250
STABILIZING AN EMBANKMENT BY CEMENT INJECTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Aug. 1965, p 609, 1 Fig, 1 Phot

The technique of stabilizing an embankment by cement injection is described. Previous attempts to drain the water trapped in the ballast on top of an impermeable sand and clay failed due to blockage of the plastic drain pipe with clay. Injection of aerated mortar at points spaced at about 1.5 m centers on top of the embankment and 3 m at the toe to a depth of 4 to 6 m was successful in stabilizing the embankment for the previous eight years. The technique was found to be inexpensive (15 pounds/hole) and was carried out with out interference with traffic.

037258
BRITISH RAILWAYS TRACK-SPRAYING TRAIN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 1181963, p 465, 1 Phot

The article describes a track spraying train for weed control that incorporates re-designed equipment to reduce water consumption and which permits operation at 40 mph. Water consumption has been reduced from 80 to 40 gallons/acre at 20 mph and is still further reduced to 20 gallons/acre at 40 mph. This led to a reduction in size of the main diesel engine from 12 hp to 7 hp, and in the main pump output from 260 to 100 gallons/mile, effecting considerable space savings. The train stores sufficient weed killer for 130 miles of spraying at 14-1/2 feet swath or over 400 miles of cess-only treatment.

037262
TOKAIDO LINE STANDARDS, TEST LENGTH AND TRIALS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, No. 11, Mar. 1963, pp 209-301, 5 Fig, 2 Phot

Various characteristics of the New Tokaido Line are presented, including track, tunnel and bridge construction, bogie design, and passenger and track inspection vehicles. Testing of rolling stock at

124 mph prior to the opening of the Line revealed wheel side thrust to be only 3-4 tonnes and lateral and vertical vibration accelerations of 0.2 g and 0.3 g respectively.

037263
TRACK-LINING EQUIPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Mar. 1963, pp 251-252, 3 Phot

The Matisa range of equipment for simple and accurate track lining is described. The equipment consists of a roll ordinator, a slewing gauge, and a curve corrector. The conventional method of surveying track for lining purposes is by "string-lining." It is claimed that one man, using a roll ordinator can string-line a curve at twice the speed and with more accuracy than the normal three-man team. Following string-lining, an alignment adjustment can be arrived at, by operating on the measured versines, either mathematically or mechanically, by using a multistation curve calculator.

037267
CONSOLIDATION OF RAILWAY FOUNDATIONS IN THE WESTERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Feb. 1963, p 132, 2 Phot

This article discusses the consolidation of railway foundations where the tracks run along a ledge cut out of solid rock. The cliff was found to be settling and disintegrating. Repair works included (1) demolition of the rock cliff (2) trimming the new rock face to a batter fixed on site and to suit existing walls on each side, and (3) building of a 2-ft thick granite face wall to protect the exposed rock face.

037268
TRACK INSPECTION WHEEL-BARROW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 116, Apr. 1962, p 433, 1 Phot

The Track Inspection Wheelbarrow is a light manually-propelled vehicle which has been designed to deliver a continuous record of gauge width, cant, and curvature (the latter for each rail separately). This device is briefly described.

037269
THE EVOLUTION OF THE AMERICAN RAIL

Allen, CJ, Massachusetts Institute of Technology

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 75, Dec. 1941, pp 581-584, 1 Fig, 1 Tab

A review is presented of the development of the railway rail in America, including the change from iron to steel, the evolution of the modern American flat-bottom section, up to 152 lb. per yd. in weight, and present-day American rolling methods. Rail sections arranged in chronological order from the 5 ft. long, cast iron plate, used in 1767, to the 131 and 152 lb. rails introduced in 1930, are shown to trace the development of the American rail. Results are reported of a study to compare 100 lb. and 131 lb. rails as to maintenance costs and life, as affected by increasing weight loads. The heavier rails extended the life, not only of the rails, but also the sleepers and fishplates.

037271
THE HEY-BACK METHOD OF RAIL FASTENING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 116, No. 10, Mar. 1962, pp 274-75, 1 Fig, 2 Phot

The Hey-Back rail fastening has two components. One is a rolled-steel base plate with parallel ribs on each side of the rail seat to hold the rails to gauge. The outer side of each rib is curved over in such a manner as to form a keyway, into which there is driven a spring steel clip. The lower side of each clip is tapered from both ends at a leading angle to facilitate its entry into the keyway; as the clip is driven in, the taper forces the clip forward, with its double bend acting as a fulcrum in the keyway, until the opposite side is exerting considerable pressure on the rail-foot. To ensure perfect contact between key and keyway, each keyway is machined to a fine tolerance. The baseplate is held down to the sleeper by coachscrews, chair-bolts, or other fastenings of a normal type. Additional information is given relating to advantages and use with timber and concrete sleepers.

037273
SPRING WASHERS FOR RAIL FASTENINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, No. 13, Sept. 1961, p 361-66, 6 Fig

Single, double, and triple spring washers have been used for several years by a number of main-line railways carrying heavy traffic, and the three standard forms of Vossloh precision-made types are known as Fe7, Fe6, and Fe19 respectively, and all with cross-sections of 10 mm, by 6 mm, and suited to 7/8 in. dia. screws. Characteristics of these three types of spring washers are shown. With an initial tension of 2 tons, an extra load Delta Z of one ton brings spring movements of 0-15, 0-13, and 0-60 respectively for the single double and triple washers, i.e.: ratios of 1:2:4. On this basis the Fe7 single washer is used where track conditions and loading lead only to low working deflections in the fastening assembly; the triple-coil washer Fe19 is used when high values of Delta f are found and the double-coil Fe6 under average conditions. An engineering physics analysis of spring dynamics is also given.

037276
HEAVY-DUTY RAIL CLIPS WITH CAST-IRON BASEPLATES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 114, Apr. 1961, pp 395-397, 4 Fig, 7 Phot

The article gives some particulars of the Mills clip, an easily-applied rail fastening widely used on wood and concrete sleepers. The Mills clip is made of special ribbed-section spring-steel bar, having a width of 2-1/8 in. and thickness of 15/32 in., heat treated. It generates its grip between the extremities of the upper and lower arms, not relying on any contact with the baseplate except directly under the point of application of load on the rail foot.

037278
TRACK-RELAYING EQUIPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 116, Oct. 1962, pp 400-401, 2 Phot

A number of Secmafer Boyer Schwarz M.6 track-relaying gantries have been supplied to British Railways. Each gantry weighs 7-1/2 tons, and the overall width is 11 feet 4 in., with 9 feet 6 in. inside clearance for lifting the load. With the twin rams and screw-jacks mounted in the side frames both fully extended a pair, or one unit, of gantries can load or unload up to four concrete-sleepered sections high on a standard Salmon wagon, with 2-in. of timber packing on the wagon deck. Power is supplied by a standard Renault Dauphine engine. The machines have operated successfully on an incline of 1 in 40. The speed of lift of the twin rams is 22 ft. per min., and of the screw jacks is 12-8 ft. per min. when the two movements are made simulatneously, these speeds are approximately halved.

037279
PRODUCTION AND MAINTENANCE OF LONG WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, Mar. 1949, pp 284-285

From 1938-1948, flash-butt welded rails, 300-ft. long, have become the accepted practice of London Transport, for both maintenance renewals and new works, and were used on more than 70 miles of main line by 1949. Some of the problems involved in the production and maintenance of this type of track are described. The machined joints, in tunnels, and the expansion switches, on open sections, were used to relieve rail stresses. Wooden keys were also used instead of steel key for stress relief. Methods used by two automatic flash-butt welding plants to produce and test the long rails are briefly discussed. A temperature variation of 50 deg F, is the maximum to which this type of track should be subjected without being freed from stress. The long rails are unkeyed during early spring and at mid-summer. Examination of track maintenance records on 60 ft and 300 ft long welded rail revealed a savings in favor of the 300-ft rail.

037280
PHOTOELASTIC STRESS ANALYSIS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, Apr. 1949, p 418, 1 Phot

The basic theory, use, and model construction for photoelastic stress analysis are briefly described. Kodak Limited, in an attempt to prove that this analysis method could be used on subjects other than static models, used high-speed photography to record a series of stress patterns through the polariscope. The model used was a rhythmical-load applied to a plastic cross section of a rail in order to simulate the passage of wheels across it. Individual still pictures were also taken by means of high-speed gas discharge lamps. A still photograph is shown of the photoelastic stress patterns in a cross-section of a British bull-head rail and chair.

037281
FASTENINGS BETWEEN STEEL SLEEPERS AND FLAT-BOTTOM RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, Apr. 1949, p 446, 1 Fig, 2 Phot

As a result of extensive trails on main lines in India, the Mills spring steel loose jaw has become a standard type of fastening used with steel sleepers throughout India and Pakistan. It is used not only in plain track, but also in turnouts with steel sleepers, if track-circuiting is not required. The formation of the jaw and its installation on the rail is described. A longitudinal section of the center of the steel sleeper, showing details of the rail fastening, is illustrated. Fifteen years' experience using the Mills jaw has shown that no wear has taken place, and that gauge has been maintained.

037282
TRACK FORMATION IMPROVEMENT IN HOLLAND

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, May 1949, pp 543-544

On the main line of the Netherlands Railways from Utrecht to Rotterdam, a seven mile section between Oudewater and Gouda passes through an area of waterlogged peat moor. Two methods were tried, in 1938, to strengthen the foundation for the track. The first method provided for the construction of two dams of sand, which completely enclosed the embankment. Large quantities of sand were deposited quickly, and the weight of this material pushed the semi-liquid peat aside. In the second method, the sand was deposited gradually, so that the peat became more compact, and less likely to move. The second method was used until 1948 due to the expense and the risk of serious disturbance of the track present with use of the first method. A third method was introduced in 1949. The top of the embankment is removed and replaced by a reinforced layer of fine sludge slag. This slag hardens into a substance resembling concrete. A layer of sand is placed between the top surface of the slag and the gravel ballast. Some 5-1/2 miles of double track are to be strengthened in this way.

037284
THE RAILWAY FIGHT AGAINST SNOW AND ICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, Jan. 1945, p 81

The problem on the 2,387 miles of electrified track of the mainline companies and the 174 miles comprising the London underground network is ice. Probably the best protection against icing is to keep trains constantly running so that the ice does not form. London Transport has a fleet of "sleet" locomotives to keep conductor rails clear. These are fitted with pneumatically operated wire brushes carried on the collector shoe; they have roller ice crushers and can also eject on to the live rail a stream of de-icing fluid to prevent the ice-reforming after the locomotive has once cleared it away. No fewer than 1,376 sets of points operating in the London area are provided with direct or indirect heating equipment, but other points and junctions have to be kept clear largely by use of rail scrapers, salt, or portable de-icing apparatus.

037287
TRUE GAUGE IN STRAIGHT TRACK

Inglis, RA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, May 1945, p 445, 2 Fig

The permissible amount of slack gauge in straight track in relation to the lateral oscillation or nosing of locomotives is considered. S or slack gauge, for any one locomotive and type of track will vary inversely as the square of the speed. Mathematical derivations for engineering physics aspects of the problem are given.

037289
A NEGLECTED POINT IN SWITCH DESIGN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, May 1946, pp 484-486, 9 Fig

A derailment of the first car behind a 6-coupled saddle-tank shunting locomotive at the marshalling yard at Kantara during World War I is analyzed. Kantara was at the beginning of the military railway from Egypt to Palestine The locomotive, in a facing direction through a turnout to the right-hand diverging road, took the turnout correctly. The wheel flanges of both the locomotive and the car were considerably worn; those of the car more so that those of the locomotive. Rail climbing by the rather sharp flange of the car wheel was suspected, but no signs of this were visible. There were signs which showed that the wheels had dropped on to the sleepers as soon as the space between the diverging rails permitted. The events leading to the derailment were reenacted under observation. When the leading wheels of the locomotive were partly through the switches the point of the left-hand switch commenced to open about 0.375 in. The fire of the leading wheel of the wagon entered this opening with the result described. The switches, which had a heel joint with a standard clear flangeway of 1.75 in., were struck by the wheel flange at the right rear of the locomotive as the locomotive's worn tire ran hard against the left rail. Detailed illustrations are given to describe the derailment cause.

037291
DEVELOPMENT AND MANUFACTURE OF PRE-STRESSED CONCRETE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, May 1946, p 538

The Tallington factory, completed in August, 1944, has 20 lines, each accommodating 100 standard main-line sleepers. Filling the moulds at one fixed place in the production line, allowed a vibrating table to be used and a water cement ratio of 0.39 for the concrete. For wiring, the coils of wire are carried on a track and the wires are drawn off under semi-tension, which obviates the need of first straightening the wires. As they leave the wire carrying truck they are automatically cleaned by passing through a scrubbing box containing carborundum granules. The method of manufacture allowed three minutes of working time per pair of sleepers during concreting and removal, this time factor also being maintained for the wiring processes. The reduction in labor costs using the mechanized mass-production process showed a savings of 88 percent over an earlier method described.

037294
FLAT-BOTTOM TRACK IN GREAT BRITAIN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Aug. 1946, pp 178-179, 2 Fig, 1 Phot

The L.N.E.R. laid a system of switch-and-crossing work in flat-bottom rail in 1944, for experimental purposes. The turnout, which used 110-lb. flat bottom rails, is illustrated. The normal 1 in 20 rail cant or tilt is retained through the connections, and heel-less switches are used; the lifting of the switch above the stock rail has been eliminated. In general the switch angles, radium of switch curve, and the top planing are similar to bull head British Standard design. The usual type of fastening used in this flat-bottom switch and crossing work is the hook bolt and malleable iron clip to secure the rail to the cast-iron base plates, and chair screws to fasten these plates to the timbers.

037295
PORTABLE WELDERS FOR JOINING RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Sept. 1946, pp 296-305, 3 Fig

The portable welder is mounted on a wheeled chassis complete with transport rollers, cold saw, centrifugal pump for cooling water, tanks for water, fuel, and lubricant, milling machine, and guide pieces, besides the usual alternator, exciter, and switchgear. Two sections of the rail to be joined are clamped in the machine and brought together, and as the current passes through the point of contact, the metal is warmed; by repeated separation and re-union, an effective preheat is accorded to the ends. Flashing then follows, during which, by applying moderate force to the fixed piece, the rail is slowly pressed forward, and to the accompaniment of a shower of sparks, molten metal is ejected. The rails attain the desired temperature for welding during this treatment, and with a powerful upset motion become united. The system is completely automated. When the rail ends to be joined are at hand, from 7 to 10 joints an hour are made. Each weld requires two to three minutes.

037296
FLAT-BOTTOM RAIL DEFECTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Sept. 1946, p 345

In 1944, 38,708 transverse fissure failures were reported, of which 31,781 were discovered in advance of actual failures by patrolling detector cars, and 6,927 were in rails that broke in the track, in certain cases with disastrous results. The use of flat-bottom rails in Great Britain will increase the need to control the cooling process during formation of the rails. The British medium manganese rail is less susceptible to fissure failure due to its lesser carbon content, 0.6 percent carbon in British rails compared to 0.7 to 0.8 percent in U.S. Rails. In the U.S. a troublesome defect is the shelling or flaking of rails on the gauge corner of the head. This problem is prevalent on the high rail of curves where traffic conditions are severe. No direct connection has been found between the chemical composition of rails and their susceptibility to shelling, except in so far as the hardness of the steel is affected; heat-treated rails and rails containing 3 percent of chromium have given better results than rails of standard composition. Water quenching can produce weeping cracks in steel. Steel with Brinell hardness after end quenching in the range 360 to 375 were not susceptible to weeping cracks. There is a continuing need for a fishplate steel of reduced notch sensitivity. High manganese alloy fishplates have given good results, but are costly.

037298
WOODEN SLEEPER LENGTHS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Nov. 1946, p 572

This article discusses an appeal by a U.S. engineer to adopt wooden sleepers 9 ft long for all lines carrying heavy traffic. The longer sleepers would add resistance to forces tending to distort the track, reduce maintenance, secure smoother riding, and minimize the risk of center binding. The British in 1946 were using sleepers 10 in. times 5 in. times 8.5 ft. Due to the timber shortage, broader sleepers, 12 in times 5 in times 8.5 ft., were no longer being used adjacent to joints.

037301
USE OF CONCRETE SLEEPERS AND STEEL SLEEPERS ON THE SOUTHERN RAILWAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 79, Oct. 1943, pp 383-388, 3 Fig, 1 Tab, 8 Phot

War time shortage of timber in England prompted experimentation with concrete and steel for sleeper construction. The first experience with the use of reinforced concrete sleepers on a main line in

1912 resulted in shattering after only 5 years' life. Concrete 1:1-1/2:3 unvibrated, reinforced with four 3/4 in. main bars were in good condition after 14 year's service on the main line between Exeter and Plymouth. Speed of trains in this section rarely exceeds 25 to 30 mph. Testing results of concrete sleepers on fast-running main line is incomplete since these sleepers have been in service less than one year. Steel is difficult to obtain during wartime; however some results on the use of steel sleepers are reported. Weight losses are reported for three types of steel sleepers. Steel sleepers are unsatisfactory when the track is to be electrified or track circuited.

037302
ALTERNATIVES TO THE WOODEN RAILWAY SLEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 79, Nov. 1943, p 477

Due to the difficulty of importing timber during World Wars I and II to make wooden sleepers in Britain, this study examines the limited data available on substituting steel and concrete for wooden sleepers. A half million steel sleepers, 98 percent consisting of mild steel, were laid from 1922-1929, under all types of service conditions. Five percent were removed after 13 to 14 years' life due to excessive corrosion. Two other steel sleepers, the Sandberg and the United Steel Type 2-A, may have longer life, but further testing is required. Only small scale trials on concrete sleepers have been made due to failures encountered in early trials, and the comparatively high cost and greater weight of concrete sleepers.

037303
CEMENT GROUTING RAILWAY FORMATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 79, Nov. 1943, p 508, 3 Fig

To eliminate water pockets and weak spots in the railway formation, pressure grouting with cement has proved satisfactory in the United States. To prepare the roadbed for grouting, water is injected to remove air, clay and other solids to make room for the grout and to test the subsoil to show whether it is suitable for grouting. Measures to avoid wasting of grout and upheaving the track during grouting are described. The proper mix of cement, sand and water and the amount of grout needed are briefly discussed.

037305
MECHANICAL BALLAST DRESSING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Jan. 1944, pp 41-42, 5 Fig

The mechanical ballast dressing unit of the Erie Railroad is described. The unit is a 40-foot steel flat car fitted with scraper blades on each side. The blades are operated by one full-time operator using compressed air for blade adjustment. The blade can be lifted to clear obstructions and can be folded against the car when not in use. The unit is propelled by a locomotive at about 3 mph.

037306
RAIL FAILURES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Feb. 1944, p 110

A train, travelling at slow speed on the down line between Tweedmouth and Kelso in 1941, was derailed by a rail broken in 12 pieces. The rail, laid in 1890, was a 90-lb one, with an average yard weight at the time of the accident of 83 lb. It was situated inside a 19-ch. curve, provided with check rails and 3 in. of super-elevation. Slipping with a heavy load when accelerating from rest was the cause of the rail failure. The heat generated by the slipping was estimated to reach about 700 C. Slipping had occurred over a several week period, but was most pronounced within two days of the derailment. Sections of the rail were subjected to falling weight tests. One piece dropped with the head up broke at 7 feet. The other piece dropped head down, broke at 1 foot.

037307
PRE-STRESSED CONCRETE SLEEPERS

Barber, RSV

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Feb. 1944, p 39, 3 Fig

During concrete sleeper manufacturing, the steel reinforcement is subjected to a high tensile stress. This stress is then utilized to induce in the concrete compressive stresses which will be directly opposite to those tensile stresses produced by the external forces imposed on the sleeper. A high-tensile steel is used and the value of the applied force is calculated so that the advantage of pre-stressing is retained permanently in the sleeper. The tensile stresses by the process of pre-stressing are so reduced as to permit dispensing with all shear reinforcing, which results in a saving of steel of between 70 percent, and 80 percent, over the ordinary reinforced concrete sleeper.

037308
HOW RAILS BREAK

Dinsdale, C, London North Eastern Railroad

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Mar. 1944, p 213

The manufacturing defects described are in ingots; in rolling methods; a transverse fissures, the fractures caused by stresses set up in cooling. The failures described arising from service conditions may be caused by excessive wear; fatigue or impact; rail-end batter; corrosion in tunnels, at water troughs, or at wet ashpits; slipping by wheels; faulty heat treatment, welding or cutting; corrugation; or war damage. Rail failures in India in 1929 due to rolling defects resulted in the use of impact testing on the side of the rail-head being added to test specification. The temperature equalization scheme adopted by British mills in 1928 to avoid transverse fissures is given.

037414
CONGRESS DELEGATES SEE ORE TRACK TESTS AT DERBY

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

June 1971, pp 238-239, 2 Phot

The British Railway's research centre includes a rolling load test rig which provides unique facilities for track structure research under controlled laboratory conditions. In the last ten years the soil mechanics section at Derby has achieved a good understanding of the way in which the truck substructure fails through inadequate ballast, and this work has resulted in a set of rules which define the minimum ballast depth in terms of the threshold strength of the subgrade and the weight of traffic. Now the main focus of attention is the ballast itself and the way in which it behaves under cyclic loading. Closely related to the stresses imposed on the ballast is the design of the track, and ORE has commissioned a two-year test programme to determine the most satisfactory combinations of rail weight, sleeper width and sleeper spacing. This will be followed by a further programme of tests on the ballast itself, taking up to four years in all.

Facilities exist to provide horizontal loading of the track so as to measure the effects on lateral stability of variables such as sleeper depth, width and spacing.

037415
ULTRASONIC CAR WORKS AT 25 MPH

Modern Railroads (Watson Publications, 5 S. Wabash Avenue, Chicago, Illinois, 60603)

July 1971, p 48, 4 Phot

British Rail's detector car uses ultrasonic methods to detect and record hidden rail flaws while running at speeds up to 25 mph. The train can test up to 100 miles a shift–means that entire main routes can be ultrasonically tested in a matter of a few days. The train's rail scanning probes are carried on a trolley mounted between the running wheels of the equipment car. For scanning the rails the trolley is lowered to run on its own wheels, allowing the probes to slide along the surface of the running rails on a thin film of water. Using the principle of reflection of high frequency sound, the probes inspect the running rails for minute cracks and internal flaws Signals from the probes are relayed to monitoring devices on the train and then recorded on film. At the end of each day's testing, the film is sent to an evaluation center near Paddington station, London, where a team of evaluators examines it and reports any signals that indicate a possible rail deflect.

037421
EAR BUILDS A MANAGEMENT INFORMATION SYSTEM

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

Nov. 1970, pp 772-773, 4 Phot

East African Railways Implemented an integrated computer-based management information system because there was an urgent need to exercise greater control over wagons, coaches and locomotives to insure their maximum utilization. In addition to this, computer application to rail wear analysis, including rail wear in curves was initiated. Developments and accomplishments are enumerated.

037422
PERMANENT WAY OF THE FUTURE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Sept. 1970, pp 710-711, 3 Phot, 2 Ref

The properties of the ballast bed and the savings in maintenance obtained by using a concrete bed in its place are apparasied. For 300 km/h service, the use of U 80 rails of 60 kg/m mounted on concrete blocks with cross-ties and double-elastic fastenings is recommended. such fastenings allow a greater degree of vertical movement of the rail and the sleepers would be laid on a ballast bed 35-cm deep. Japanese experience with continuous welded track and 53.5 kg/m rail mounted on pre-stressed monlithic concrete sleepers with double-elastic French-type fastenings is cited. Mention is made of the problem of ballast and the continual maintenance it incurs. Swiss studies on ballastless track for tunnels is reviewed.

037423
SAR EVOLVES A MODERN PERMANENT WAY

Townsend, BP, South African Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, 3 Phot

To help cope with increasing freight and passenger traffic, South African Railways has made many improvements to the track on its trunk routes. A rail of 115 lb/yd section is now being used to replace the 96 lb/yd rail on the more heavily-loaded lines. Only 400,000 wood sleepers are used annually. Fist and Pandrol types of fastenings are used. Maintenance is mechanized, including the use of 62 heavy, on-track tampers. Concrete sleepers are being laid at the rate of about 1,300,000 a year. Concrete track is being laid in tunnels. The weed control program is described.

037428
DEVELOPMENTS IN BR TRACK MAINTENANCE PROCEDURES AND MECHANISATION EQUIPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, May 1970, pp 345-347, 1 Tab, 5 Phot

To minimize adverse effects upon long welded track, British Railways has established a policy of assuring that extensive track work will not commence during temperature extremes (above 32 degrees C nor below 0 degree C). To minimize lateral movement of the track attention to shoulder widths as well as to cribs being well filled. To increase efficiency, new types of maintenance equipment are described and discussed.

037431
ULTRASONIC FLAW DETECTOR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Mar. 1970, p 195, 1 Phot

The Sonatest TE/9 is a miniature battery-operated instrument for use where very small size and light weight are important. The unit measures only 8-1/2 times 5 times 10-1/4 in. weighs 7 lb, and is powered by a separate battery pack. Coarse and fine controls allow the range to be adjusted from 0.5 in. to 10 feet in steel so that axles can be tested with this instrument.

037433
NS ADOPTS GLUED INSULATED RAIL JOINTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Feb. 1969, p 144, 3 Phot

Netherlands Railways has devised a simple solution to the insertion of an insulated joint into a length of long-welded rail for signalling purposes. It involves sawing through most of the rail section from below, but leaving the rail head intact while a strong glued joint is made with special fishplates. Holes for the fishplates are drilled before sawing begins. Because this technique produces such a perfect joint between the two rail ends, its use has now been extended to insulated joints in jointed track or point-work.

037436
REFURBISHING BR TRACK FOR HIGH SPEEDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Nov. 1969, pp 863-865, 5 Phot

British experience on improving track for increasing traffic is recounted. Track designs and construction methods are covered and a section on crane design is included.

037441
THE UNISTEEL RAIL CONTOROGRAPH

Babb, AS, British Steel Corporation

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Feb. 1969, pp 153-154, 3 Fig, 2 Phot

The use of the Unisteel contorograph is described and the unit is photographed. This contorograph has proved more useful than previously available measurement techniques where rail wear is relatively rapid and where a record of the full head contour, including side cutting and plastic flow, is required, rather than just measurement of head height loss.

037442
LOADING OF THE RAIL REGARDED AS A BEAM

Eisenmann, J

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18, No. 8, Aug. 1969, pp 306-312, 10 Fig, 2 Tab, 10 Ref

The author presents a procedure whereby rail loading as a result of bending, eccentric imposition of load, internal, thermal and other stresses, as well as the ballast coefficient, can be determined. From data and formulae presented, it is possible to calculate the permissible speed and axle loading for a given rail profile. The condition of the soil foundation and the ballast bed are also considered in this study.

037443
GERMAN FEDERAL RAILWAY EXPERIMENTS WITH CONCRETE TRACK BEDS

Birmann, F, German Federal Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Apr. 1969, pp 308-310, 3 Fig, 6 Phot

If sleepers and ballast prove inadequate for speeds over 200 km/h, some form of structural support for the track will be necessary. Because of the vibrations induced by high speed trains and the need to maintain the line and level of track within closer limits, the upper speed limit for sleeper track may be regarded as 260 km/h. Three types of track and three types of fastenings are examined. Comparative stresses in the ground under concrete bed track and conventional sleeper track in ballast are shown.

037444
ONE-MAN PORTABLE MITSUBISHI TRANSISTORIZED CRACKMETER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, May 1969, p 24, 2 Phot

Mitsubishi's Type CM-2 all-transistorized crackmeter is designed to be handled easily by one operator. Providing both visual and aural confirmation of defects at rail joints, it can pinpoint flaws without removal of the fishplates. Ammeter registration of approaching trains is an added safety feature. It can be used on rails of different widths by a simple screw adjustment.

037445
DETECTION OF RAIL FAULTS ON SNCF

Deutsch, R, French National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Sept. 1969, pp 459-464, 3 Fig, 10 Phot, 3 Ref

French National Railways methods of magnetic examination of rails in service are so successful that 95 percent of all rails lifted in 1967 for transverse cracks were as a result of inspections made on only one-sixth of the main lines. The development of transverse cracks in the rail head generally follow an exponential law related to the traffic carried. A transverse crack increases by 10 percent of the section of the rail head and with an initial detection at 55 percent by the electromagnetic process, the risk of breakage is reached when about 15,000 tons have passed over the track.

037447
EXPERIMENTAL CONCRETE TRACK-BED AT RADCLIFFE

Lucas, JC, British Railways
Lindsay, D, British Railways
Aitken, WK, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, July 1969, pp 547-549, 4 Fig, 2 Phot

Using a slip form continuous road making machine, British Railways has laid a trial length of concrete slab foundation on which six kinds of fastenings are being tested. All systems were laid to give rail alignment level and gauge tolerances considered adequate for 200 km/h conventional trains, although the actual speed of trains through Radcliffe will not exceed 110 km/h. Axleloads are up to 25 tons. Acoustic and vibrational measurements will be made, together with general structural and component performance. Load-detection tests are being made in the laboratory on the different fastening assemblies and site measurements will be made under service conditions.

037449
RAIL TO SLEEPER FASTENINGS

Srinvasan, M, Indian Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Aug. 1969, pp 611-615, 6 Fig, 6 Phot

Laying the rail on a sleeper and fixing the two together can be done in four ways: direct laying and direct fixing; direct laying and indirect fixing; indirect laying and direct fixing; and indirect laying and fixing. A sample of each type is shown. Methods of fastening to wood, concrete and steel cross ties are discussed. The fit-and forged fastenings, such as the SAF fastener, the heyback and the Pandrol clip are illustrated in use.

037450
BALLAST CONSOLIDATION AND DISTRIBUTION ON THE TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Sept. 1969, pp 670-671, 2 Phot

Two machines introduced by Robel and Company for ballast distribution and consolidation after the track has been laid have been introduced. The ballast plough incorporates a novel design to meet the higher capacity of the modern 32-tool tamper. High-speed vibrators mounted on the guiding forks exert a compacting force of up to 10 tons. The machine proceeds along the track at 1,000 to 1,500 m/h and consolidates continuously. This matches the greatest working speed of double head tamping machines and guarantees a consistent compacting effect for the whole length of the bed over which it is run.

037453
KEEPING THE TRACK IN ITS PLACE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Oct. 1969, p 720

The lateral stability of track laid with continuous welded rail may be affected by unusually warm periods which cause trouble at points where insufficient care was taken in clamping at correct combination of rail temperature and stress. Adding ballast to the shoulders is only part of the answer. If the shoulders are to resist lateral movement they must be compacted after the track has been lined and levelled and the sleepers tamped. Machines are now available to do this work.

037454
HYDRAULIC TENSIONING OF CONTINUOUS WELDED RAIL

MacLeod, NJ, British Railways
Martyn, PH, Greenside Hydraulics Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Jan. 1969, pp 31-33, 2 Fig, 1 Tab, 3 Phot

Stretches the rail to the expansion which would occur by a temperature rise from the installed temperature to the mean of the normal extremes of heat and cold to which the rail is subjected in the annual weather cycle. Rails installed in ambient temperature conditions higher than the specified ideal temperature range are not adjusted at the time of installation. The rail is laid, the temperature is noted, and at the first suitable opportunity it is brought into the optimum stress condition.

037455
RAIL DEFECT TESTING IN THE UNITED STATES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Mar. 1969, pp 180-184, 4 Fig, 3 Phot

Over 130,000 miles of track are tested annually in USA by the Sperry fleet of 25 self-propelled test cars. A new and highly efficient ultrasonic detection system was developed which is capable of finding most cracks and flaws in the joint area. Details are reported. As part of its service Sperry Rail Service has compiled and published a comprehensive manual of rail defects, covering subjects from history and methods of rail manufacture to causes of rail defects and classifications of every known rail defect. This Rail Defect Manual is furnished free to any railway.

037456
PRESENT TRENDS IN MACHINES FOR TRACK MAINTENANCE

Diaz Del Rio Y Jaudenes, M, Fixed Installations RENFE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Nov. 1968, pp 845-846

This article provides a general discussion of the importance of coordinating materials and machines for track construction. Detailed discussion focuses on the operations involved in tamper—leveller—liner activities and the limitations of them.

037457
ULTRASONIC RAIL TESTING AT THE ROLLING MILL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Oct. 1968, p 752, 1 Phot

Studies have shown that fatigue defects which appear in rails in the track can always be traced back to segregations in the metal, inclusions or microcracks. Metallographic tests which show up these defects are lengthy, costly and must inevitably be restricted in scope because they involve destruction of the specimen tested. Consequently, it was necessary to find a non-destructive method of detecting these defects by sounding the whole length of the rail head. The ultrasonic method using echoes was chosen by SNCF and ORE. The Ralus equipment was designed to detect heteorogeneities which are particularly harmful to the performance of the rail in the track: nonmetallic inclusions and flakes located in the critical zone of the railhead where most fatigue defects originate. Studies have shown that the Ralus testing method does give a reasonable indication as to the quality of the rails.

037458
SURVEY OF RAIL FAILURES ON JNR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, July 1968, pp 505-508, 1 Fig, 1 Tab, 3 Phot

JNR examined 675 faulty rails as part of a comprehensive study of rail failures in Japan. This article examines some of the findings in relation to type of failure and cause. Sections are devoted to transverse cracks, vertically-split webs, impurity distribution, shatter cracks, tensile tests, heat treatment methods, chemical composition, and cold shortness. Photographs show some of the problems encountered.

037459
NEW RAIL FASTENINGS FOR CONCRETE TIES

Henn, W

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

The development of concrete ties has produced a rigid reinforced, prestressed concrete tie that has proven so successful that there are more than twenty million of them in use today on the German Railways. From both the engineering and economic standpoints, they are giving fully satisfactory service, even on heavy travelled routes. However, the search is still going on for a fastening to hold the rail in proper relation to the tie. Hopefully a fastening will hold the rail firmly to guage under both vertical and horizontal load; provide the necessary elasticity; afford resistance to lateral and longitudinal movement of the rail; provide full electrical insulation between rail and tie: and have the lowest total cost. Data and charts are included to show the relative worth of the various fastenings that have been tried, and are in use today.

037460
THE REQUIREMENTS OF THE RAILWAY AND ITS FURTHER DEVELOPMENT FOR HIGHER SPEEDS AND AXLE LOADS

Eisenmann, J

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 17, No. 5, May 1968, pp 184-196, 26 Fig, 12 Ref

Constant research has been conducted in the permanent way with the rails, ties, ballast bed and the underneath ground structure for improvements to cope with the increasing axle loads and higher speeds. This article considers the more sophisticated concrete rail bed structure. The conclusions are as follows: The present ballasted rail structure with rails of 90 kp per mm (super 2) is suitable for axle loadings of 25 to 28 tons, at present speeds. With rails of 110 kp/mm (super 2) and weight per meter of 70 kg, the axle loading can be increased to 37 to 42 tons. However, the ballast bed must be strengthened. For speeds greater than 220 to 250 km/h, there will need to be new developments for the railroad track structure. Because the present ballasted right of way would require too much maintenance under such conditions. The concrete rail bed for urban railways has a potential for effecting substantial savings in track maintenance costs, thereby reducing the over all cost of the track structure.

037467
TRACK GEOMETRY AND PERMANENT WAY CONSTRUCTION FOR HIGH SPEED LINES

Birmann, F, Bundesbahndirektion, Nurnberg

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 17, No. 12, Dec. 1968, pp 513-532, 24 Fig, 4 Tab, 6 Phot, 34 Ref

This article discussed the heavier demands imposed on the track structure by the maximum operating speeds on railways. The problems are presented and considered as determined by both theoretical studies and the results of field tests of 200 Km/h operations consideration of the line construction and the alignment, superelevation and transition run-offs on curves is shown by actual data and charts, including theoretical studies of speeds up to 400 Km/h. The stability of the track structure, horizontally and longitudinally, under different axle loads and spacings are considered, and the relations thereto of rail strength, type of fastening, the ballast bed and the underneath soil foundation. Switch, turnout and frog designs are dealt with: This article gives a comprehensive, detailed study of the requirements for track geometry and construction for high speed operations.

037468
TRACK FOUNDATION DESIGN

Waters, JM, British Railways
Shenton, MJ, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Oct. 1968, pp 734-737, 7 Fig, 3 Phot

Procedure has been evolved for relating the depth between sleeper and sub-grade to the axle loading and traffic speed. This article describes the first phase of an investigation into the effects of cyclic loading upon the behaviour of soils in general and London Clay in particular. Derivation of tentative design curves is illustrated relating speed, axleload and depth of track construction to the results obtained when a sample of the subsoil is deformed in a triaxial testing machine applying cyclic loadings.

037476
PREPARING BRITISH RAILWAYS TRACK FOR HIGH SPEED RUNNING

Paterson, A, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, June 1968, pp 413-416, 1 Tab, 6 Phot

Before speed limits are raised to 125 mile/h or higher, action must be taken to eliminate bolted rail joints and gaps in the rail at crossings. Experience with 100 mile/h trains running in quantity indicates that the standard continuous welded rail track on prestressed concrete sleepers will be capable of carrying trains at 125 mile/h without any particular difficulty. At speeds of 100 mile/h or over, the presence of all kinds of rail joints and of crossings present an increasing problem in maintenance. The desirability of providing monoblock or swing-nose crossings increases as the speed rise.

037479
DOUBLE–AND SINGLE-SHANK ELASTIC RAIL SPIKES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Apr. 1968, pp 267-268, 2 Fig, 3 Phot

A simple fastening with built-in gauge holding and self-torsioning features used by the German Federal Railway is described and illustrated. They maintain all their qualities in service over long periods and can be re-used. The spike design enables it to be re-inserted into existing holes in sleepers without loss of security. The cost of these double and single shank spikes compares very favourably with other equivalents.

037480
RESILIENT RAIL-SEAT PADS IN BONDED RUBBER CORK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Mar. 1968, p 182, 2 Phot

Concrete cross ties are less resilient than the flexibility of a roadbed of ballast, and wooden cross ties. Therefore, it is necessary to insert a pad between the concrete crosstie and the rail or baseplate. Such padding is important to avoid abrasion of the rail and to damp out noise and vibration, as well as an insulator of track circuits. Rubber has been used, but when compressed, solid rubber tends to spread sideways, leading to abrasion and finally to rupture. Combinations of cork with synthetic or natural rubber permit use of pads of pre-determined load/deflection characteristics. The rubber also seals the cork from moisture, as well as helping the pads to adhere to rail foot and crosstie.

037481
BROACHING HOLES IN RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Nov. 1968, p 892, 1 Phot

Anything that can be done to reduce bolt hole stresses will increase the fatigue life of rails. The perfect result is achieved by completely eliminating fishbolt holes. Four methods of improving fishbolt holes are: 1. careful drilling to produce holes of smooth fish; 2. radiusing the edges of the holes; 3. reducing the diameter of the holes; 4. work hardening the internal surface of the holes. Work hardening the hole is achieved by forcibly increasing its diameter after the initial drilling. The fatigue strength of the drilled rails is improved by at least 25 percent by work hardening.

037588
REDUCING ERRORS IN CURVE REALIGNMENT PROCEDURES

Schubert, E

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 15, No. 6, June 1966, pp 229-231, 8 Fig, 7 Ref

The author discusses the differences between the realignment of curves by the old manual method and the use of track aligning machines for this purpose. The methods of reducing the errors for the mechanized realignment of curves are compared, and graphs are shown depicting the conditions for the various methods. The conclusion reached is that be using the two chord procedures, it is possible to correct the alignment to double the accuracy.

037602
RAIL GUIDANCE TECHNIQUES AND SWITCH DESIGN

Miller, CT Muench, W

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Oct. 1967; pp 350-355, 8 Fig

With railways endeavoring to reduce running times, in addition to increasing trains speeds, particular emphasis attaches to improving the design of switch points and track connections in stations to avoid speed reductions there. This article deals with the application of theory and practical experience to the design of switches, from the points through the frog. The importance of a proper design of switch configurations is emphasized by charts of force reactions of vehicles moving through switches.

037608
MAUL BLOWS ON WEBS CRACK RAILS AT LOW TEMPERATURES

Railway Engineering and Maintenance (Thomson Publications Limited, Box 8308, Johannesburg, South Africa)

Dec. 1944, 2 pp, 1 Tab, 7 Phot

The fact that the webs of rails can be fractured readily in cold temperatures by heavy spike maul blows has been demonstrated by laboratory tests. These tests in which rails were chilled to a temperature of 20 deg below zero and then struck on the web with a spike maul while at temperatures ranging from 13 deg below zero to 25 deg above zero, point to the danger of heavy blows on the web of a rail, particularly under low temperatures, at any time during its life. The second series of tests were made for the purpose of determining to what extent if any rail design might influence the development of cracks from spike maul blows. Summarizing this second series of tests, it was observed that cracks were produced in one or more specimens of all rail sections included in the tests. Concerning all of the tests, it is of interest to note that cracks were produced irrespective of the branding, stamping, rail position in the ingot or rail section. "It may be concluded from these tests that it is entirely possible to produce cracks in the rail web by striking the web a heavy blow when at a low temperature."

037610
SOIL MECHANICS OF THE BALLAST BED UNDER CONCRETE TIES

Klugar, K

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 16, No. 6, June 1967, pp 215-222, 15 Fig, 11 Ref

The problem of transfer of load and stress imposed on the railway bed and the ballast bed through the concrete ties is considered. Tests revealed that uniform stress transfer of these loads from the ties to the coarser grain of the ballast bed did not occur. Results showed that the isotropy and homogeneity of the bearing layer of the ballast could be improved by a finer screening of the ballast materials and by heavy tamping of the ballast bed. Insuring a better and more stable condition of stress transfer from the rails through the ties and ballast to the underlying track structure.

037615
CONTINUOUS WELDED TRACK IN RAILWAY OPERATIONS (HUNGARIAN STATE RAILWAYS)

Kerkapnly, E

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 1-2, Jan. 1965, pp 6-24, 14 Fig, 15 Ref

The author evaluates the engineering and economics of continuous welded track on the Hungarian State Railways. The details of the engineering of the track construction are described, and show the continuous welded rails are laid on concrete ties 8 feet long, spaced 24 inches apart, on a rock ballast bed 20 inches deep, with 16 inch shoulders, and having a base 16 feet wide. A theoretical consideration of the improved riding conditions provided by the continuous welded track, and the reduced maintenance made possible reveals that this construction can effect substantial savings over the jointed track to justify its extra cost, depending on the traffic density.

037616
THEORETICAL OBSERVATIONS OF RAIL HEAD STRESSES AT POINT OF LOADING

Eisenmann, J

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 1-2, Jan. 1965, pp 25-34, 16 Fig, 16 Ref

The author presents a theoretical treatment of the stresses in rail heads resulting from both vertical and lateral pressures, as well as the oblique loading from imposed wheel loads, including the torsional as well as the vertical and horizontal stresses. Specific attention is directed to the "S 49" and "S 54" rail sections.

037617
TRACK WARPING OVER A FINITE LENGTH

Schweda, F

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 1-2, Jan. 1965, pp 44-48, 4 Fig, 2 Ref

The author presents a theoretical study of the distortion of an infinite length of track subject to critical rail temperatures in wave lengths of various patterns, as applied to track of finite length as continuous welded rail, under the influence of high ambient temperatures.

037618
ULTRASONIC TESTING OF RAIL—EXPERIENCE AND IMPROVEMENTS

Egelkraut, K

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 1-2, Jan. 1965, pp 49-59, 15 Fig, 11 Ref

The author discusses improvements in the methods of ultrasonic testing of rail for defects and flaws on the German Federated Railways, giving details of the present state of the art in the new test equipment, and reviewing the knowledge accumulated. Possible improvements in the testing techniques are discussed, including the need for doubling, at least, the speed presently required for this testing of rails.

037619
DETERMINATION OF THE COMPACTING OF BALLAST UNDER SERVICE LOADING BY THE GAMMA ABSORPTION PROCESS

Birmann, F Cabos, P

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 1-2, Jan. 1965, pp 59-69, 27 Fig, 9 Ref

Increased train speed and axle loadings require effective measures to keep maintenance costs and maintenance work on the track within acceptable limits. An important factor in this is a well compacted road bed. The authors describe how the effectiveness of compacting of the road beds performed by the various makes of tamping machines had hitherto been measured by a so-called "water substitution" method. The new gamma absorption method of making this determination of the specific gravity of the compacted ballast bed, and the measuring procedure associated with it, are described. Charts of measurements are given, showing the correlation of this new with the old method. Data as well as theory are included. Information is also given, showing the increase in resistance of the track structure to lateral displacement and longitudinal creep from a well compacted ballast bed.

037620
RAIL FASTENINGS ON THE GERMAN FEDERATED RAILWAYS

Doll, A

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 1-2, Jan. 1965, pp 2-15, 28 Fig, 5 Tab, 5 Ref

The author reviews the various types of rail fastenings used on the German Railways, from the long used ribbed sole plate through the usage of resilient rail spikes, to the modern tension harness fastenings. Data and charts are presented for each type of fastening.

037622
WORK STUDY IN ENGINEERING MAINTENANCE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Jan. 1957, pp 96-97

The pilot schemes for use of work study for railway civil engineering maintenance are summarized from a paper presented to the Institution of Civil Engineers. In 1956, permanent-way length-gang maintenance was applied to eight inspectors' sections, and also to steelwork fabrication in the civil engineering workshops, to bridge and station repairs and to painting on the Southern Region. The advantages to both management and staff of work-study techniques include reduced costs, better-quality work, more consistent work loading, higher pay, shorter hours and better management and working conditions.

037623
LONDON TRANSPORT DE-ICING EXPERIMENTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Feb. 1957, p 164, 1 Phot

Sleet tenders attached to the front and rear of an empty service train are being used to de-ice conductor rails. One prototype tender has already been completed at Acton Works and another is under construction. The tender consists of a specially constructed four-wheel bogie to which is fitted de-icing equipment similar to that of a sleet locomotive i.e., three sets of crushing rollers, steel brushes and de-icing sprays. One of the three sets deals with the center negative rail, and the other two with the positive rail.

037625
OSCILLOGRAPH RECORDING EQUIPMENT ON THE SOUTHERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Feb. 1957, pp 219-221, 1 Phot

The amplifier unit is basically a six channel self-balancing push-pull amplifier which will accept symmetrical and asymmetrical inputs. The outputs of the six amplifier channels are fed to six cathode ray tubes. The indications on the cathode ray tubes may be recorded simultaneously on photographic paper. The equipment has been used on a variety of projects. The recording equipment is used for the measurement of the rail bending stresses set up in bull head and flat bottom rails due to the passage of vehicles. Tests involving the measurement of stresses set up in an L.T.E. bogie frame gave useful information regarding stresses under static and dynamic conditions. The equipment has also been used for development tests on electrical equipment for multiple unit trains.

037627
LOCATING SUBSIDENCE SLIP PLANES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Mar. 1957, p 356

The alkathene tubing method for locating the slip plane in embankments and cuttings is described. Auger tubing is driven vertically to a depth below the probable slip surface. The alkathene tubing is placed into the auger tubing hole and is allowed to deform by the shearing action of the slip. A mandrel on a cord is suspended down the tubing to measure the depth at which the deformation occurs.

037628
EXPERIMENTS WITH POINTS AND CROSSINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Mar. 1957, p 363, 2 Phot

The partially welded type of frog, in which the only loose parts are the through securing bolts and nuts has been installed on the German Federal Railway, with, considerable success. As much as 80 percent saving in maintenance is claimed, compared with the ordinary built-up type. Hardening is done by a special process which gives a maximum value of 120-130 Kg/mm 2. That part of the frog forming the distance piece and the nose at the point rail is made up from a forging which is welded to the point rails by flash welding. The life of welded frogs is twice that of the normal type, but cost of maintenance is almost negligible, furthermore gauge widening is eliminated.

037629
LONG WELDED RAIL INVESTIGATIONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Apr. 1957, pp 472-473

The Western Region of British Railways has been carrying out valuable investigations into the behavior, control, and economic factors relating to long continuous lengths of welded rail. The test lengths of long welded rail in South Wales were subjected to apparatus for measuring and recording movements of the rail. Nine pairs of instrument stations 100 yd. apart were initially established with recording instruments grouped at a central point. The behavior of the track recorded was mainly longitudinal movement due to changes in temperature but transverse movement was also registered. Laboratory static tests were for resistance to longitudinal movement of a rail through its fastenings, and a dynamic testing machine was also evolved for equating track loading and deflection under the equivalent of the passage of a locomotive at 60 mph. Long continuous rail lengths carrying fast traffic must be provided with ample ballast and a firm foundation. Maintenance must be to a first-class alignment and special attention must be paid to the maintenance of the fastenings. More accurate means of costing maintenance will also have to be devised for ascertaining the economics of long welded rails.

037632
SOIL MECHANICS ON BRITISH RAILWAYS

Toms, AH, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Apr. 1958, p 384

Fresh evidence of research work is provided in a lecture entitled "Soil in British Railway Civil Engineering", by Mr. A.H. Toms. The properties of clay soils, the test methods to determine these properties, and the design of railway structures for problem soil conditions are discussed.

037634
SELF-PROPELLED TRACK RECORDER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, June 1957, p 688, 3 Phot

A track recording trolley, is being used by the civil engineering department, Eastern Region, for detecting and recording track irregularities. It is self-propelled, weighs some eight tons, and is powered by a 65-hp petrol engine. As the vehicle travels along the track a series of probes and wheel flanges in contact with the rail surfaces communicate any irregularities to the recording table by means of wire cables and mechanical linkage. Records obtained include gauge variation, superelevation, and alignment. Speeds during recording are up to 20 mph, but up to 50 mph can be attained when not recording. A crew of five is carried.

037636
WELDED RAIL IN THE U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, July 1957, pp 65-66

The elimination of rail-joint maintenance is claimed to be more than covering the additional cost of welding, transporting the welded strings to site, and handling them. In general, few troubles have been experienced. Expansion and contraction at the ends of welded strings has been little more than normal, and has been restrained by increasing the number of rail anchors applied over the last six lengths of rail (234 ft) at the end of each string. Given proper anchorage, no trouble is experienced with buckling, but that considerable care has to be exercised as to the temperatures at which continuously-welded rail is surfaced.

037638
QUALITY OF RAILS AND MEANS OF GUARANTEEING IT

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publication 24, Jan. 1967, pp 19-23, 2 Fig

Question D45.

The revisions of the album of sample sulfur prints appended to UIC leaflet No. 860 for the supply of rails are summarized. Results are reported of the correlation between performance of Thomas steel rails with test results. The object was to develop a single test or group of tests to project performance during the initial acceptance of the rails. These tests show that with Thomas steel rails, there is a specific relationship between the results of the transverse tensile test, the compression test, the turning-by-stages test, the magnetic powder test, the dye penetration test, deep etching and the microscopic determination of silicate inclusions and the liability of the rails to "shelling" (dark patches), horizontal longitudinal cracks and transverse cracks.

037641
REINFORCED CONCRETE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Nov. 1940, p 545, 1 Fig, 1 Phot

The Stanton Ironworks Co., Ltd. is producing reinforced concrete railway sleepers. Modified into sub-standards to suit either bullhead rails used with standard chairs, or flat-bottom rails. There is provision for adjustment of gauge to suit requirements. The sleepers are manufactured with 3/8 in. graded granite, local sand, and portland cement. The reinforcing is with bars and wire to B.S.S. No. 785-1938. For fixing flat-bottom rails, patent creosoted wooden blocks to take coach screws are inserted during manufacture; or the sleeper may be provided with cored holes and square-headed recess to prevent rotation of 7/8 in. diameter bolts. Another type of fastening consists of plastic inserts cast during manufacture to take special coach screws.

037642
CHEMICAL CONSOLIDATION OF GROUND IN RAILWAY WORK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 72, Feb. 1940, pp 147-151, 3 Fig, 6 Phot

Some applications of a successful chemical injection process to tube railway construction work in London are described. The extension of the Central Line tube railway between Bow and Leyton was carried out in water-logged ground by means of compressed air. At Leyton station the lines are carried from the tunnels to the surface in an open cut. On approaching this open cut the two shields of the 12-ft. running tunnels were carried through with a cover of only 4-5 ft. of ballast, with water level almost at the surface. The method of foundation strengthening is discussed and the tunnel network and track foundation is illustrated in drawings and photography.

037643
UNDERPINNING AND STRENGTHENING TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, Sept. 1942, p 224

Five methods were tested to strengthen the black cotton subsoil under a section of the Great Indian Peninsula Bombay-Nagpur main line. One method used a wooden sleeper mattress under the ballast. Two methods used trough sleepers. The fourth method used a reinforced-concrete mattress under the present track. The fifth method used a corrugated-iron mattress. Only the reinforced-concrete mattress stabilized the track.

037644
CONCRETE SLEEPER BLOCKS ON THE L.N.E.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, July 1942, p 86, 3 Phot

L.N.E.R. has used concrete blocks, with wrought-iron tie bars, as a substitute for, or in conjunction with, timber sleepers for more than 20 years. Current uses for concrete block are limited to sidings and tracks used by slow traffic. The applications are shown in photographs.

037645
TRACK DRAINAGE ON THE NEW HAVEN RAILROAD

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 75, Oct. 1941, p 437, 1 Fig

Two sections of four-track road, one in a tunnel and one in a cutting, are effectively drained by systems of Armco corrugated pipes. In the tunnel the 8-in. perforated pipe was installed between the track at 6 to 7 ft. below rail level, a fall of 1 in. 250. In 24 hr 3500 gal. of water were pumped out. The ballast at the 1500-ft. shallow cutting was 3 to 4 ft. deep. Two lines of subsurface 12 in. diameter longitudinal drains were installed beside the ballast. Volume of drainage varies from 350 gal. per hour during a dry spell to 2500 gal. per hour after several days of intermittent heavy rain.

037646
TIMBER FOR RAILWAY SLEEPERS

Hardy, E

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, 420130, p 160

Due to the war shortage of wood in England, alternate sources of timber, possessing insect and weather resistant characteristics, were sought. Three include European larch, Japanese larch, Scots pine or fir, Douglas fir, Weymouth pine, Austrian pine, and Corsican pine. The Indian Pyinkodo and African Iroko were also considered.

037647
SYSTEMATIC DETECTION OF RAIL DEFECTS IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, Jan. 1942, pp 159,166, 1 Tab

The Missouri Pacific Lines have increased the daily mileage of a Sperry detector car from 21.1 to 30.0, and its annual mileage from 6,188 to 9,074. Annual examinations are made of 55 percent, or 4211 track miles, of the total rail system. Rail inspection statistics are given for the years 1931 to 1939, including: transverse fissures detected; longitudinal fissures detected; other defects; total defective rails; and average defects per track mile.

037648
HIGH-SPEED JUNCTIONS AND CROSSOVERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Sept. 1957, pp 333-334, 1 Tab, 3 Phot

British Railways has developed two new switches in 109-lb. f.b. rail. They are the "Curved F" and "G" switches and are both of the chamfered type, which, by the undercutting of the stock rail, permits the retention of sufficient metal in the switch rail to provide the robust section desirable at and near the switch toe when very fine entry angles are used. In the Southern Region a speed restriction of 50 mph is considered suitable for Curved F switches diverging from the straight. G switches will be used where higher speed restrictions up to 75 mph from straight are required and site conditions permit. Layout drawings for a double junction embodying G/24 turnouts have been completed. By the use of two-level baseplates and transition curves as necessary, a practially constant cant deficiency of just over 2-1/2 in. at 75 mph is possible.

037649
RAIL-END HARDENING IN NEW ZEALAND

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Oct. 1957, p 412

Flash-butt welded, 91-lb. rail is being flame-hardened to increase the Brinell hardness of the rail end 50 to 100 points above the remainder of the rail. The hardening extends 1.5 to 2 in. from the rail-ends, to a depth of 0.189 to 0.25 in. Experiments have been carried out at temperatures from 32 to 90F, with practically no variation in results. The hardening process is described in detail.

037650
HANDLING CONTINUOUSLY WELDED RAIL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Oct. 1957, p 483, 1 Phot

The Denver & Rio Grande Western Railroad has perfected a new unloading method for continuously welded rail, which pushes the rails off the rail train rather than to pull them off. This eliminates the danger of damaging the rail as it drops from the train in the pulling method. The new method uses specially adapted flat cars located directly behind the locomotive to thread and push the long rail onto the track. A crew of 4 or 5 section men in addition to the train crew are needed to lay the rail.

037652
LONG-WELDED RAILS ON EAST COAST MAIN LINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Nov. 1957, p 594, 1 Phot

The first long-welded rails on the East Coast main line were laid on a section of line where a continuous stretch of almost a mile now exists. Normal 60-ft. rails were first flash butt welded into 300-ft. sections. On the site, the ends of the rails to be joined together were held in a mold and heated. A mixture of powered metal and magnesium was ignited and the powered metal melted into the gap between the rail-ends. The mold was knocked off as soon as possible and spare metal trimmed by cold chisel and grinder. Each weld took about 45 min. to complete.

037655
EXPERIENCE OF UNDULATORY WEAR OF RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, July 1958, p 90

Undulatory wear on corrugation in rails is universally considered to be of two main types: roaring rails or washboard track; and what is sometimes described as saddles. The majority of railways consider that speed has no relationship with corrugations. Undulatory wear appears from 3 to 12 months after laying. The general opinion is that braking decreases washboarding but increases saddles. In the U.S.A. experiments with an acetylene torch to temper the Martensitic area of the high polished spots of washboard corrugations caused the ridges in the track to disappear. Various methods of grinding have been tried, but none have proved permanently successful.

037656
REPAIRING RAILS DAMAGED BY SLIPPING LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Aug. 1958, p 160

The advantages of welding were the elimination of an undesirable microstructure from the steel, the elimination of low spots in the rail at a point of metallurgical weakness, and the recovery of much rail for main line use which otherwise might be relegated to secondary service or scrapped. Laboratory tests and service experience in the U.S. thus appear to show that it is preferable to repair wheelburns by welding than to leave the damaged rails in the track without welding. Repairing up to eight or nine burns per rail would probably be cheaper than replacing it and would therefore be justified.

037657
LONG WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Aug. 1958, pp 242-243

A survey was taken to determine the uses and value of long welded rails, their manufacturing and laying techniques, and maintenance. The results were reported to the Seventeenth International Railway Congress. The maintenance costs are at least 15 percent less for the welded rail than for conventional track. The most suitable length for welded rail and anti-creep devices are discussed. Isolated cases of breakage due to welded defects, buckling due to disregard of temperature regulations of poor ballasting, and creep due to thermal stress are cited.

037660
HEAT-TREATED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Nov. 1958, pp 589-590

There has been a considerable increase in the heat treatment of rails for U.S.A. railways. Apart from controlled cooling, which is applied universally as a protection against the development of transverse fissures, rail-end hardening is extensively practiced, to reduce batter of the rails at the joint. In one specific case mentioned the addition to the basic price for rails control-cooled, end-hardened, chamfered at the extreme ends on the running surface, and drilled for fishbolts, was about 59 percent. It was considered advantageous to use heat-treated rails in switch and crossing work. For trackwork subject to exceptionally heavy wear an alloy steel, such as chrome-vanadium is preferable, though this is more costly than heat-treated rail. The disadvantage of such alloys is that it is impractical to weld them by the oxyacetylene method, so that on site repairs by welding are ruled out.

037661
LONG-WELDED RAILS LAID IN CONTINUOUS OPERATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Nov. 1958, pp 625-626, 4 Phot

The method allows one track-mile to be laid in 600-ft. lengths in one continuous operation. Up to 36 welded rails, 300 ft. long, can be loaded on to the bolster wagons at the new rail welding depot. Pairs of these rails are fishplated together to form 600-ft. lengths. Eventually continuous welded rails 600 ft. long will be available. The rear wagon of the train has special gantry equipment designed for guiding the lengths of rail off the wagons at normal rail spacing of 4 ft. 8-1/2 in. and for lowering the rail ends.

037662
RUBBER RAIL-TO-SLEEPER FASTENING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Nov. 1958, p 54, 4 Fig, 1 Phot

A rail-to-sleeper fastening on trial on British Railways is applicable to ordinary flat-bottom rails, but is specially designed to resist any tendency towards buckling in long-welded rails. The advantages claimed are: simplicity; cheapness in first, maintenance, and replacement costs; safety, sufficient elasticity to protect the sleepers against impact and so increase their lives; and no interference with track-circuiting. The fastening consists of a cast-iron baseplate enclosing a rubber pad upon which the rail-base is held securely both vertically, transversely and laterally by metal-rubber wedges fitting tightly into jaws cast integrally as part of the baseplate.

037663
ADHESIVES IN RAIL-JOINT ASSEMBLIES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Dec. 1958, p 677

Railways are testing the use of adhesives in rigidifying rail-joints to eliminate rail-end batter and reduce maintenance. Preliminary tests showed that joints so rendered inflexible ensured a smooth-running continuous rail likely to add 10 to 15 years to the life of existing track. The glued joints also reduced maintenance by eliminating the expansion and contraction in ordinary joints. A 300,000-lb resistance to slipping is reported with Bondarc applied to clean, sand-blasted fishing surfaces, and by butt-glueing the rail-ends additionally a further 40,000 lb is obtained. As no fishbold tension in excess of 20,000 lb was needed it was not found necessary to use high-strength bolts. Tests were conducted in Northeast Canada to ascertain the effects of a combination of the lowest temperatures and heavy traffic on glued joints.

037669
"FROZEN" RAIL JOINTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Feb. 1958, p 180

The Delaware and Hudson, on its main line stretching from Albany, New York, to Montreal, has experimented with frozen joints for continuous-welded rails. For frozen joints, the rails are laid tight, allowing for no expansion at the joints. The elimination of joint maintenance is a main argument in favour of welding into long lengths. The weld itself is expensive, not to speak of the extra cost of handling the long lengths of "ribbon rail." Furthermore, if a rail is damaged, it can easily be replaced, whereas with ribbon rail the section damaged has to be cut out. There may be extensive potential maintenance economics to be effected by laying rail tight with frozen joints.

037670
RAIL-END HARDENING IN NEW ZEALAND

Colligan, GK, New Zealand Institute of Welding

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Dec. 1958, pp 765-766

A paper from the British Commonwealth Welding Conference is summarized. In New Zealand the rails as originally received are from 30 to 40 feet. long but the 91-lb rails are now being flash-butt welded into 210-feet lengths, and it is the ends of these long rails that are hardened at three main depots. The composition of the rail has the greatest influence upon the results obtained from flame hardening. The methods used to harden and quench the rails and the apparatus used are described. The principal aim in heat treating a rail is to obtain a definite percentage increase in hardness over that of the untreated rail. To this end in New Zealand, the 91-lb rails now being end-hardened are treated for 1-1/2 to 2 in. from the end and to a depth of from 3/16 to 1/4 in. To avoid surface cracking or shelling there should be a definite hardness range which should not be exceeded.

037672
CONCRETE SLEEPERS

Harmsen, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, May 1958, pp 560-561

A thesis discussing concrete sleeper development is summarized. This thesis explains the necessity for an exhaustive study to counteract the results of severe high-frequency vibration by damping it down and so protecting the concrete from damage. Typical examples of modern concrete sleepers are reviewed, notably the English Dow-Mac and Stent, the German "B53V", and the French "V.W.", all with their tensioning steel and concrete bonded together and pretensioned.

037673
RAIL-MOUNTED TRENCH-DIGGING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Mar. 1958, 3 pp, 5 Phot

A rail-mounted trench-digging machine developed by the Western Region of British Railways enables seven men to do the work of 40, in less than one-third of the time, when excavating trenches for surface water drains alongside the track. The machine saves 86 percent of labor costs on the site, the major portion of expense in any drainage scheme. It can dig a 6-ft. length of trench, 6 ft. deep and 2 ft. wide, in one min. The rail-mounted trench digger is driven by a 48-hp Perkins P6 diesel engine. The power to all motions is transmitted hydraulically. The weight of the machine in working order is about 30 tons, and during the past two years it has operated without significant mechanical failure.

037674
LONG-WELDED RAILS

Jackson, F, South African Railways & Harbours

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, May 1958, p 622

A comparative study of methods for welding very long rails was made for Great Britain, South Africa, New Zealand, Australia, Sweden, Japan and the U.S.A. The use of long rails is largely experimental and no definite policy has been reached as to the length of section to be laid with them. Wood, steel, and concrete sleepers are being used and their numbers vary from 1,240 to 1,920 per km. Methods of fastening the rails to the sleepers include dog spikes, elastic spikes, clips and bolts, and cast iron chairs with keys. The most favored method of manufacturing long-welded rails is by flash-butt welding in the depot into transportable lengths and then by thermit welding into long sections on site.

037675
RAIL WELDING AND METHODS OF LAYING IN NEW ZEALAND

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Apr. 1958, pp 421-422, 3 Phot

At the Woburn machine-welding depot, 117-ft, 126-ft, and 351-ft welded rail sections were fabricated using a British-built flash-butt electric welding machine and a post-heating machine. The shorter rails were then transported to and laid at the approaches to the Rimutaka Tunnel. This 5.5-mile tunnel was laid wih 351 ft pre-fabricated track. The 351-ft rails were unloaded and pre-fabricated into track at a special temporary depot designed for that purpose. The fabrication method is described.

037677
SPECIAL COMMITTEE ON CONTINUOUS WELDED RAIL

Cramer, RE, Illinois University
Wise, E, Jr

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 59, Feb. 1958, pp 895-904, 3 Tab, 5 Phot

Rolling-load tests were made of specimens of continuous welded rail in the 12-in stroke machine on four acetylene welds, 4 electric welds, and 4 thermit welds. All of the thermit welds failed in this test. One acetylene weld also failed just below 2 million cycles. Other rolling-load tests were made in a 33-in. stroke rolling machine primarily to test the welds in the rail bases. All the acetylene and electric welds ran to over 2 million cycles without failure. Two thermit welds developed failures in the rail heads. A few other observations on possible causes of weld failures are listed, including grinding burns electrode burns, and cases where the flame goes out in oxyacetylene welding. The fastenings subcommittee reports five methods used to anchor welded rail across open-deck steel viaducts or long deck steel spans.

037678
SERVICE TESTS OF DESIGNS OF MANGANESE STEEL CASTINGS IN CROSSINGS AT McCOOK, ILLINOIS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 591958, p 1010

This report covers the service performance of the solid manganese test castings in the crossings between the double-track lines of the Baltimore and Ohio Chicago Terminal Railroad and the Atchison, Topeka and Santa Fe Railway at McCook, Illinois. This solid pedestal design that was not depth hardened on the tread corners was retired after a service life of 3.60 years. This casting was removed from service because of the combined weakening effect of the cracks from the top to the bottom of the casting. On June 3, 1957, for the same defects, the solid pedestal design with depth hardening was retired after 4.44 years of service in the same crossing. Although the USS depth-hardened casting had more cracks at its retirement than the unhardened specimen, it is judged that the major portion of the increase in life for the depth-hardened one can be attributed to that treatment.

037679
THE NEW C AND O TRACK INSPECTION CAR

Burris, TF, Chesapeake and Ohio Railway

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 631962, pp 758-676, 4 Fig, 4 Phot

The design of the new car allows accurate measurements to be made at all speeds through 100 mph. The overall system of the RI-2 includes means for measurement of such track characteristics as curvature, cross level or superelevation of rails, surface, and joint condition. These measurements are continuously recorded on tape along with landmarks and other notes indicating location, as well as speed of the car. The recording and control facilities are compactly located near the center of the car. Facilities are provided for unobstructed visual observation of the railroad through an observation deck seating 31 persons. The car is placed as the last car in a train with the observation end towards the rear. At the other end of the car are kitchen, office, conference, sleeping and toilet facilities. Two men can operate all the measuring and recording facilities. The operation and facilities of the RI-2 are illustrated.

037682
PHYSICAL PROPERTIES OF EARTH MATERIALS

Legro, HW

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 491948, pp 499-507, 5 Fig, 6 Phot

This is a preliminary report on the use of soil pressure cells with electrical recording equipment for the measurement of pressures in railroad subgrades under moving loads. Three cells of different construction were used; the AAR cell, waterways experiment station cell, and poulter cells. No analysis of the accuracy of the cells has been made but the indicated pressure appears proportional to the load on the tie as determined by the dynamometer tie plates. The manner of installation has considerable effect on the action of the pressure cells. The need for an open trench is indicated and the wider the trench the sooner the gages will register full pressure. These tests afford no more than an approximate evaluation of the effect of impact on soil pressures, although they demonstrate that considerable impact effect is present.

037683
FURTHER THREE-DIMENSIONAL PHOTOELASTIC STUDIES OF STRESSES IN RAIL HEAD DUE TO WHEEL CONTACT PRESSURE

Frocht, MM, Illinois Institute of Technology

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 601959, pp 1167-70

A transparent model of a rail head about two-thirds scale was constructed and tested. The model testing showed that the three principal stresses are compressive immediately under the wheel, but as we go away from the wheel both to the right and to the left, all these compressive stresses become tensile. The main difficulty in this study was not studying the stresses in the model of the rail head or the rail, but rather from the difficulties of interpreting the meaning of the stresses in relation to shelly rail failures, or failures in general.

037686
MEASUREMENT OF RAIL HEAD WEAR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Aug. 1940, p 228, 2 Fig

A novel method of rail wear measurement is being used on the London Midland and Scottish Railway in order to compare rails of special composition or rails which have been specially treated to increase resistance to wear. The apparatus is simple, and consists of a jig formed to the contour of the part of the rail to be measured, and a dial gauge reading to 0.5 in. by 0.001 in. graduations. The actual gauging can be done at the rate of about one minute per section.

037687
ESTIMATING WEIGHTS OF RAILS IN THE TRACK

Brown, GW, London Midland & Scottish Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Aug. 1940, pp 203-204, 2 Fig, 1 Phot

The Railimeter measures rail in two directions simultaneously, and indicates the weight of the section in lb. per year by a pointer on a scale. If side cutting is present, a reading from a side-cut gage is subtracted from the reading of the Railimeter. Where the rail is galled it is of course necessary to displace the chair at the gall when measuring the weight of this section. A chart estimating rail life based on the Railimeter reading is illustrated. The results obtained with this instrument compare favorably with more laborious methods previously used.

037689
DYNAMIC MEASUREMENT OF ABSOLUTE TRACK PROPERTIES

Cass, R, Canadian National Railways
Berthiaume, PP, Canadian National Railways
Kalita, RE, Canadian National Railways
St. Louis, L, Canadian National Railways

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Aug. 1969, pp 855-860, 12 Fig, 4 Phot, 2 Ref

A transducer developed to mount on the track of a standard railway coach is the basis of a special track evaluation car. The practical application of this facility to track maintenance is described. The basic principles of the seismic transducer showing the test mass, constant force spring, and damping is illustrated. Rail profiles, surface roughness charts and a sample print-out of data for a quarter mile track section are displayed. Prototype equipment using magnetic induction transducers is being field tested.

037690
ELECTRODYNAMIC BALANCING OF WHEEL SETS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Apr. 1958, pp 480-483, 2 Phot

The use of the Avery electrodynamic machine has been extended to the balancing of wheelsets. The principal advantages are stated to be that a relatively unskilled operator can quickly and accurately determine the position and amount of correction required; and that good sensitivity is obtained without having to use delicate mechanical or electronic amplifiers. The balancing machine consists of a heavy base on which are mounted two adjustable pedestals and a driving head. On the top of the driving head is fitted the indicating head; this contains a wattmeter, four-position switch, sensitivity switch, plane potentiometers, calibration controls, and polarity switches. The arrangement of the indicating head is shown.

037693
THE EFFECT OF TRACK GEOMETRY ON RIDE QUALITY

Ullman, KB, Department of Transportation
O'Sullivan, WB, Department of Transportation

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

69CP355-IEA, Paper, Apr. 1969, 8 pp, 3 Fig, 1 Tab, 4 Ref

Paper recommended by IEEE Land Transport Committee of the IEEE Industry and General Applications Group for presentation at the joint IEEE/ASME Railroad Conference, Montreal, Quebec, Canada.

In this test, acceleration measurements were taken with one lateral and one vertical accelerometer attached to the floor of the test car. The sensitivity of ride roughness to changes in crosslevel during the negotiation of a curve is shown. Also shown is the change in ride response due to bolted to welded rail transition. The track geometry measurements used in this investigation were: centerline profile, the average profile of both rails; alignment; gauge; rate of change of gauge; and warp. The track and ride data were then sorted according to speed. The data for the 100-110 mph tests are plotted on scatter diagrams. Correlation coefficients were then computed for each of the six track exception densitites and the density of the sum of all exceptions with vertical, lateral, and mean lateral/vertical ride. The results are shown. Though sample populations are small, data correlation is sufficiently reasonable to lend support to the approach.

037699
THE SUPERELEVATION OF RAILWAY CURVES

Rapley, F, Buenos Aires Great Southern Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 78, May 1943, pp 509-511, 2 Fig, 1 Tab

The most suitable superelevation for a given curve is determined as follows: the average speed on a tonnage basis should be ascertained from the actual known speeds of all trains, and the curve given the full theoretical superelevation corresponding to this average speed; and the maximum permissible speed on the curve should then be fixed as that corresponding to the above superelevation plus 4 inches. The first condition will result in equal loading of the two rails, and hence equal head wear and even maintenance of surface. The second ensures passenger comfort, and gives an ample factor of safety against derailment which is uniform for all curves, while at the same time it fixes an upper limit to the lateral forces acting on the track which is also the same for all radii. A table gives the superelevation for various radii for different average speeds, and the corresponding maximum permissible speeds.

037709
CONTROL OF TRACK IRREGULARITIES IN JNR

Ban, Y, Japanese National Railways

Japanese National Railways (Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 4, Dec. 1963, pp 30-32, 2 Tab, 2 Phot

The existing rules in Japan regulating track irregularities are given. Inspection cars and techniques used for examining track are described. Recommendations are made for revisions of track irregularities limits considering their effect on safe operation, riding quality, and economic aspects.

037710
THE EFFECT OF LONGITUDINAL FORCES ON CONTINUOUSLY WELDED TRACK AND ON TRACK BALLAST

Siekmeier, EW, Hanover Technical University

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, Brussels, Belgium)

July 1965, pp 446-489, 20 Fig, 8 Tab, 3 Phot, 53 Ref

The properties of the ballast under the influence of longitudinal forces or longitudinal stresses in continuously welded track are discussed. The first part of the paper deals with the different causes of longitudinal stresses. The second part is concerned with research on the mechanical properties of the ballast. From theoretical considerations and on the strength of test results, characteristic data for the resistance to longitudinal displacement are obtained. The third part deals with measurements of rail stresses encountered in tracks under traffic. A description is given of investigations based on train braking tests on continuously welded track.

037712
LANDSLIDES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 581957, pp 735-737

Replies to 12 questionnaires on landslides returned from U.S. and Canadian railroads are summarized. The responding roads represent 24 percent of the line mileage in the two countries. Direct annual maintenance costs due to landslides are reported for each railroad. An estimation is made both of average direct maintenance costs for all U.S. and Canadian railroads due to landslides and an estimate of the indirect costs. Preventative maintenance methods in use by the lines are outlined.

037713
TRACK MAINTENANCE AND HIGH CAPACITY TRUCKS

Hammond, WT, Pennsylvania Railroad

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 1-3

The high capacity truck from the maintenance of way standpoint is the means by which the increased gross weight of the large modern freight car is transmitted to the track, roadbed, bridges, trestles, viaducts and culverts, over which it must pass. As such, its design, dimensions and position are of vital concern to those responsible for the satisfactory operating condition of the railroad. Stress in rails and joint bars, track deflection, maximum load on ties and effect on undergrade bridges require specific consideration in determining whether or not a car can be accepted for movement; and if so whether it will be free-running or whether it will be restricted as to speed and routing. An immediate concern in relation to high capacity car trucks is the anticipated increase in shelling rail failures due to increased bearing pressure. Shelling rail failures are the result of the plastic flow of metal from the middle portion of the head toward the guage corner under high shearing stresses produced by intense wheel loads eventually starting a horizontal crack. The Joint Committee on Relation between Track and Equipment has recommended maximum axle loads of 52,800 pounds on 33 inch wheels, 58,400 pounds on 36 inch wheels, and 62,400 pounds on 38 inch diameter wheels.

037728
FRENCH RAILWAYS TUNNEL-GAUGING APPARATUS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Mar. 1957, pp 247-248, 1 Fig, 3 Phot

A French National Railways tunnel contour measuring device known as Castan is described. The apparatus has a number of rollers carried at the ends of a series of arms. These roll along the tunnel walls as the apparatus moves along the track and their undulations are used to influence pens which register the variations on a continuous moving paper band. The Castan apparatus sections of tunnels, low or narrow portions of arches, projecting points of rock, or structures too near the line can be recognized at once.

037755
EFFECT OF BALLAST CONDITIONS ON TRACK STABILITY

Eisenmann, J, Munich Technische Hochschule
Gnad, H, Institute fur Bau von Landverkehrswegen, Munich

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, May 1970, p 349, 1 Fig, 1 Phot

Installation of long-welded rail on Europe's principal trunk routes has created problems of track stability caused by the presence of thermal stresses in the track due to local climatic conditions. These investigations have led to the development of track stabilizers which follow closely behind the tamping machine. With this treatment the compacting effect which results from traffic is partly achieved in advance. Relationships between lateral resistance and deformation obtained from the tests carried out on a length of track are shown.

037756
RECLAMATION OF RAILS BY POWDER WELDING

Cookson, C, British Railways Board
Shawe, F, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, May 1970, pp 350-351, 4 Phot

In situ repair of wheel burn and cupped thermit welds is now a practical proposition using the powder deposition process. The powder welding process requires a brightly ground or scurfed surface and the usual precautions obligatory with any welding procedure, that of removing fatigued metal, flow ridges and lapping. Should the weld fail, the failure will occur at the weld/base metal interface and experience has shown that a few microns of weld metal still remain, and consequently protection is afforded against atmospheric oxidation.

037759
COMPREHENSIVE TRACK MAINTENANCE SYSTEM

Genton, D

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, June 1970, pp 465-467, 1 Fig, 2 Phot

Railway engineers aim to achieve as economically as possible a long-life track and a stable relationship with the vehicles running over it at high speed. Flaw detection and track laying and cleaning equipment is described. Ballast site rehabilitation, track material renewal, and track lifting lining and tamping procedures are discussed.

037762
PERMANENT WAY IN AN AGE OF HIGH SPEED

Diaz Del Rio Y Jaudenes, M, Spanish National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Aug. 1970, pp 588-590, 1 Fig, 1 Tab, 3 Phot

Rails of adequate weight, rigid fastenings and good ballast, as well as programmed mechanized maintenance procedures, are essential for high speed lines. Methods used for track construction and maintenance by several European countries, Japan, U.S. and U.S.S.R. are briefly presented.

037765
RAIL FASTENING TEST CENTRE OPENED

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Sept. 1970, p 687

The test center is part of the Elastic Railspike Company manufacturer of the Pandrol Clip. Key personnel are listed. The Amsler hydraulic rig for simulating dynamic rail loading conditions is described. The laboratory also has nine fatigue testing machines to accommodate various types of rail fastenings.

037766
SOME RECENT FACETS OF CONTINUOUS-WELDED TRACK PRACTICE IN BRITAIN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Sept. 1970, pp 705-707, 5 Phot

Maximum working temperatures have been laid down for continuous welded rail above which it is not permissible for consolidation of the track or work to be undertaken on it. With slag or crushed stone ballast this temperature has been set at 32 deg C. Should slewings at any time exceed 1-1/4 in. the whole of the rail length affected must be restressed. An important aspect of continuously welded track is the strict adherence to restressing and destressing procedures. These have been developed to ensure that continuously welded track is kept in a uniform and safely stressed condition at all temperatures.

037772
WEAR OF RAILS ON CURVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Mar. 1954, pp 266-267

Abrasion caused by locomotives and electric motor coaches, the condition of the track, and methods of alleviation are discussed. Insufficient information is available to say what type of vehicle produces the most rapid wear in the outer rails on curves. Increase in tractive effort may result in increased transversal reaction and greater lateral wear of the rails. Rate of wear varies inversely as the radius of the curve, but no quantitative relation between degree of wear and radius has yet been established, nor have the effects of irregularities in curvature. What is certain is that excess or deficiency in cant causes unequal wear on rails.

037774
RULES FOR THE DESIGN OF CURVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 97, Aug. 1952, pp 116-117

To ensure safety and the riding comfort consideration has to be given to the cant of the track, the rate of gain of the cant, the gradient leading up to, or down cant deficiency, and rate of gain of cant deficiency. In providing cant on a curve, precise rules alone cannot be applied. Usually it should be the equalibrium cant for a selected or equilibrium speed. On curves carrying mixed speed running, a mean speed should be selected— usually the average speed of ordinary passenger trains— and equilibrium cant should be provided for that speed. The maximum speeds for turnouts and reverses for some typical crossovers between straight mainlines with various spacings, and laid without cant are shown.

037778
ULTRASONIC RAIL TESTER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Jan. 1970, p 35, 1 Phot

This sturdy lightweight rail tester has been designed to inspect rails automatically for bold hold cracks, wheel burns, "snowflakes," shatter cracks and other separations in the head and web. Pointwork and welded rail joints can also be examined manually. The assembly moves easily along a rail and test speeds of 80 ft/min are easily accomplished by skilled operators. The device is pictured.

037781
INSPECTION AND MAINTENANCE ON A HIGH SPEED RAILWAY

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

Jan. 1971, pp 22-24, 2 Fig, 3 Tab

Despite consistent operation at 200 km/h, cars on the Tokaido Shin Kansen now cost less to maintain on a distance-run basis than JNR's 3-ft 6-in gauge electric railcar fleet which is limited to 120 km/h. As a result of a review of maintenance procedures for rolling stock and fixed equipment, the labor force now used to maintain 515 km will be redeployed in 1972 to cover the 165-km San-yo extension as well. Periodic inspection and maintenance routines are given and failures of electrical equipment over a five year period are itemized.

037792
DEVELOPMENT OF THE CONCRETE SLEEPER

Shrinivasan, M, Indian Railway Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Jan. 1968, pp 25-28, 3 Phot

The article discusses the unique advantages of concrete crossties as outlined by the French National Railways. There are three basic types of concrete crossties; reinforced concrete, prestressed concrete and special, which is defined as asbestos cement, longitudinal and zig-gag. Representative crossties within the categories are described and some are illustrated. The manufacture of these ties is described as well as experience with them on French, German, Swedish, Italian and Netherlands railroads.

037794
ULTRASONIC FLAW DETECTION TRAIN ON THE DB

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, No. 1, Jan. 1968, pp 29-32, 1 Fig, 2 Phot

The German Federal Railway utilizes a two car set of railway vehicles which make graphic recordings of rail flaws. These flaws are detected by an ultrasonic detector which records the type of flaw, the size, and its relative position in the rail. Oblique and transverse flaws are also detected by the system. The vehicles may be operated at a speed of 10 km/h upwards, with a speed of 40 km/h as normal.

037797
MULTI-PURPOSE TEST TRACK AIDS CZECH RESEARCH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Mar. 1970, pp 179-180, 1 Fig, 3 Phot

At Sokolec near Velim, the Traffic Research Institute (VUD) of Prague has built an oval test track 13.3 km long. This is the only such standard-gauge testing circuit in Europe, although there has been one of 1,524-mm gauge near Moscow for many years. This installation is of a very comprehensive nature to permit tests of many different kinds. The test track is an oval of single track with two semi-circular ends of 1,400 m radius connected by transition curves to two straight sides, each 2 km long. There are two level stretches, one nearly 8 km in length and one just over 2-1/4 km, joined by 1-1/4 km of 0.2 percent gradient and just over 1-3/4 km at 0.14 percent. With a superelevation of 150 mm, the line is suitable for speeds up to 200 km/h and the permanent way is such that axleloads of 25 tons are permissible. If required for tests of either track or vehicles, known irregularities can be introduced into the track in either top line or cross-level. There is only one turnout which is run through trailing if the train is circulating clockwise and facing if anticlockwise. The line is electrified on the overhead system. The overhead is a simple catenary with stitch wires at the supports, and is composed of a copper contact wire. The biggest advantage of trails on the test circuit, as compared with similar tests on the main line, is that long-term endurance trials can be carried out much more quickly. This is particularly true of Czechoslovakian conditions, largely because of the very intense traffic on the CSD.

037803
BALLAST COMPACTOR

Railway Gazette International (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Aug. 1971, p 325, 1 Phot

The windhoff ballast compactor has been designed to follow immediately behind a tamping machine, reprofiling and compacting the ballast to its previous standards. It is self-propelled and has 10 vibratory compacting arms. Eight of these are mounted vertically, two on each side of each rail, while the remaining two are larger side-mounted units for compacting the ballast shoulders. Shoulder compactors are adjustable to suit the cross-section of the ballast, and the static pressure, frequency and intensity of vibration, as well as its duration, can all be regulated to obtain optimum results.

037812
PERMANENT WAY CONSTRUCTION AND PROCEDURE STANDARDS ON THE FRENCH NATIONAL RAILWAYS

Nagel, H

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 13, No. 10, Oct. 1965, pp 449-460, 15 Fig, 5 Tab, 12 Phot, 1 Ref

The author details the standards of track construction and track maintenance procedures on the French National Railways. Prescribed superelevations are given, together with the transitions. The shape and form of the standard cross-section of the ballast are shown on a drawing. The tracks are grouped in classes as to usage and load, ranging from IA, IB, II, IIA, IIIB, to IV. Many other details are given relating to rail fastenings, rail joint bars (6 hole), concrete ties, and expansion joints in the rails. Altogether, this is a comprehensive presentation of the French track standards.

037817
ELASTIC RAIL SPIKE DEVELOPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Apr. 1967, pp 255-257, 5 Fig, 3 Phot

The development of a simple and economical fastening for use with flat-bottom rail resulted in development of the elastic rail spike. This provided a simple and economical fastening for use with flat-bottom rail on wood sleepers. The lockspike baseplate fastening, which is an alternative to the elastic rail spike, is a simple one-piece spring spike designed specifically to secure baseplates to wood sleepers. It fills the hole in the baseplate by spring action in a lateral direction, and holds the track gauge secure with the baseplate fixed firmly to the sleeper. For high speed track it is evident that an indirect rail fastening is desirable. A large number of designs have been developed and tried on many railways in an attempt to obtain the ideal independent rail fastening. The need to reduce track maintenance led to the development of spring clip. The Pandrol fastening, which is designed for reduced track maintenance, provides an adequate toe load on the rail, and this toe load is the result of considerable deflection which is more than adequate to absorb normal manufacturing tolerances and small wear which could occur in service. The Pandrol rail fastening is also ideally suited for use with steel sleepers. This assembly is one of the most economic methods of securing a rail to a steel sleeper and at the same time providing adequate resilience and freedom from maintenance problems.

037820
WELDING JOINTS FOR HIGH-MANGANESE CROSSINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, July 1967, pp 510-511, 4 Phot

The efforts by the Budapest Research Institute for the steel industry to develop a technique for welding Hadfields steel to ordinary rail steel so as to enable these fishplated joints to be eliminated have been successful, and patent rights have been taken out. The process developed by Kalman and Kisfaludy enables welding to be carried out without allotropic conversions taking place, and the two types of steel can be welded without difficulty. Joints welded in this way have been submitted to a mechanical bending-rupture test with 1-m separation of the supports. The joints withstood the specified 15 mm buckling with cracks. These joints have already been in service without a failure for over a year.

037827
FLANGE AND RAIL LUBRICATION

Fujinawa, I, Kinki Nippon Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Dec. 1967, pp 899-902, 10 Fig, 1 Tab

The Japanese National Railways has experimented with systems to reduce wheel and rail wear. Results of tests show that rail oiling reduces electric current consumption by 66%, reduces wheel wear to 1.25%, and reduces rail wear to 1%, compared with dry rail. Three systems have been suggested for lubricating the rails: site lubrication where it is picked up by the flange; flange lubrication in the vehicle; and automatic lubrication of the inside rail edge. A comparison of various devices to accomplish lubrication is included as well as a description of each system. Benefits of lubrication for different situations are included in a series of tables and charts.

037832
STRESSES BENEATH A RAILWAY TRACK

Heath, DL, British Railways
Cottram, M, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Dec. 1966, pp 1001-7, 13 Fig, 1 Tab, 4 Phot, 6 Ref

By physically testing track structure the British Railways attempted to confirm the validity of theoretical stress calculations. Those stresses studied were located beneath the track, between the sleeper and ballast, and within the track formation proper. Results show blanket material does not influence stress level. They found agreement between measured and theoretical results. There is a greater degree of reversing shear in the formation than in the blanket layer.

037833
SIMPLE STABLE RAIL FASTENING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Dec. 1966, pp 968-71, 2 Phot

The Springlock fastening, designed and patented for use with pre—or post-stressed concrete cross ties and long welded rails, comprises a steel stirrup cast into the sleeper body, a spring-steel vee-clip, an insulator and a heel block. The last two items are precision-injection mouldings in thermo-setting plastic materials. The stirrup is an accurate pressing made in Corten steel to resist corrosion, and the vee-clip is hardened and tempered to ensure a constant and consistent grip loading. Insulators are positioned on the rail feet, the vee-clip is slipped in beneath the stirrup by hand, the heel of the clip is then raised and lowered on to the heel block. The whole procedure is quick, no further adjustments are needed.

037834
SYNTHETIC RESIN BONDING

Perrett, ME, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Nov. 1966, pp 861-65, 14 Phot

Solventless adhesives do not require heat or pressure to provide sound joints, and therefore, have proved useful in railway engineering for they are amenable to site application. Two types of adhesive in particular have permitted these advances: polyesters and epoxides. A sleeper which has been made good with epoxide resin mortar is illustrated. Repair of E4 concrete sleepers under chaired track is carried out by displacing the sleeper and drilling holes, so that fastenings may be made good by using a polyester resin to secure rubber inserts in the concrete. Resins have been used to repair manganese steel crossings. Limitations on the use of adhesives for fixing chairs and baseplates to concrete sleepers appeared to be the difficulty of surface preparation of the metal, large glue line thickness, and low resistance to impact and peeling forces of the adhesives used. Cable hangers have been attached to a tunnel wall using an epoxide adhesive.

037836
ANCHORING BALLAST BY CEMENT GROUTING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Sept. 1966, p 694, 1 Phot

Cement injection has prevented the scouring of ballast by high seas at Dawlish, England. The grout used consisted of four parts of pulverised fuel to one part of cement. All points were driven vertically except those nearest the sea, which were at 58 deg to the vertical. The grout was injected until breakout occurred. Experience showed that some points could be dispensed with because grout from the others covered the whole area satisfactorily.

037837
CONCRETE SLEEPER TO RESIST THE EFFECTS OF FROST

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Oct. 1966, p 789, 1 Fig

Serious frost heaving is a menace which is encountered frequently in Japan. The pre-requisites of a prestressed sleeper to be used in such winter climates are that it must resist the distructive action of frost, and the metal and rubber parts of its fastenings must not become brittle or deteriorate at low temperatures. To ensure this resistance, air-entrained concrete should be used and its surface must have no holes, hollows or depressions, however slight, in which water can lodge. Rough edges and corners where deterioration in the concrete begins must be avoided, and the whole must be of fine concrete and quite smooth. The design of both sleeper and fastenings must be such that they will resist abnormal rail-loading and ballast reaction during frost-heaving and subsequent thawing. A special sleeper, Type 3F, was prepared for a series of tests in mid-winter in Japan. This prestressed sleeper contains 20 pairs of 2.9 mm diameter prestressing wires. Stresses were recorded during the most severe season of frost heaving. The expected centre-binding of the sleepers did not take place during the frost-heaving; instead many sleepers were supported under the ends as beams. In the cross-sections of the sleepers under the rails the measured values of the resisting moments were below the design values during both frost-heaving and the following thaw. Further testing is considered necessary before these sleepers are accepted as a standard.

037845
RAILWAY SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 119, Nov. 1963, pp 486-89, 2 Fig, 6 Phot

The unique qualities of wooden, concrete and steel crossties are described and their application throughout the world noted. Those cross ties which are being tested for future utilization are indicated.

037846
LONDON TRANSPORT RAIL DE-STRESSER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 119, Nov. 1963, pp 519-20, 2 Phot

A new device was designed for de-stressing long-welded rail after any disturbance to them in cold weather. The machine, a rail-heating trolley is so geared that it is easily propelled along the track by one man at the low operating speed required—about 2 mile/h. At each corner of the trolley is carried a 100-lb bottle of propane, and from these, flexible hoses run to the rail heaters. The equipment is designed for use on the open sections of line. De-stressing is not necessary in tunnels as the temperature remains almost constant throughout the year. On open lines, rails are de-stressed after they are installed, and it is only necessary then to de-stress them again when they have been disturbed for changing a block-joint or resleepering outside the mid-range temperature.

037849
STRADDLE VEHICLE FOR LAYING LONG-WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 119, Oct. 1963, p 438, 1 Phot

A machine was developed for unloading and laying long-welded rail. Straddling the sleepers, this device is a self-propelled unit having a steel underframe and deck mounted on four large pneumatic-tire wheels. It is powered by a diesel engine.

037850
CROSS-SECTIONS BY PHOTOGRAMMETRY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, June 1963, p 723, 1 Phot

When exceptional loads have to be conveyed by rail, measurements must be made along the route to determine by how much the normal loading gauge may be infringed. The Swiss Federal Railways has devised a method based on stereoscopic photography and has built a special measuring vehicle that houses the appropriate equipment. Stereo photographs coupled with a special viewing attachment permit the recording of continuous profiles as a cross-sectional diagram. The vehicle is equipped with a dark room to provide immediate on site inspection of exposures. An electric tractor is used to take the vehicle to site and also provides a 220V supply for the spotlight, heating, and charging of the car-lighting batteries. In transit speeds up to 56 mph are permitted. While operating, the speed is limited to 18 mph.

037852
RAIL CURVE CALCULATOR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 117, Oct. 1962, p 487, 1 Phot

The Matisa Multi-Station Curve Calculator functions according to the simple three point principle of curve correction. By using the calculator, an alignment may be set up in the form of a versine diagram and modified or corrected at will without calculation or possibility of error. The slews necessary for the realignment are automatically registered at each point. The unit has 30 indicators with which to set up the versine diagram, on graduated scales of 250-mm length. The operator can couple together two or more calculator units, and thereby use 60 or more versine stations, according to the length of the alignment. The unit can be supplied with a tracing equipment, which makes it possible to trace a record on paper of the original versine diagrams, the corrected diagram, the slews and any other desired information; for example, a cant diagram.

037854
WEAR AND CORROSION OF RAILS

Dearden, J, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Jan. 1965, pp 518-521, 3 Fig, 2 Tab, 1 Phot, 13 Ref

The use of the Shaw Rail Contourograph to measure vertical wear is described and illustrated. The wide limits of specific rail wear on the British Railways and London Transport are shown as a result of corrosive influence of atmospheric pollution in tunnels and industrial areas. Annual wear is approximately proportional to the square root of the number of axles passing per annum. A comparison between the British and American rail wear values shows much lower values in America for specific wear at the same traffic intensity. This may be partly because of the higher carbon content in America where the relative humidity is above 80 percent for much fewer hours per annum, and atmospheric pollution from industry is less concentrated than in Britain. The effects of steel composition, axleload and braking on rail wear are discussed.

037855
TRACK REPAIRS USING EPOXY RESIN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Jan. 1965, p 68, 2 Phot

The water and cleaning chemicals at the railway car washing plant deteriorated the precast concrete pot cross ties. Rather than imbedding the new concrete cross ties in mortar, epoxy resin mixed with a special sand was used. Although much more expensive, the epoxy-sand mixture is unaffected by the cleaning solutions used thus, it should prolong the track life.

037858
V-CLIP RAIL FASTENING FOR CONCRETE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Mar. 1965, p 245, 2 Phot

This fastener was developed for S.H.C.-type concrete sleepers, in hope of achieving a larger working deflection than the standard S.H.C. rail-fastening. Whereas the rectangular clip has a thickness of 0.225 in. the V-clip is 0.196-in. thick, to provide a toe-deflection of 0.420 in. with a minimum toe-load of 3.4 ton. The toe-load and deflection of the rectangular clip were 0.90 tons and 0.30 in. so that the improvement effected by using the V-clip made the effect of rail, sleeper, and hoop tolerances much less significant. The V-clip is less expensive to manufacture than the standard clip and laboratory and track tests confirmed the technical advantages of the V-clip.

037859
REPEATED LOAD TESTS ON RAIL-SLEEPER ASSEMBLIES

Loach, JC, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Apr. 1965, p 274, 1 Fig, 1 Phot, 1 Ref

The rig incorporates one hydraulic jack capable of imposing repeated loads in one direction only, the jack being connected to a pulsator. Because the jack must always exert some load, it has been necessary to resort to pre-loaded springs to provide an upward force counteracting the minimum exerted by the jack; these springs also provide the upward force equivalent to that normally due to the precession wave between the applications of the downward loads. The arrangement is illustrated. The pulsator gives 250 loadings per minute. Effects of corrosion are not simulated. The test-rig has been working for only a few months but it has indicated weaknesses in rail-sleeper assemblies very like those occasionally found in service, even though, sometimes, the service conditions have not, nominally, been nearly as severe as those simulated in the tests.

037862
ASBESTOS-CEMENT SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Apr. 1965, p 289, 1 Tab, 2 Phot

These Italian cross ties are manufactured by compressing a number of asbestos-cement sheets, interspersed with steel rods at very high perssure. The compression, flexure, and shearing strengths are given. Because of the material's intrinsic elasticity, a smooth ride results due to the reduction of rail hammer and hunting. Springs clips with rubber seating cushions and securing bolts with mushroom heads are used as the fasteners. The cross ties have operated satisfactorily under extreme climatic conditions and under heavy traffic.

037863
MEASURED SHOVEL PACKING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 70, Feb. 1939, pp 180-182, 5 Phot

The packing of the track by the L.M.S.R. method of shovel packing is accomplished in three stages. First, low places on the rail are measured by means of sighting boards; secondly, the depth of any voids there may be between the underside of the sleepers and the ballast when the track is unloaded is recorded on a series of Abtus voidmeters; and thirdly, the requisite amount of chippings, determined by the two measurements, is spread under the sleepers. These stages are described in detail and photographers show the use of the sighting board, voidmeters installed on the track, and the spreading of clippings under the sleepers.

037864
TRANSITION CURVES

Reddington, CG

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 75, July 1941, pp 55-56, 1 Fig

A monogram for readily finding the cant required on the arc and the length of transition for specified conditions is illustrated and the mathematical proof is shown. This method is an improvement over a prior method in which cant was dependent only on speed and radius of curvature. This earlier method did not account for the relationship between speed and rate of curvature, which exists as a governing factor in the maximum permissible speed. The monogram is simple enough to use that it can be used for designing and setting out of transition curves on the site.

037865
PACKING BALLAST UNDER THE RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Sept. 1939, p 373, 1 Fig, 1 Phot

The ballast packing machine illustrated, designed by August Scheuchzer, is claimed to permit even packing without crushing the stones. It is carried on a four-wheel frame and is operated by a 45 h.p. petrol motor, with a four-speed gearbox providing forward and reverse speeds varying from 4 to 28 m.p.h. The packing device is a pair of vibrating tool frames, which is illustrated. The tool is automatic, and depends on the amount of resistance of the packed ballast to release the packing mechanism of the tool.

037867
CURVE REDUCTION ON ROUTE OF SUPER CHIEF

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Aug. 1939, p 208

By extensive realignment works, hundreds of speed restrictions have been eliminated on the 2,227-mile main line of the Santa Fe Railroad between Chicago and Los Angeles. Isolated curves, rather than curves forming a series, were removed to eliminate the speed restrictions placed on a very limited stretch of track necessitating appreciable deceleration below that allowed beyond both ends of the curve. The costs of removing single curves were also modest in comparison to removing curves in a series. In two years, 479-track curves were removed, 228 by realignment and 251 by slewing. The realignments eliminated 3626 degrees of curvature and 325 miles of track length.

037868
RAIL-WELDING IN SOUTH AFRICA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Aug. 1939, p 205

The first of six flash-butt rail welding depots on the South African Railway is in operation and the method of producing 120 ft. welded rails is briefly described. The Thermit or Boutet process is used for welding. Existing rolling stock has been converted to insure safe transport of the rails to the point of use. An unloading system is used whereby the rails are unloaded from the converted bogie vehicle as they are being laid on the track.

037869
LONG WELDED RAILS

Cantrell, AH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, July 1939, pp 101-103, 2 Phot

The experiments conducted using welded rails in Great Britain and the U.S. are reviewed. The expansion and contraction of the long rails caused by temperature changes are discussed. Ballasting and sleeper spacing techniques are important in developing a strong support against the expansion and compressive stresses created in the rails. Photographs of welded rails at Southern Railway installations are shown.

037870
IMPROVISED SLEEPERS IN WARTIME

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, Mar. 1942, pp 230-232, 6 Fig, 1 Phot

Methods used in the U.S., England, and Australia to prolong the life of wooden sleepers are described and illustrated. The sleeper should be fitted with an anti-split device, such as an S-clamp, frame clamp, through bolt, wooden screw, or band-strip. To repair spike-killing damage a Metospir, a hard-wood plug, or a plastic filled plug is suggested. Strengthening of the sleeper at a location of the chair is accomplished by saddling, or by inserting a steel plate between the chair and sleeper. The formation of compound sleepers for use on siding is described.

037871
SEVEN YEARS OF CONTINUOUS WELDED RAIL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, Jan. 1942, 3 pp, 3 Tab, 1 Phot

The Delaware and Hudson has installed 10,984 butt-welded joints in 12 locations comprising 446,024 feet of rail. The longest continuous stretch of rail is 7018 feet. Of the welded joints, there have been only 29 failures, a failure rate of 0.26 percent; 25 failures occurred in thermit welds and four in flash welds. The causes of failure are itemized. Comparative maintenance costs between the welded rail and jointed rail for two locations are presented in tabular form. The man-hours expended per annum per mile were 19.75 and 25.71 for welded and jointed track, respectively, for the Port Henry, N.Y., installation.

037872
RECENT PROGRESS IN RAIL FISSURE DETECTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 75, Aug. 1941, pp 216-17

The experience with Sperry detector cars during 10 years of service in the U.S. is reported. Changes in the design of the car to increase sensitivity and reliability are reported. The rails are pre-energized by a magnetic flux, followed by the magnetic flux from the search unit. The searching unit has four-coils which are staggered rather than in line. The Type 80 modification is described which contains special amplifiers and recording pens to differentiate defects of certain types. During 5 years of experience 40 percent of the defects detected were transverse or compound fissures, 40 percent were vertical split heads, 15 percent were horizontal split heads, and 5 percent were miscellaneous defects. Five hundred miles of fissure-containing rails have been removed during the last 10 years after detection with Sperry detector cars.

037873
CONCRETE SLEEPERS ON THE G.W.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 75, Nov. 1941, p 504, 1 Fig, 1 Phot

The limited experience of the Great Western Railway with pot type concrete sleepers is reported. The pot type is less than half the weight of the transverse pattern and requires less reinforcement. The pot sleeper weighs 246 lb when chaired and contains 5.75 lb of reinforcement. The design of the pot sleeper is illustrated. Thus far no abnormal maintenance has been required on the track laid on pot sleepers.

037874
A NEW RAIL JOINT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, June 1942, pp 632-33, 4 Fig, 1 Phot

The ends of the two rails to be joined are recessed on the outside for the reception of an angle bridging piece of rail quality steel which forms the outer fishplate, and a standard fishplate is used on the inner side. A cast-iron base plate takes the bearing of the rails and the angle fishplate bearing directly on to the bedplate, assisted by the inner fishplate and the base plate itself. As these three elements develop the full strength of the rail across the space between the joint sleepers there is practically no deflection of the rail ends, and noise and pounding of the joint sleepers are eliminated. The iron bedplate is secured to the sleepers by means of through bolts. The elevation, plan, and section of the rail joint are illustrated. The joints have operated satisfactorily under heavy and fast traffic on the Southern Railway.

037875
THE BOUTET RAIL-WELDING PROCESS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, Feb. 1942, p 266

The Boutet method of thermit welding appears to have overcome the objection to the older thermit welding, that the high temperatures involved tend to produce brittleness in the finished weld. It provides a reliable weld at a relatively small cost, either in situ, by means of portable apparatus, or at a rail depot. On the Southern Railway, with a gang of twelve men it was possible to make ten to twelve welds a day. The welding operation is in three stages—preheating, welding, and post-heating.

037878
RECLAIMING MANGANESE STEEL TRACKWORK BY WELDING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, July 1942, pp 57-58

Cast manganese alloy steel is used for trackwork in the U.S. because of the prevalence of railway level crossings. The manganese alloy steel is subject to an exceptional degree of work hardening. Prior to welding the worn rail, the work-hardened layer should be removed by griding to a depth of at least 0.25 in. Nickel-manganese electrodes, carefully selected for diameter and amperage, are used for welding. The metal is deposited in two or more layers to protect the rail from absorbing the extreme heat generated by the welding process. The welded area must be ground down to a straight and level surface, to avoid high spots which work-harden so rapidly under load that permanent stresses result.

037879
RAILWAY ENGINEERING AND RADIOGRAPHY

Knights, ED

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, Oct. 1942, pp 348-50, 1 Fig, 12 Phot

When X-rays penetrate a substance opaque to visible light they are partly transmitted, partly absorbed, and partly reflected or scattered, the amount of each depends on the substance and its thickness. Substances of high density and atomic weight usually absorb X-rays to a much greater extent than those of light weight, for the latter tend to scatter the rays rather than absorb them. An outline arrangement for taking a radiograph is shown. In welds, unsoundness of the weld metal, imperfect penetration of the weld head and cracks in both bead and parent plate may be sought for. In castings, any such defects as porosity, draws and hot tears are likely to be revealed. Radiographs are shown of various welded and cast specimens.

037880
RECENT AMERICAN STEEL RAIL DEVELOPMENTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, Oct. 1942, p 370-71

The practice of taking impression tests on rail-heads, with a hardened steel ball under an applied load of 100,000 lb., is being abandoned. The controlled cooling and Brunorizing processes used on rails to eliminate shatter-cracking are described. The steps being taken to detect longitudinal fissures, which result in split webs and split heads, are described. The detection methods still fail to detect some transverse fissuring. Other causes of rail failure include engine burn fracture, piping, enclosed gas pockets, and rolling overlaps. Rail-ends are being flame-hardened or quench-hardened to arrest battering of rail-ends under extremely severe load, speed, and traffic conditions.

037881
BRITISH RAILWAYS TO STANDARDISE F.B. RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, Feb. 1949, p 115

The conversion of the British Railways, excluding the London Transport railways, to 109-lb flat-bottom rail for main lines and heavily travelled secondary lines and high speed lines and 98-lb flat-bottom rail for lightly travelled lines is discussed. The conversion from bull-head rail for 22,000 track miles is projected to take 40-50 years. The 109-lb rail will be 4 percent heavier than the 95-lb bull-head rail per track mile. Cost savings are expected due to increased life, reduced maintenance and fewer components, such as fasteners, needed when compared to the bull-head rails.

037882
THE NEW STANDARD BRITISH RAIL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, Feb. 1949, pp 124-25, 3 Fig, 4 Tab

The British Railways, excluding the London Transport lines, has adopted as standard the flat-bottom rail instead of the traditional bull-head type. Diagrams are given of 113-lb, 109-lb, and 98-lb flat-bottom rails. The 109-lb rail will be used on main-lines and others carrying intensive traffic at high speeds. It will replace the 95-lb bull-head rails. The 98-lb flat bottom rail supersedes the 85-lb bull-head rail for secondary lines. The new rails will be much stronger both vertically and laterally than the bull-head types they are replacing and will keep better alignment. Comparisons of the properties of the 109 lb and 98-lb flat-bottom, rails are made with the bull-head rails they will replace.

037883
EXPANSION IN LONG RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, Feb. 1949, p 144

Experiments have been conducted on rails up to 1 mile long. These rails are fixed by means of the resistance of the fishplates, sleeper fastenings, and sleepers themselves embedded in the ballast; thus, for a 75 degrees F temperature variation above and below the temperature at which the rail was laid, a total force of about 61.3 tons (137,800 lb) is brought into play for a 96-lb rail, and the tendency to push the rail ends away from the center of the rail is resisted, and contained within the rail in the form of compressive stress (or with the tendency to contraction, tensile stress). The prevention of a rail from expanding or contracting causes an internal stress of 195 lb per sq. in. for each 1 degree F change in temperature. To minimize these high internal stresses, it is customary to lay long rails at the mean average annual temperature, and thus reduce the tendency of the rail to buckle, if the fastenings should become weakened. One of the great difficulties with long rails, apart from the practical limitations provided by transport, is that the opening up of the track can be done only at approximately the same temperature as that at which the rail was laid. The London Transport railways has used sliding expansion joints at the ends of the long sections. this expansion joint enables the keys to be knocked out, and any tendency toward expansion or contraction which may be imprisoned in the rail can exhaust itself at each end before further operations are begun.

037886
FORMATION STRENGTHENING ON THE BOURNEMOUTH LINE, SOUTHERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Aug. 1949, pp 240-41, 2 Fig, 2 Phot

Extensive blanketing work was undertaken to stabilize the roadbed. Most of the worst trouble was experienced in the neighborhood of certain of the bridges over cuttings where lifting of the track to provide a greater depth of ballast over the soft formation has been impossible. Rather than raise the bridges, which are mostly brick arches in good condition, it was decided to dig out the weak formation materials. In 1948 and 1949 nearly a mile of double track was treated in this way, and in addition, extensive drainage work was undertaken to collect the water flowing into the cuttings. All of this work was highly mechanized and one of the characteristics was the small amount of labor required. A diagram of a four-mile section between Brockenhurst and New Milton shows the location of blanketing works.

037889
LONG WELDED RAILS IN THE CASCADE TUNNEL, U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Nov. 1949, pp 551-52

The long welded rails were used in the recent renewal of four miles of track in the Cascade Tunnel. The tunnel, which is 7 miles 1,397 yd. long carries the main line of the Great Northern Railway from St. Paul to the Pacific coast through the Cascade Mountains. The railway was laid with 110-lb rails, rolled to the standard American length of 1,326 feet de-stressed by heat treatment, tested magnetically for flaws, cleaned, and given a coat of anti-corrosive paint. The new rails are secured by four cut spikes in every baseplate. The rails are anchored by 48 grip-type anchors in each 39-foot panel. To provide anchorage in both directions, these are applied in pairs for each rail against both faces of alternate sleepers. Insulated joints are inserted in the track at intervals of one mile.

037891
A DIESEL-ELECTRIC TRACK SWEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Dec. 1949, pp 680-81, 3 Phot

To remove cinders and wagon spillings from the track, a combined diesel-electric scarifer, sweeper, and conveyor machine is now in service on the Pennsylvania Railroad. The scarifier consists of 18 curved strips of spring steel each having a detachable digging tooth. Ten of the prongs rake between the rails and the other eight outside the rails. The sweeper is a rotating broom comprising a metal shaft with a number of arms or brackets to which are bolted steel segments forming a closed cylinder. The train travels about 2 mph and the broom rotates at 100 rpm. Refuse is removed to a level just above the sleepers and is thrown onto a series of three conveyors, which deposit the sweepings into a series of hoppers. Photographs show the sweeper train and the sweeping equipment.

037892
IMPROVEMENT OF TRACK FORMATION

Toms, AH, British Railways
Beatty, WF, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Dec. 1949, p 697

The problems involved in maintaining a satisfactory track on unstable formations, and the remedial measures adopted are considered. In recent years, it has become the practice to remove all overstressed and disturbed materials with the best load spreading properties. The biggest range of problems arises on formation renewal work of the blanketing type. Considerable success has been claimed in America for pressure grouting and driving a pointed "spud" at close spacing into the formation, and filling the holes with sand. In France and in Denmark, blanketing with sand has proved satisfactory. On the Netherlands Railways, fine sand or ashes are used for blanketing clay formations. In Sweden, weak tracks have been strengthened with a continuous mattress of logs laid transversely under the ballast on a blanket of fir tree branches or a layer of fascines. On the Norwegian railways, dried peat has been used as a precaution against frost-heave.

037893
TRACK STABILIZATION AT WADDESDON, EASTERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Dec. 1949, pp 704-05, 3 Fig, 1 Phot

Sand piling was adopted as part of the treatment of soft clay formation in a shallow cutting. The operation consists of driving a 9 in. dia. steel spud into the formation between and at the ends of the sleepers, withdrawing on reaching a specified depth and finally filling the hole with sand. A pattern of four piles every sleeper was found to be satisfactory. The track, as was expected, heaved as the piles were driven, the average heave being 2 inches. the rock layer was encountered at depths varying from 3 feet to 5 feet and was missing altogether in plaçes. The drainage is being renewed; precast concrete channel drains are being used.

037900
GAUGE AND CROSS-LEVEL TRACK RECORDER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 93, July 1950, p 15, 3 Phot

The recorder, known as the Gauge Master P.11 consists of a 3-wheel chassis on to which are built the various instruments used for measuring and recording rail track dimensions and superelevation as it is propelled along the track. All measurements are graphically recorded on a registering strip and actual measurements can be read off as they are recorded. The instrument is provided with a driving stick for propelling purposes, the single operator walking beside the instrument, a warning bell fitted to the recorder rings when the instrument is passing over a portion of the track where gauge tolerances have been exceeded.

037902
NORWEGIAN RAIL-SPREADING AND LIFTING EQUIPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 93, Oct. 1950, pp 399-400, 3 Phot

A series of detachable rollers, partly arranged as a vertical S-curved ramp, and fitted to a flat-wagon train are utilized for rapid rail spreading and lifting. A typical standard-gauge train to which the equipment has been fitted consists of an engine followed by a safety wagon, 21 flat wagons, a brake wagon and a control wagon. A description of the use of the equipment and the rails to be laid is given.

037903
PERMANENT WAY ON CONTINENTAL SECONDARY RAILWAYS

Ripert, L, French Light Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 93, Nov. 1950, p 429

A summary is given for replies received from 31 administrations, to whom a questionnaire was circulated by the International Railway Congress Association. The report covers both lines worked by secondary railway companies and the secondary lines of main-line railway systems. Large and small gang maintenance categories are examined and their characteristics discussed. Maintenance cycles and their structure and methodologies are discussed. The article concludes that long-distance gangs, being better organized, supervised and checked, definitely improve the quality of the work and facilitate supervision by the district officer.

037904
OVERHEAD LINE EQUIPMENT INSPECTION VEHICLE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 93, Dec. 1950, pp 489-92, 4 Fig, 4 Phot

A diesel-driven vehicle for overhead line inspection is described. Of steel construction, the interior provides space for eight men and necessary working equipment. Drive is from either end with speed options of 1.5, 5.6, 9.8, 14.8, and 23.1 mph. A hydraulically operated tower is housed in a well in the vehicle body. Windows are set at 45 degrees to permit inspection from inside the vehicle. Accessory lighting is provided by two separate battery-operated 24 volt circuits.

037906
THE WOODEN SLEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, Feb. 1947, p 152

The position of the wooden sleeper is reviewed in relation to concrete and steel ones. Emphasis is on usage and economic considerations as they exist in 1947.

037907
LONG WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, Feb. 1947, pp 180-81

The item gives an historical and an evolutionary account of the development of long welded rails. Mention is made of the practice in the U.K., U.S.A., Germany and elsewhere. The use of welded rails has proven technically sound and comparative maintenance labor costs between continuously-welded rail and fishplated rail show savings in lining and surfacing ranging from 31 to 46 percent, and in gauging of from 33 to 39 percent.

037908
RECLAMATION OF WORN PARTS BY METALLISING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, Mar. 1947, p 307, 4 Phot

Metallising is suitable both for the reclamation of worn parts and for the application of a protective metal coating. In this very brief article, a worn shaft is used as an example. The deposition of the metal is carried out by means of a metallising gun, in which the metal is fed in the form of wire into the tip of an oxy-acetylene flame which melts it, and an air blast atomises and projects the molten metal at high velocity on to the rotating shaft. The spraying is done first at an angle of 45 deg. in order to fill the under-cuts of the grooves, and completed at 90 deg. The final operation is the finishing of the sprayed surface by turning or grinding.

037909
TRACK DEFECTS REVEALED BY MAGNETIC TESTS

McBrian, R, Denver and Rio Grande Western Railroad

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, May 1947, p 502

Notes are given on experience gained on the Denver and Rio Grande Western Railroad in the Magnaflux method of inspecting rails, fishplates, welded joints, track tools, and chains.

037912
TYPES OF SLEEPERS AND SLEEPER MAINTENANCE

Train, JCL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, June 1947, p 615

Wood, steel, and concrete sleepers are compared based on experience to date with each type. No alternative has been found to the cross-tie or sleeper and timber was almost universally preferred at the time. Steel sleepers begin to fail from corrosion followed by cracks around the baseplate. Concrete sleepers may fail through cracking with ultimate exposure of the reinforcement. On an annual cost basis concrete may prove to be the cheapest sleeper–but this opinion is based on an estimated 50 year life for pre-stressed sleepers and experience is insufficient to justify the estimate. Preservation of wood sleepers is usualy by creosoting. The article concludes that treated timber sleepers with fastenings are approximate in cost to steel sleepers, with concrete sleepers costing more than either.

037913
LONG WELDED RAILS IN THE U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, July 1947, pp 10-11, 1 Tab

Experience to date with continuously-welded rail has revealed the following facts: (1) A sound practicable welded joint can be made. (2) Welded rail in long lengths can be transported and installed readily. (3) In the climate of that part of the U.S.A., welded rail should not be installed at a temperature under 60 degrees. (4) Welded track can be surfaced, lined, and otherwise worked without risk when done at a temperature equal to or less than that at which laid. (5) There are fewer failures in welded rail than in jointed rail. (6) Proper superelevation must be maintained on curves for the type of traffic handled to secure the maximum life of the rail on curves. (7) It is practicable to transpose welded rail on curves to increase rail life. (8) It appears that a less expensive fastening for welded rail is possible. (9) Difficulties experienced with continuously-welded rail can be eliminated by proper construction and maintenance. Considerable statistical data are included on costs and number of welds.

037914
PERMANENT WAY CROSSING BOLTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, July 1947, p 102, 3 Phot

In the assembly of permanent way crossings, the heads and nuts of the transverse bolts which hold the various parts together must tighten on varying angles of seating. Hitherto this has meant using a variety of taper washers to suit the different angles of crossings and bolt positions. To obviate the necessity for using so large a number of different types of washers, a universal washer consisting of two parts having spherical seats has been devised. This washer assembly incorporates the ball-and-socket principle, and the auxiliary washer maintains the bolt alignment irrespective of that of the main washer.

037916
L.M.S.R. PERMANENT WAY DEVELOPMENTS-3

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Aug. 1947, pp 181-182, 8 Phot

The L.M.S.R. is at present making use of welding for four main categories of trackwork, namely, re-conditioning worn and damaged switches and crossings; welding of rails into longer lengths; welding electric track components; and welding other track components, such as buffer stops, damaged rails, and wheel stops. For repairs on site portable oxy-acetylene equipment is used, and the welders usually work in pairs so that a lookout man protects both welders. The welding of water troughs into long lengths has also proved satisfactory.

037917
AN AUTOMATIC TAMPING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Aug. 1947, pp 211-213, 2 Fig, 7 Phot

This machine is Swiss made and takes the form of a 4-wheel rail trolley which can travel from the depot to the site under its own power at a speed of about 25 miles an hour. It draws a trailer consisting of a shunting or parking platform which can be set up near the site of the work and enables the machine to be pushed clear of the running line for the passage of traffic. An essential feature of the machine is the tamping mechanism, which is housed in a pair of vertically-reciprocating tool frames operated by compressed air. Each frame holds four pairs of opposed tools.

037918
BALLAST CLEANING

Protzeller, HW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Aug. 1947, pp 229-230

The cause and cleaning of dirty ballast are summarized. Information presented was extracted from a technical paper. It was found that if the ballast shoulders and the "cribs", or ballast between the sleepers—together comprising under 40 per cent of the total section—are cleaned, the work will be more than 60 per cent effective. In opening out the ballast preparatory to cleaning, care must be taken not to disturb the part under each sleeper and, in removing the shoulders and cribs, at least 1 in. or 1-1/2 in. should be left intact against the sleeper and the excavation sloped off thence at 1 to 1. Permanent way staff are warned against scooping 3 in. or 4 in. of ballast from under the ends of sleepers to remove the mud which tends to collect there to form compact dams round and under the sleeper-ends. Good ballast cleaning with modern plant will remove 85 to 90 per cent of the dirt.

037921
CREOSOTING SLEEPERS FOR TROPICAL RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Sept. 1947, p 325, 1 Phot

Early in 1943 it was decided to carry out tests to make wooden sleepers impervious to termites. These were first made in the research department of the Southern Railway in England. In addition, information on tropical woods in railway systems was supplied by the Sudan Railway. After nearly three years of trial, it was decided to erect a plant at Zungeru on the Nigerian Railway to treat hardwoods from the Southern Provinces. Timber are impregnated thoroughly with hot creosote under pressure by wheeling them into long cylinders, pulling a vacuum, and applying creosote at temperatures above the boiling point. The removal of the air from the wood cells of the sleepers makes easier the work of the pumps in forcing the creosote into the wood.

037923
BLANKETING OF TRACK, SOUTHERN RAILWAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Dec. 1947, pp 673-675, 5 Phot

Soft formations underlying roadbed layed on marsh ground fill were treated by excavation and backfilled with quarry waste. Followed consolidation of the material, ballast was spread and tamped, and the track replaced. Another method utilized precast concrete slabs emplaced between a 12 in. blacket of quarry waste and the ballast. Additional details are given on the two methods as employed at specific sites, and include information on the typical "soft formation" conditions encountered and test procedures prior to rebuilding the roadbeds.

037924
INSPECTION CARS AND GANG TROLLIES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Dec. 1947, 3 pp, 9 Phot

The wide range of motor inspection cars and gang trollies manufactured by D. Wickham and Co., Ltd., are described. Nine models are pictured. One out of four variations of the type 40, 6 to 9 person car is shown, as is the new type 30. Also shown are the flyweight, one-man trolley; the one-man, light-weight type 8B; the type 18A gang trolley; the heavy-duty type 18A; the 5-ton loader version of the type 18A; the covered version of the type 18A; and the medium-duty type 17A gang trolley. The power unit in each type of vehicle is described.

037925
SPEED ON CURVES ON THE L.N.E.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Dec. 1947, pp 692-693

The item comments upon early standards for alignment and superelevation of curved track and extracts from the text of Technical Booklet No. 11 "Speed on Curves." Portions of the extract include information related to the determination of the permissible rates of change of cant and diffusing, and their relation to the form and dimensions of the transition curve of the track. A portion of the booklet is devoted to the consideration of curves without transition, and formulae are developed which cover permissible speeds through crossover roads, double junctions, and reverse curves.

037927
ICE REMOVAL ON TYNESIDE ELECTRIFIED LINES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Feb. 1948, p 166, 1 Phot

Kilfrost No. 1 Railway Solution is applied by means of two specially-equipped vans which carry sufficient fluid to treat the whole of the 90 miles of electrified running lines at least once every trip. In operation, the van is attached to an engine and brake van and is restricted to a maximum speed of 15 mph but experience has proved that the ideal operating speed is about 10 mph. If it is found necessary to scrape the third rail before applying the fluid, this is done quite readily, as the van is equipped with scrapers, and so arranged that no matter in which direction the train is traveling, it is always possible to scrape the rail before applying the Kilfrost solution.

037928
SPRING-STEEL RAIL SPIKES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Feb. 1948, pp 191-192, 2 Fig, 4 Phot

The Macbeth spike is described and physical properties of the No. 2 and No. 3 spike are given. The spike has undergone exhaustive trials and has proved to be completely effective. The following advantages are claimed: 1. They are easily fitted with no other tool than a hammer. 2. They are easily extracted by use of a simple tool. 3. Having round legs driven into round holes, they do not split the timber as do square spikes. 4. The spacing of the legs avoids piercing the heart of the timber, thus preventing splitting. 5. The elastic spring grip on the rail is more than sufficient to provide, without constant attention, for wear of either the wood sleepers or the baseplate. 6. The grip anchoring rail to sleeper is greater than the creep resistance to be obtained from the ballast. 7. The grip of the two legs in the timber considerably exceeds that of a single-legged spike used in similar conditions. 8. The rail can be held to gauge, and the sleeper and rail held in permanent contact under all conditions by the same spike.

037929
PREVENTION AND DESTRUCTION OF WEEDS ON THE PERMANENT WAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Apr. 1948, p 453

A number of suggestions are advanced for clearing tracks of weeds that have gained a foothold in the ballast. The expedient of renewing the ballast has been tried on certain lengths, where perennial weeds have become particularly troublesome. This has not always had the desired effect as the new material appears to have acted as a fertilizer. Annual weeds, although not so deeply-rooted as many perennials, call for special attention, as they grow quickly. The grasses growing on embankments and the sides of cuttings can give serious trouble, if they are allowed to seed on to the ballast. This can be prevented by cutting the grass early in the summer, before the seeds have formed. A second cutting, in August or September, is advisable, to prevent late seeding. The disposal of old and dirty ballast has an important bearing on the problem of weed prevention. The introduction of weed-killing trains, fitted with chemical sprayers, has alleviated considerably the task of the maintenance gangs, but it is not always easy to find paths for these trains on lines that carry a heavy traffic.

037930
A REMEDY FOR LOOSE CHAIR SCREWS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Apr. 1948, p 466, 1 Fig, 2 Phot

A new coiled-strip device is described which enables sleepers with enlarged holes to be used within conventional plugging and reboring. The coil is approximately 15/16 in. dia. x 3-1/2 in. long x 1/32 in. thick, and weighs about 1/10 lb. It is formed mechanically from straight strip. The steel mandrel is 5/8 in. dia., and has a short length of screw thread terminating abruptly. The head is similar to that of an R.B.S. chair screw. Its effective length of 6-1/2 in. is such that the coil is placed about 1/2 in. below the top of the sleeper, if it is screwed down until the mandrel head touches the ferrule, which is assumed to project 1/4 in. from the chair boss when the mandrew is unscrewed, it disengages at once leaving the coil embodied in the sleeper. The replacement of the chair screw expands the coil slightly. The operation can be repeated, to place a second coil inside the first one. The coils are delivered to the site ready for use, and it is the work of a moment to fit them on a mandrew. The remainder of the operation consists only of inserting or withdrawing chair screws, which can be done by machine.

037937
AUTOMATIC BALLAST CLEANING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, May 1948, p 632, 1 Phot

An automatic ballast cleaning machine is described. This machine automatically removes and riddles deteriorated ballast from beneath and between the sleepers while it is moving along the track. The rate of progress when working varies with the depth of the ballast removed. The main body of the machine is in the form of a trolley about 18 ft. long, mounted on two four-wheel bogies. Most of the mechanism is on this trolley, including the diesel generator, the vibrating screen, and the means of disposing of the screenings and the cleaned ballast. It is claimed by the maker that with a team of eight men, this machine can deal with about 130 linear yards of track an hour.

037938
FLAT-BOTTOM TRACK

Lee, CE, Railway Gazette

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, June 1948, p 649

In a comprehensive review of the potentialities and development of flat-bottom track extensive reference was made to experiments on the L.M.S.R. and showed that compared with the 100-lb B.S. bull-head rail, the 110-lb. B.S. flat-bottom section had the advantage or 41 percent, increased strength in the vertical plane, and the wide foot (6 in.) gave considerably greater resistance to bending in the horizontal plane. Taking the standard 95-lb B.S. bull-head as a basis, the 100-lb. flat-bottom was 43 percent stronger in the vertical plane, the 113-lb 62 percent, and the former 131 lb. American section 85 percent stronger. Considered as a beam, the 113-lb. flat-bottom rail was 62 percent stronger and 88 percent stiffer than the B.S. 95-lb. rail. The 113-lb. flat-bottomed rail was approximately two and a half times as stiff laterally as the bull-head section, due to the bottom flange of 5-1/2 in. The B.S. 110-lb. flat-bottomed was even better in this respect and with its 6-in. base, was three times as stiff. The article concludes that a considerable period of experiment would be necessary before it became possible to translate into terms of an accurate financial comparison, the relative merits of full-head and flat-bottom track.

037940
THE RAIL CORROSION PROBLEM

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, July 1945, pp 3-4

Hitherto the problem of rail corrosion has found no completely satisfactory solution. Innumerable remedies have been tried, but most of them have proved to be no more than palliatives, effective over a limited period. Welding the rails into continuous lengths reduces the number of joints, and the number of fatigue failures also, but does nothing to reduce the corrosion. The Norfolk & Western Railway has made a new approach to this problem. A preservative coating used for the rails is Texas No. 45 oil, which contains 45 per cent of asphalt, and it is applied after the rails have been flame-cleaned with oxy-acetylene jets. It is in the flame-cleaning that the novelty lies, and the value of this treatment is that the steel surface is not merely cleaned, but is dehydrated also, and provision is thus made for a good bond between the oil coating and the rail. The flame-cleaning has been found more effective and cheaper than sand-blasting for the same purpose.

037941
TRACK INSPECTION ON THE L.N.E.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, July 1945, p 10, 2 Fig

A system of assessing numerically the condition of track is briefly described. Track is evaluated for 10 different characteristics and awarded a maximum of 100 points for each. A perfect score is 1000–average scores on the L.N.E.R range from 650 to 950. Uniformity of assessment is essential: to this end the judgment of individuals of considerable experience of the system was pooled and a small nucleus was formed which trained others, who again became apostles to spread over a widening field the level of uniform discrimination.

037942
TRACK AND ROADBED FOR HIGH-SPEED TRAINS

Johnson, RP, Baldwin Locomotive Works

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Aug. 1945, pp 113-114, 1 Ref

The article discusses the factors of roadbed and track as related to high speed operations, as well as the importance of maintenance for such operations. Track layout and the relationship of curves and superelevation are also discussed.

037943
CONTINUOUS RAIL WELDING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Aug. 1945, pp 142-143, 3 Phot

One of the most extensive examples of continuous rail welding yet laid was completed by the Elgin, Joliet & Eastern Railroad of the United States, between Joliet and Coynes, Illinois. The total length is 5-1/2 miles, and the longest individual rail is 3,503 ft. The principle interest in this installation lies in the fact that the rails were welded at a depot, then moved in continuous strings up to 1,750 ft. long, to the sites at which they were to be laid in. The rails were of the 131 lb. per yd. flat-bottom section, in 39-ft. lengths, and 1,156 tons were required for the work. Butt-welding by the oxy-acetylene process was the method used. The total cost of the continuous rail was about $1,-150 a mile greater than that of the conventional type of track with 131 lb. rails 39 ft. long and bolted joints. A minimum saving in maintenance of $100 a mile should justify the investment. The absence of joints is expected to increase the life of rails, eleminate excessive wear of joint sleepers and the constant attention needed to packing at the joints.

037944
GROUTING SOFT SPOTS IN TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Nov. 1945, p 454, 2 Fig

The New York Central System improved its main lines by systematic pressure grouting between the ballast and the formation of soft places. The total cost in 1942 of grouting 31 soft spots was only $4,300. The next year the saving in maintenance at these points amounted to more than $13,000–thus both repaying the original investment and gaining more than 200 percent profit in a single year. The cost is now averaging about $1.50 per ft. of track. No speed reduction is found to be necessary over the affected track while the grouting is in progress.

037945
COMPARATIVE STRESSES IN VERTICAL AND CANTED RAILS

Inglis, RA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Nov. 1945, pp 480-482, 4 Fig

An analysis and comparison is made of the stresses in rails laid either vertically or canted at the usual angle of 1 in 20. The method employed is the usual graphical one for any horizontal girder subjected to purely transverse loading. The two general cases of rails in straight track or tangent and curved track will be considered independently.

037946
CONTROL OF LANDSLIDES WITH DRAINAGE TUNNELS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Dec. 1945, pp 614-615, 1 Fig, 1 Phot, 1 Ref

The most effective measures to control landslips take the form of drainage tunnels for intercepting and disposing of sub-surface streams or springs in the vicinity of sliding areas. Tunnels may be up to 2,000 ft. in length or they may be only 50 ft. Where sub-surface drainage is essential it can be effected by constructing intercepting subsoil drains in the form of corrugated-iron piping or earthenware pipes back-filled with crushed stone. Pipes can also be used to drain the slide itself. If, however, these measures are ineffective, either singly or together, drainage tunnels offer the most likely means of curing the disorder.

037949
THE PROBLEM OF THE TOP RAIL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Mar. 1945, pp 272-273

It is a matter of common knowledge that the least reliable part of any normal steel ingot is the top. Standard rail specifications require that the rail shall be free from all top-of-the-ingot defects, and though in principle this requirement is carried out, in actual practice the average top rail from the ingot is not 100 percent free from the influence of these defects, as the broken rail records of every railway show. Theoretically the top rail should be the equal in quality of the middle rail or the bottom rail; practically it is not always so. Things that can and cannot be done to insure sound top rails are reviewed. From the manufacturing point of view, additional precautions can be taken to assure sound top rails, but they add to manufacturing costs. One is to cast the ingot large end up and provide it with a head encased in a refractory lining, which keeps the top of the metal molten until the ingot proper has solidified. Another precaution is to cast a larger ingot, so that a greater percentage of crop may be removed from the top end.

037950
THE CAST-IRON PLATE SLEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Apr. 1946, pp 424-425

Some cast iron sleepers are designed for use with bull-head rails and have timber tie bars between the plates. Other types have steel tie bars. The principle of all the designs is that there are two castings integral with which are jaws to house the various types of rail. Tapered and split cotters passing through the tie bars lock them to the plates and also provide adjustment to gauge. Plate sleeper track has been shown by experience to have the advantage of long life.

037951
BRITISH METAL PLATE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Apr. 1946, pp 429-431, 1 Fig, 1 Phot

A description of six types of British-made cast-iron plate sleepers is presented and their advantages noted. Severe breaking tests on both the bull-head and flat-bottom standard-gauge plates have proved that each individual plate has a safety factor of at least 100 percent. These cast-iron sleepers will last 100 percent longer than their wooden counterparts. The complete sleeper can be made up, readily inserted in the track, and the rail positioned in the jaws and keyed up.

037955
MINISTRY OF TRANSPORT ACCIDENT REPORT

Langley, CA, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Aug. 1951, pp 190-192, 4 Fig, 1 Tab

This accident report describes an occurrence on September 2, 1950, near Mansfield, England, when a passenger train derailed on plain straight track. A derailment on plain track usually is due to (a) excessive speed, (b) defective locomotive, (c) defective track, (d) an obstruction, or a combination of two or more of these. There was no evidence to suggest that the train was travelling at high speed and no reason for the driver to do so. Examination of the engine showed excessive side play in the pony truck and the broken springs mentioned above, which would have affected the balance of the engine. The only track defect was the variation in cross-level, which was remarkably regular, though the actual differences at any one point were not excessive. It is likely that low joints on the curve set up minor oscillations, slightly increased perhaps by water surging in the tanks, but not becoming serious until the straight track was reached, where regular cross-level changes increased them. Then build-up must have been unusually rapid, probably due to short pitch cant variations synchronising with the periodicity of the engine. The theory of engine hunting is borne out by the track distortions, etc., all tending to show that the leading wheel became forced over the rail when it was carrying little weight.

037962
IN SITU BALLAST CLEANING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Mar. 1944, p 480

The use of McWilliams' "Moles" and Speno Railroad Ballast Cleaning Co. ballast cleaning machines on the Illinois Central is described. This ballast consists mainly of crushed limestone. Dirt samples removed from this ballast showed it to consist of 41 percent limestone dust, 45 percent soil from adjacent fields and 11 percent coal dust. The remainder was moisture. Experiences in cleaning this ballast are explained in some detail.

037963
NIGHT WELDING OF BATTERED RAIL-ENDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Mar. 1944, p 312

The building up of the battered running surfaces of flat-bottom rails at the joints has been developed in two ways: the first method consists in the use of some small "off-track" welding units, the second method is by means of larger "on-track" units. While on-track welding units are in the daytime in yards, the most interesting methods are those for use at night on running lines. Procedures for night-time welding are described.

037965
SIMPLIFIED SIDING-TRACK FORMULAE

Preston, A

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Apr. 1944, p 386

Various formulae have been compiled for the design of "ladder tracks" for sidings, and those the author has seen so far have entailed the use of leads with special lengths for the stock rails and/or crossing rails. In the author's opinion, groups of sidings should be designed so as to reduce to the lowest the number of curves. The adoption of proposed formulae will eliminate reverse curves and so make a reduction of almost 50 percent in the number of curves, compared with some other forms of layouts.

037966
CONCRETE RAILWAY SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Apr. 1944, pp 409-410

This article presents the salient features of British Standard 986 which was published in 1944 and which deals with concrete sleepers. The Standard covers transverse or block sleepers for standard-gauge track over which speeds higher than 30 mph are not attained and provides for separate designs as follow: Class A, for lightly worked and storage sidings; Class B, for heavily worked and refuge sidings, goods loops, etc.

037967
A COMPOSITE TIMBER AND CONCRETE RAILWAY SLEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, May 1944, pp 467, 2 Fig

A composite timber and concrete sleeper of simple design was evolved to meet requirements for wartime purposes and which could be adopted also for post-war needs should the shortage of timber continue. Its chief merit lies in doubling the use of existing supplies of timber and halving future requirements of this material. The following advantages were claimed: The resilience of timber is retained; centre binding is eliminated; an adequate tie is ensured; the tilting of blocks is eliminated and better gauge is maintained.

037968
AN UNUSUAL SLIP IN A ROCK CUTTING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, May 1944, pp 498-501, 2 Fig, 3 Phot

The circumstances surrounding a landslide in England in 1942 are reported, and the corrective actions enumerated. Considerable detail is given including restoration of the tracks and stabilization of the slip.

037969
CONCRETE POT SLEEPERS ON THE G.W.R.

Cookson, EC, Great Western Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, May 1944, pp 545-546, 3 Fig

A brief history of the evolution of "pot" sleepers on the G.W.R. is presented. Details of manufacturing and in-service experiences are also mentioned. Pot sleepers get a better bearing on ashes, but also have been used successfully with stone ballast. Discretion was used as to the employment of pot sleepers on new embankments but little trouble was experienced on banks up to 10 feet depth.

037971
TRACK TESTS ON THE ILLINOIS CENTRAL RR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, July 1944, p 11, 1 Fig

This article describes a number of tests conducted on the Illinois Central. One test was conducted to determine whether the removal of the mill scale from the rail ends and fishing surfaces of the plates would reduce the initial rate of bolt tension loss or have beneficial effects on fishplate wear. Insulated joints were also tested. Tests were also carried out with various types of bearing plates in an attempt to eliminate the cutting of soft wooden sleepers by such plates. To prevent creep, 14 rail anchors of different types were fitted per rail length, and in addition 12 rail clips to the rail length were used. Eight different arrangements of the anchors were installed. Various kinds of sleepers and ballast were also tested.

037973
CROPPING BATTERED RAIL-ENDS IN THE TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, July 1944, p 88

The Southern Railway of America has perfected a method of cutting off the battered ends of rails in the track, and restoring the road without interruption of train service. The method involves cutting off rails in situ, re-drilling, drawing up the rails, and inserting closures as necessary to compensate for the removed materials. It is estimated that the life of the rails will be extended by 6 years, and joint maintenance will be reduced by 10 percent. A maximum of 263 rails has been cropped in a single day of light traffic, but the average is 150; cost has varied from $0.98 to $1.26 for each rail-end cropped, or an average of $1.10, which works out at $2.20 for an entire rail. In a year, 42 miles of track have been successfully reconditioned.

037974
ELECTRIC BUTT WELDING PLANT AT DONCASTER WORKS, L.N.E.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, July 1944, p 89, 1 Fig, 1 Phot

A large automatic resistance butt welder of 200 kVA capacity and capable of welding sections up to 13 sq. in. is described and illustrated.

037975
UNIT TAMPERS FOR PACKING SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Aug. 1944, p 133, 2 Phot

The unit power tampers in use on the Missouri Pacific are described. As compared with multiple-tool power tampers, the advantage of the unit tamper is its portability. On the job the unit tampers are used chiefly for spot tamping, and in particular for picking up low joints and for tamping ties that have been renewed.

037976
WELDING IN MODERN PERMANENT WAY PRACTICE

Croom-Johnson, P, London Passenger Transport Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Aug. 1944, pp 160-164, 12 Phot

A survey of recent welding developments is presented with particular reference to the experience of London Transport. Attention is focused on thermit, flash-butt, electric arc and oxy-acetylene welding procedures for producing long welded rail, and resurfacing crossings and switches.

037977
MODERN BRITISH TRACK DEVELOPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Sept. 1944, pp 234-235

A brief survey is made of recent innovations in permanent way maintenance and design. The survey includes the following topics: transition curves for high speed, mechanical tamping; weed killing; sleepers and timber shortage; the rail joint problem; and flat-bottom track.

037978
HOW LONG CAN A RAIL BE?

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 81, Oct. 1944, pp 281-282

The continuous welding of rails as practiced in the United States by five railways is summarized. Summarizing the collective views at the time of this article, it was clear that expansion and contraction would not present problems. It was equally clear that there are appreciable savings in the costs of maintenance as compared with standard jointed track. There are good prospects of longer rail life, because destructive action on the part of the rails is reduced. Rolling stock rides more quickly and smoothly. Track circuits give less trouble, and can be lengthened.

037979
STRAIN GAUGING FOR RAILWAY ENGINEERING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Oct. 1944, p 335, 1 Fig, 1 Tab

The modern method of measuring steady and alternating stresses as applied to aircraft structures, is of great potential interest to railway engineers as a convenient and very accurate means of investigating the failure of rolling stock and all moving parts, loads on rails, crossovers, and so forth. The method described makes use of the wire-wound resistance gauge, which depends for its action on the fact that a stress applied to the gauge causes a small change in its resistance.

037980
THE HEAT TREATMENT OF RAILS IN INDIA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Oct. 1944, p 406, 2 Phot

An apparatus for the heat-treatment of rails was installed recently in the signal shops of the North Western Railway, India. The process, which is stated to be both simple and efficient, so far has been confined to the wing rails on points and crossings. The rails to be treated are clamped on a table and travel under an oxy-acetylene flame and subsequently a water-jet, attached to the tool-holder of the planning machine. The rail immediately under the torch is heated to approximately 850 degrees, and the same point on the head is quenched about 46 sec. after passing from under the flame. The depth of hardening is about 3/16 in; the surface is sufficiently hard yet not hard enough to produce flaking the gradation from surface to center is regular and gradual, and the structure throughout is reported to be excellent.

037981
LARGER SOLEPLATES FOR SLEEPER PRESERVATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Nov. 1944, p 450, 1 Fig

The Norfolk and Western Railway introduced a large steel soleplate to increase the life of bridge timbers directly used for the support of railway track. It was soon realized that if these plates were substituted for the 13-in. plates already in use on bad curves in main lines, the former would bridge the spike-killed portions of the timber, and make it possible to drive the holding-down spikes in sound wood. It was hoped also, with the greater length to reduce if not to eliminate plate-cutting. So far as possible the 18-in. plates have been inserted only as part of a complete relaying operation. Where desirable, special methods have been devised lengthening the existing soleplate seats in order to accommodate the longer plate. The operation of substituting the new plates is performed by a gang of 20 men, who first draw the old spikes, remove the old plates, adze the sleepers, plug the old spike-holes, and then insert and spike the 18-in. plates.

037983
EXTENSIVE USE OF FORMATION GROUTING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Dec. 1944, p 616

Cement grouting as a cure for unstable railway formation is not intended to provide a concrete slab under the ballast, but to stabilize the existing formation by driving out from it all free water and semi-liquid soil, which surges under passing trains. In fact pressure grouting has a double function by filling all the voids and setting in them, it seals them against penetration of further water by pumping action from below, and also from above. The grout, which is usually one part cement to five parts of sand, forms with the lower ballast a cemented mass that distributes the load evenly over the formation. The experiences and technical achievements of the AT&SF Railway with cement grouting are reported.

037988
FACING POINT LOCKING

Nock, OS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Feb. 1959, p 176

A paper by O.S. Nock on facing point protection presented to the Institute of Railway Signal Engineers on Feb. 4, 1959, is summarized. The question how far one should go in applying supplementary precautions against irregular movement of power points by using local track locking and/or revised circuit arrangements, designed to give greater security against the effect of faults, is discussed. It is determined that facing points must be made as safe as the latest techniques can make them.

037989
FASTENING FLAT-BOTTOM RAILS ON CONCRETE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Mar. 1959, pp 275-276, 2 Phot

The Skull Hoop Clip fastening consists essentially of two steel hoops cast into a class "F" concrete sleeper on each side of the rail seat, and two resilient spring steel clips. Insulation of the assembly is provided by a rubber rail pad and two insulators to fit between the rail flange, the vertical bars of the hoops, and the spring clips. Laboratory testing included torsion, creep, and moment of resistance tests. The results showed an efficiency superior to that of most other fastenings tested in the same manner. Besides a superior holding-down efficiency compared with a number of other types of fastenings, this clip features simplicity of design, ease of assembly, and extraction of the clip without the need for specially designed tools.

037990
THE A.D. RAIL FASTENING FOR CONCRETE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Mar. 1959, 4 p, 4 Fig, 6 Phot

A new type of rail fastening, for use with flat-bottom rails and Class F concrete sleepers with modified rail seatings, are in use with long welded rails on a main line of the British Railways Track sections are illustrated. The assembly consists of an insulating clamping block, malleable cast-iron containing collar, and triple-coil spring washer. These are secured firmly in position against the rail foot by a holding-down bolt, tightened by a flanged nut and restrained by a locking pin which passes transversely through the concrete sleeper and also through a hole in the end of the holding-down bolt. The rail is seated on a rubber pad.

037991
TRACK-SIDE FOUNDATIONS IN SUBSIDENCE AREAS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Apr. 1959, pp 390-391, 2 Fig, 3 Phot

The main line between Manchester and Crewe, British Railways, passes through a section subject to serious subsidence caused by brine extraction. The average yearly subsidence is 8 in. The design of the overhead line equipment to maintain the contact wire within the maximum and minimum heights above rail level is discussed and is illustrated. The track can be lifted for a period of four to six years before the foundation for the overhead structure will need to be lifted.

037992
FRICTIONAL BRAKING BUFFER STOPS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Apr. 1959, pp 479-480, 3 Tab, 4 Phot

Braking buffer stops with fractional retarding action, widely used on the Continent, have been tested in South Wales. There are three principle types of Rawie buffer stop in use but each can be modified or supplemented by altering or adding components, as conditions may render advisable. The simplest is the rail brake design. In this, friction grips, or clamps, provided with bronze inserts, are bolted to the rail head in such a manner as to give the desired brake power in tons.

037993
NEW SERIES OF STEEL RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, May 1959, p 501

Important changes in British Standard 11 for flat-bottom rails are given. These new rails, designated "A" series, have larger fillet radii, joining web to head; use equal top and bottom fishing angles resulting in the reversion to the double angle foot, to obviate an unbalanced section, with excess metal in the foot; have reduced foot widths to allow better disposition of metal within the section; have sides tapered 1 to 10 to give added metal to resist wear; and have a larger head radius.

037994
MODIFIED BLANKETING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, May 1959, pp 506-508, 3 Fig, 1 Tab, 1 Phot

The two main types of soil foundation failure are pumping and strength. Pumping failures derive from slurry formed from ballast or erosion in the vicinity of the sleepers, especially near rail joints. Strength failures occur with a greater time-lag than pumping failures, and are recognizable by heaves of soil in the cess, six-foot way, or four-foot way. A modified method of blanketing is described and cost estimates are made for the re-ballasting process.

037995
AUTOMATIC WELDING, GRINDING, AND HANDLING OF LONG RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, May 1959, pp 537-538, 3 Phot

An electric, automatic, flash welding machine, designed by a Swiss firm, is being used to weld 132-lb., 39-ft. rails for the Louisville & Nashville Raolroad. Rail ends are ground to remove rust, then heated to plastic consistency and forced together with a 30-ton force. A 50-ton hammer-blow forces foreign matter, gases, and surplus molten metal from the weld. An automatic grinder removes mill-scale and hand-grinders are used to remove any remaining roughness. The welding unit, grinder, and pusher are mounted in tandem on a 60-ft. all-steel car. About 60 welds per 8-hr. shift can be made by a crew of 8.

037996
TRACK RECORDING ON THE SOUTH AFRICAN RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, May 1959, p 624, 3 Phot

Four track-recording trolleys, self-propelled by a 65-h.p. gas engine, purchased to mechanize track maintenance on the South African Railways, are described. As it travels along the track at 19 MPH, irregularities are detected by the combined movements of probes and wheel flanges carried on three sets of detector assemblies. The function of the trolley is to record high and low points on both rails, versines (curvature) of both rails, superelevation or cant of the track, twist or skew, gauge variations, recording speed, and mileage.

037997
THIMBLE DEVICE FOR LAYING LONG-WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, June 1959, 2 pp, 3 Phot

London Transport has introduced a thimble device which, attached to a crane hook, enables 300 ft. lengths of welded rail to be installed rapidly with a labor force of five men. Laying speeds of up to two miles of single rail an hour can be achieved. The new conductor or running rails to be laid are shop-welded into 300 ft. lengths. Conductor rails are then site welded into longer lengths, usually of half a mile.

037998
BLANKETING AND DRAINAGE AT LAPWORTH, WESTERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Aug. 1959, p 48, 2 Phot

The bottom of the cutting slope adjacent to the down relief line was supported by a dry stone wall which was crumbling badly because of the earth pressure behind it and the constant flow of spring water through it. The spring water was diverted and a Gabion wall was constructed. The permanent way was then deep reballasted.

037999
BRITISH RAILWAYS TRACK RECORDING COACH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Aug. 1959, pp 49-50, 3 Phot

The coach is a four-wheel self-propelled vehicle capable of being driven at either end. It can travel at any speed up to 30 m.p.h. when recording and is capable of speeds of 55 m.p.h. when not recording. Cant is measured by comparing the position of one of the axles with a datum provided by the gyroscope mounted immediately above this axle. Measurements of curvature, gage, and cant are obtained as a.c. signals from synchro type pick-offs. These signals are linearly demodulated and the resulting d.c. signals applied to high sensitivity mirror galvonometers. In addition to the main measurements, the record includes the speed of the vehicle, distance marking, facilities to indicate events such as stations, and space for making notes.

039002
ANALYSIS OF STRESS DISTRIBUTION BENEATH EMBANKMENTS

Lambe, TW Hirschfeld, RC Christian, JT

Massachusetts Institute of Technology, Soil Mechanics Division, Cambridge, Massachusetts

R66-53, Final Rpt, Nov. 1966, 57 pp

Contract C-85-65t

Northeast Corridor Transportation Project.

A mathematical analysis adapted to computer calculation is used to calculate stresses and displacements for complicated soil movements and for a large class of boundary conditions. Vertical stresses are found to be insensitive to variation in material properties and some boundary conditions, but marked changes in horizontal stresses suggest that elastic theory may be inaccurate. Additional work is suggested, to include further computer runs on a systematic basis, some improvements in the programs, and an extension of the work to study consolidation (the time-dependent dissipation of pore pressures), which is a major unsolved theoretical problem. (Author)

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PB-173637

039101
STUDY OF METHODS OF STABILIZING CONVENTIONAL BALLAST USING POLYMERS

Rostler, FS White, RM Nair, K Hicks, RG Newton, JW

Materials Research and Development Incorporated, Oakland, California

Final Rpt, Dec. 1966, 219 pp

Contract C-352-66

See also PB-179220

An elastomer compound based on a thermoplastic polymer has been developed which when applied to ballast rock as constituting conventional ballast, provides a continuous structure of high strength, good load distribution, and effective damping characteristics. Experiments were performed testing the properties of ballast treated with this compound as compared to non-treated ballast. The preparation was applied in form of a solution of the polymer compound in volatile solvents. One rate of application was explored in detail. (Author)

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PB-179466

039112
STUDY OF NEW TRACK STRUCTURE DESIGNS

Bhatia, GS Romualdi, JP Thiers, GR

Carnegie-Mellon University, Transportation Research Institute, Pittsburgh, Pennsylvania

Mar. 1968, 103 pp

Contract C-222-66

The effect of an abrupt change in elastic foundation properties upon the motion of a high speed vehicle is detailed in this study. Limiting allowable accelerations are chosen as the criteria for riding quality. The study indicates that there is a likelihood of encountering a variety of elastic soil combinations which can seriously deteriorate the riding qualities of a rail vehicle on conventional track. As remedial measures, two alternatives are considered to improve the quality of ride; one by improving the rigidity of the track structure by means of providing a track structure utilizing narrow vertical walls embedded in the subsoil, and the other by carefully compacting the foundation soil to minimize local variations. A study is also made to evaluate the relative economics of the alternatives. (Author)

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PB-179401

039114
STUDY OF METHODS OF STABILIZING CONVENTIONAL BALLAST USING POLYMERS. FINAL REPORT ON CONTRACT MODIFICATION NO. 3

Rostler, FS Newton, JW

Materials Research and Development, Incorporated, Oakland, California

Final Rpt, July 1968, 47 pp

Contract C-352-66

The report presents the results of the work performed in continuation of the research study on stabilized railroad ballast. The purpose of the continuation was to test the feasibility of applying the elastomeric cementing composition in the form of an emulsion. The principal advantage of this is that most of the agent is concentrated at the contact points of the rocks. Included are the testing procedures for the large-scale tests at the A.A.R.

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PB-179220

039204
STABILIZED BALLAST INVESTIGATION

Magee, GM

Association of American Railroads, Research Center, Chicago, Illinois

Final Rpt, Aug. 1969, 89pp

Contract DOT-FR-3-0254

The purpose of the investigation was to evaluate the ability of a compound to enhance the load resistant characteristics of conventional stone ballast. This compound, an emulsion based on a new butadiene-styrene block copolymer, was sprayed on the stone ballast of a short section of railroad track. A second section of track, similar but untreated, provided the sample of conventional construction. In the conduct of the investigation pulsating, single point, vertical loads varying from 5000 lbs. to 50,000 lbs. (and to 75,000 lbs. in some cases) were applied to, first, the untreated track and, then, the treated specimen in a uniform manner for 4,000,000 cycles. The treated ballast was finally subjected to 11,000,000 vertical stress cycles. Static lateral stress was also applied to each section. Comparisons established through this study are, conservatively stated, that the permanent settlement of ties supported on the untreated ballast was 10 times that recorded for the ties of the treated ballast test phase. Resistance to lateral displacement was, at least, five times greater for the treated specimen than for its companion. (Author)

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PB-192720

039233
STUDIES FOR RAIL VEHICLE TRACK STRUCTURES

Meacham, HC Prause, RH Ahlbeck, DR Kasuba, JA

Battelle Memorial Institute, Columbus, Ohio

Final Rpt, 6609-7004, Apr. 1970, 208p

Contract DOT-FR-9-0021

Conventional (tie-type) and non-conventional rail vehicle track structures were studied, with the restriction that standard gauge and rail-head contour be used. Computer programs were developed and used to analyze track response to both static and dynamic vehicle loading. The models of conventional track were validated by track, and on the Penn-Central high-speed track near Bowie, Maryland. The DOT research cars were used to obtain a series of controlled-speed passes at speeds up to 125 mph. Track response under Metroliner and regular freight traffic was also recorded, both at a joint and away from a joint. The measurements showed the lack of consistency of track characteristics at different locations and at different times, and indicated the computer results to be as accurate as the degree to which track parameters could be defined. The predicted presence of individual pressure pulses for individual axles on trucks with wheelbases exceeding 6' was verified by measured subgrade pressures 3' beneath the tie base, at speeds up to 125 mph. A major philosophy in the development of improved track structures was to reduce the magnitude and number of pressure cycles transmitted into the roadbed, with the number of cycles reduced by using beam and slab type rail supports having substantial longitudinal bending stiffness. Following the analysis, performance specifications were written for rail fasteners and three types of reinforced concrete structures recommended for further evaluation in field tests: cast-in-place slab, cast-in-place twin beams, and precast twin beams. (Author)

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PB-194139

039252
A TECHNIQUE FOR EVALUATING TRACK CONDITION USING RAILCAR VIBRATIONS

Clevenson, SA Ullman, KB

National Aeronautics and Space Administration, Langley Research Station, Langley Station, Virginia

Apr. 1971, 7p

Presented at the AIAA/ASME Structures, Structural Dynamics, and Materials Conference (12th), Anaheim, California. 19-21 April 1971.

A technique for evaluating rail track roughness and irregularities using vibration measurements in the railcar is discussed. The technique has been applied to a demonstration train route now operated under DOT contract and has been used in establishing priority for track maintenance. Specific attention is placed on the portable, low-frequency, low-amplitude, acceleration measuring/recording system. The data reduction and computer programs are described. Sample vibration measurements are given and the rating system is described. The project was a joint DOT-NASA effort. (Author)

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PB-201623

039256
STUDY OF NEW TRACK STRUCTURE DESIGN. PHASE II

Meacham, HC Voorhees, JE Eggert, JG Enright, JJ

Battelle Memorial Institute, Columbus, Ohio

Summ Rpt, Aug. 1968, 64p

Phase 1 of this research investigation was undertaken in September, 1966, for the Office of High Speed Ground Transportation (OHSGT) of the Department of Commerce by Battelle Memorial Institute for the purpose of conceiving new and improved track structures for high-speed trains. As a result of the Phase 1 program, a number of track structures and fasteners were devised which met the specified requirements. Following the conclusion of the Phase 1 program, the OHSGT requested additional studies and computer analyses of track structures and rail fasteners. The additional track structures of interest were chosen by OHSGT from many designs which had been submitted to them. In addition to the analysis of the track structures, they were interested in a more detailed analysis of rail fasteners, particularly any analysis which was amendable to computer techniques. This project (which was then designated as Phase 2) was then conducted, and the results are summarized in this report. The report contains detailed discussion of material summarized in: 'Studies For Rail Vehicle Track Structures,' PB-194139, and is a reference source sited in that document.

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PB-202273

039260
STUDIES

Dietrich, RJ Salley, JR

Shannon and Wilson, Seattle, Washington

Final Rpt, Aug. 1971, 167p

The events and considerations leading up to the production of an embankment design for the support of the Kansas test track are described. Included are discussion of site description, field investigations, laboratory investigations, sub-surface conditions, embankment design, and instrumentation. (Author)

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PB-202808

039263
DEPARTMENT OF TRANSPORTATION. DESIGN STUDIES

Eidt, JT Marks, BD Stewart, JF

Hemphill Corporation, Tulsa, Oklahoma

Final Rpt, Aug. 1971, 75p

Exploratory borings and soil classification studies are reported on for two locations; southeast Kansas and northeast New Mexico. The objective of the work was the revelation of sufficient sub-soil information to enable a decision on the part of the sponsoring agency as to where to most appropriately install a railroad test track. Duplication of physical conditions most representative of present railroad track support conditions and economics of construction were important considerations. (Author)

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PB-202271

039288
A MODEL STUDY FOR VERTICAL TRACK BUCKLING

Kerr, AD

New York University, Bronx, Department of Aeronautics and Astronautics, Bronx, New York

NYU-AA-71-31, Oct. 1971, 31 pp

Contract DOT-FR-10019

The paper contains a study of two models which represent the mechanism of vertical buckling of a track when subjected to a mechanical or to a thermal compression force, respectively. The postbuckling equilibrium curves and their stability are discussed and a stability criterion is defined. The effect of various track model parameters upon the buckling load or buckling temperature, are shown. The nonlinear equilibrium equations were then linearized. It was found that the buckling loads, or temperatures, obtained from a linearized analysis have no relevance to the actual values obtained from a nonlinear analysis; the difference in results being substantial for buckling temperatures. (Author)

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PB-209614

039303
THE KANSAS TEST TRACK

Federal Railroad Administration, Department of Transportation, Washington, D.C.

FRA-RT-72-08, Prog Rpt, Oct. 1971, 33 pp

Prepared in cooperation with The Atchison, Topeka and Santa Fe Railway Co.

The Federal Railroad Administration and the Atchison, Topeka and Santa Fe Railway Company are jointly sponsoring the construction of a test track as part of the railroad's heavy tonnage main line in Kansas. The objective of the project is a determination of the levels of increased train stability provided by 8 specimens of incrementally improved track support. A further objective is a definition of the cost-benefit relationship associated with each augmentation of stability. The various test segments are defined, associated instrumentation requirements are outlined, and progress to data described. (Author)

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PB-206622

039304
WEEDKILLER SPRAY TRAIN ON WESTERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Sept. 1959, pp 138-139, 6 Phot

A new, British Railways, weedkiller spray train is described, with the capacity to spray up to 68 miles of full-width track before needing replenishment. The new train comprises four 20-ton tank wagons, each of which has a capacity of approximately 4,750 gal. of weedkiller solution ready for use, a messing and sleeping coach for the normal operating crew of three, and a spray van containing the pumps and other machinery, to which are attached the spraying booms. All vehicles are close-coupled and fitted with twin-cylinder vacuum brakes. Spraying is carried out at the rate of approximately 280 gal. of weedkiller solution per mile, generally over a width of 17 feet 6 inches. Normal spraying speed is 20 mph.

039306
PROGRESS IN RAILWAY WEED CONTROL

Hartley, GS, Chesterford Park Research Station

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Oct. 1959, pp 298-301, 1 Fig, 8 Phot

This article gives a brief review of the use of herbicides on railways, chemicals used, and methods of application. The main emphasis is on methods applicable under British conditions of climate, population density, and social and legal standards. Photographs show spray equipment and a prototype spray train. The results of spray treatment using simazine weed-killer is shown graphically.

039308
BALLAST TAMPING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 111, Nov. 1959, pp 388-389

The first types of mechanical tampers sought to imitate the action of the beater packing. These tampers resemble a road drill with a blunt T-head steel which delivers about 90 blows a min. to the ballast at the bottom of the sleeper. The type of mechanical tamper which has been most widely used is that having a "vibrate and squeeze" action. The use of vibration (about 2,000 blows a min.) causes the ballast to flow into a closer arrangement of particles, and by combining this with a squeeze it is possible to obtain the result more quickly and to control the formation of the ballast mold. The standard Matisa machine was produced to meet the special requirement for packing hollow steel sleepers. The Matisa machine applies its squeeze mechanically by means of left–and right-hand threaded shafts.

039309
CIVIL ENGINEERING MAINTENANCE WORK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Nov. 1959, pp 475-476

Regular examination is the basis of railway civil engineering maintenance work, ranging from daily examination of passenger-carrying lines to underwater examination of the piers or abutments of a bridge at 20-year or longer intervals. The Matisa track-recording self-propelling trolley unit, introduced during the last two years, enables reliable records of cross level, track curvature and track gauge to be obtained at a running speed of about 20 mph. Examination of rails with manually-applied ultrasonic-type flaw probes was introduced in 1954. A special rail-mounted adaption of the principles and mechanism of the Simon hoist has been developed to provide better means of regular examination of high masonry vaiducts. At the end of 1958, only two major equipment developments were being pursued. First, a prototype "on track" self-propelling machine was under construction. This is designed to excavate track ballast from outside the ends of sleepers, and screen it, and replace the clean ballast. Secondly, a design of a type of low-loading lorry with both pneumatic-tired road wheels and steel flanged tired wheels is being developed.

039310
RAILWAY SLEEPERS IN ASBESTOS CEMENT

Hubbard, W

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Dec. 1959, pp 510-511, 4 Tab, 3 Phot

A brief description is given of asbestos cement sleepers, the method of manufacture, characteristics and present usage. Asbestos chrysotile a hydrated silicate of magnesia, is very pliable and contains an extremely high tensile strength approximating that of steel wire. Railway sleepers are manufactured by compressing several thin layers of asbestos cement while still in a pliable condition and arranged in such a way that the fibres are evenly oriented. The sleepers are supplied in two classes. These vary in thickness dependent on their intended use, principally in respect of traffic density and speed. Two types of rail fastening are offered; a rigid fixing for secondary lines and sidings and spring type clips for high speed traffic. Asbestos cement offers very high insulating characteristics. While the life of the asbestos cement sleeper can only be assumed, practical tests show that it remains unaltered after 20 years of use.

039312
CONCRETE SLEEPER TESTS ON AN L.M.S.R. MAIN LINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, June 1942, 3 Phot

Concrete sleepers are being tested to indicate their suitability for use on heavily worked main lines. Two types of reinforcement are being tested. The sleepers are 7 feet 6 inches long, 10 inches wide, and 5 inches deep; they are fitted with inserts to take standard chairs and screws. A felt pad has been inserted between the chairs and the surface of the sleepers; short 9 inches fishplates, with two bolts, are used at rail joints. The test track was laid on the Euston-Crewe main line.

039315
STAGGERED RAIL-JOINTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, May 1959, pp 612-613

Pros and cons about staggered rail joints are examined. Both U.S. and British opinion are presented with emphasis on the experiences of the Great Eastern Railway of Great Britain. Rail-end batter, car rolling, and economics of each method is discussed.

039403
TRACON-A NEW SYSTEM FOR TRACK ANALYSIS

Lombaroo, LR, New York Central Railway

Instrument Society of America, 630 William Penn Place, Pittsburgh, Pennsylvania, 15219

23-1-T1D-67, Conf Paper, Sept. 1967, 6 pp, 7 Fig

22nd Annual ISA Conference and Exhibit, September 11-14, 1967, Chicago, Illinois.

The article discusses an electronic track inspection system which is designed to give management rapid information on track condition. The system can be attached to almost any passenger car without any modifications. It measures dynamic cross level at speeds above 35 mph. This concept was not expected to be an accurate defect detection and locating system, but is meant for rapid statistical analysis of track conditions for the allocation of maintenance funds.

039405
DYNAMIC FORCES IN BRIDGES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-21,24,26, Report, 6507-6801, 9 pp, 4 Fig

Question D23.

This report discusses testing conducted to determine dynamic stresses in bridges caused by rail traffic. The relation between these stresses and other factors as bridge span and train speed are also considered. Formulae used in determining these factors are given as well as the findings of dynamic stress for conventional ORE bridge structures crossed by typical rail traffic. Not included are studies of non-conventional structures on rolling stock with regularly spaced axles.

039408
STRESS DISTRIBUTION IN THE RAILS DUE TO TRAFFIC LOADS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-24,29, Report, 6701-6907, 18 pp, 24 Fig, 2 Tab

Question D71.

Tests were conducted to determine stresses in rail which result from vehicle wheels. These stresses were measured on the rail surface of a rail section, in the track and in the inner zone. Tests to determine the relationship between actual and theoretical stresses of ballast and blanket were also conducted. The conclusions were that the force between rail and sleepers was proportional to the force exerted. Stress within ballast was determined to be related to the method of packing. Hand packing resulted in more stress concentration than machine packing.

039418
REUSE OF PARTIALLY LIFE-EXPIRED ROLLER BEARINGS

Timken Roller Bearing Company, Incorporated, Canton, Ohio, 44706

Aug. 1969, 3 pp, 1 Fig

The life expectancy is discussed of freight car roller bearings which have seen extensive service. The meanings of the terms life expectancy and B-10 life as defined by the AAR are given. A typical bearing life expectancy curve is shown. A group of used bearings which are carefully inspected according to manufacturer's recommendtions should perform with reliability very nearly the same as new bearings. For maximum economy, such bearings should be reused based upon normal inspection and maintenance practices.

039436
INVESTIGATION OF THE DURABILITY OF IMPREGNATED TIES

Kakegawa, Y

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 3, Aug. 1964, pp 41-44, 8 Fig

The service life of cross ties and the factors which lead to their replacement were studied. The average life of wooden ties is 14.1 years with a variation of 4 years, depending on tonnage. The life of ties on curves is 2.4 years shorter than in straight sections. Tie plates increase this life. Rotting of the ties is less of a problem than cutting by the rails.

039437
INVESTIGATION OF LATERAL STRENGTH OF RAIL FASTENINGS ON TOKAIDO TRUNK LINE BETWEEN FUJIEDA AND SHIMADA BY LATERAL FORCE TESTING CAR

Minemura, Y, Niigata Railway Administration, Japan
Ichikawa, S, Niigata Railway Administration, Japan

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 2, June 1964, pp 50-53, 5 Fig, 1 Tab

As a result of tests by the JNR lateral testing car, several types of rail fasteners were designed. Statistical prediction gave a stress variation of 3 to 6t. All designs were designed to withstand a lateral force of 3t and will not easily fail at stresses of 6t. The strongest fasteners utilizes polyurethane gauge blocks. Weaknesses of design and materials in the order fasteners tested are also discussed and compared.

039439
RAIL CORRUGATION–CAN IT BE PREVENTED

Spaderna, CH

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

This is a research report which attempts to determine the causes of rail corrugation. The author suggests that higher rail speeds may cause rail corrugations or undulations as deep as 0.01, which accelerate rail wear. A relationship is established between the natural frequencies of rail vibration and the wear length of the corrugation. Further experiments are required into the possibility of eliminating corrugation by axle redesign as well as changes in rail profile and tie spacing.

039440
EXPERIMENTAL RESULTS OBTAINED ON THE LATERAL PROBLEMS OF THE LONG WELDED RAIL CONTINUOUSLY LAID ON SEVERAL SPANS OF THE BRIDGE WITHOUT BALLAST

Sato, Y, Japanese National Railways
Nagata, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 1, Mar. 1969, pp 8-10, 3 Fig

To show the lateral stability of continuous welded rail on a bridge, and the character of the lateral load to the bridge as a result of such rail, a test was conducted by the JNR on an actual bridge. The data resulting from this test shows that even though there were no problems resulting from unballasted rail on a bridge, the lateral forces between rail and sleepers varies and may reach a value which is ten times the calculated value. The phenomena is a result of continuous rail laid on a bridge resulting from the high lateral elastic coefficient of the rail supporting system.

039445
NOVEL BALLAST SCREENING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Feb. 1946, pp 222-223, 2 Phot

This article describes a ballast screening machine which is to be used in the French railways. The equipment is capable of removing, screening and replacing in one night the ballast in a quarter mile of track without breaking the road or obstructing more than one track. The machine consists of two units, diesel powered, which can quickly be removed from the track, a process requiring about 15 minutes.

039446
TESTS OF RAIL JOINT IMPACT EFFECTS ON THE CHICAGO AND NORTH WESTERN

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 571956, pp 865-883, 7 Fig

Tests were conducted to evaluate the economics of 78-foot rail. Fundamental information was obtained on the impact effects on joint ties due to rail end batter, joint gap, and joint bar fit of regular rail joints compared to the impact effects with a butt weld. Conclusions suggest that to compare welded rail joints with conventional joints, the costs of maintaining a rail joint in equally good condition including the maintenance of rail end batter not to exceed 0.015 in., replacement of joint bars, tightening of track bolts plus corrosion protection must be included.

039447
MEASUREMENT UNDER TRAFFIC OF THE DYNAMIC RAIL CREEPAGE FORCES EXERTED ON TIES BY RAIL ANCHORS AND THE STATIC LOAD REQUIRED TO MOVE TIES IN THE BALLAST, NEAR KANSASVILLE, WIS., ON THE MILWAUKEE ROAD

Hiltz, JP Adams, LL Barge, DB, Jr

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 561955, pp 283-322, 13 Fig, 3 Tab

This report presents the results of a field test which involved the measurement, under two-way traffic, of the dynamic forces exerted by rail anchors on the ties, of rail and tie movement, and also of the resistance of ties to movement in the ballast by static loads. The primary maximum forward forces recorded on the weigh bars occurred ahead of each wheel before it reached the rail anchors. The rail creepage forces caused by rolling out the convex upward wave ahead of each wheel were present, but were masked out by those caused by the angular changes of the rail. The greatest forces on the weigh bars occurred under the winter measurements when the ties were partially frozen in the ballast. No very large forces were measured under the braking and accelerating movements made by the way freight trains. The magnitude of the dynamic forces was not a function of the train speed.

039448
FEATURES IN THE SELECTION OF WEIGHT OF RAIL FOR NEW OR REHABILITATED LINES

Code, CJ, Pennsylvania Railroad

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 55, pp 343-345, 1 Ref

The principal features to be considered in the selection of the weight of rail for a new or rehabilitated line will be: the type and axle loading of motive power and cars; the physical characteristics of the line; and the type, intensity and speed of traffic. Given these controlling factors a reasonable decision should be possible, which will result in minimum annual total cost of maintenance with a satisfactory condition of line and surface. New locomotives require stress calculations to determine the results of using existing roadbeds and rail.

039449
THREE-DIMENSIONAL PHOTOELASTIC INVESTIGATION OF THE PRINCIPAL STRESSES AND MAXIMUM SHEARS IN THE HEAD OF A MODEL OF A RAILROAD RAIL

Frocht, MM, Illinois Institute of Technology

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 1112-19, 3 Fig

This report discusses the technique used to make a photoelastic model of a rail which indicates the interior stresses present under load. Differences between frozen patterns and those obtained at room temperature are discussed. The method to determine actual principal stresses and principal shears is also described and discussed.

039450
STRESSES AROUND A BOLT HOLE OF A RAIL WITH THE JOINT IN TENSION

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 541953, pp 1254-61, 4 Tab, 9 Phot

The stresses which develop at bolt holes when rail contraction causes contact between bolts and the edge of the hole are discussed in this report. Strain gauges at the rail web were used to measure stresses present.

039451
ELEVENTH PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 541953

This report discusses the test program of rolling load tests of joint bars using 3-33 inch stroke rolling machines. The results of the tests of joint bars, which were heat treated and tempered are given. Hardness tests of the bars are included as well as the rolling load tests. Test results of 132 RE leadfree bars (oil quenched) averaged 573,100 cycles before failure which started at a rail end. Tests of 132 RE leadfree bars (water quenched) averaged 365,300 cycles. 4 bars failed, 2 from the top, 2 from the base.

039454
ULTRASONICS FOR PERMANENT WAY INSPECTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Apr. 1954, p 468, 1 Phot

A portable ultrasonic flaw detector known as the Sonirail is easily operated, and simple to adjust. The electronic apparatus, enclosed in a metal box, is connected to a probe stick which the operator slides on the rail. Indications are given audibly by means of a built-in loudspeaker, supplemented by visual signals on a milliammeter. An operator can identify common defects and estimate their size. The equipment is particularly suited for checking at fishplates.

039456
COUNTING TRACK DEFECTS

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Apr. 1966, pp 30-31, 4 Fig

This article discusses the development of a system for the New York Central Railroad to measure track irregularities, which uses crosslevel as the parameter of measurement. The readout is given in digital form at the end of any geographic unit desired. Crosslevel limits have not yet been determined. Further improvements include the addition of horizontal and vertical accelerometers to record dynamic action.

039459
TRACK LIMITATIONS ON SPEED

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, July 1956, pp 100-101

The article is a review of the findings of a book, "Super-Railroads for a Dynamic American Economy." The discussion is concerned primarily with the effects of curvature and gradients upon hp requirements for locomotives. The effect of speed restorations upon train speed and resulting power waste is considered. Although locomotive power increases, this does not eliminate the need for track alignment and re-grading to reduce the number of speed limitations.

039460
TIGHT-JOINT LONG RAIL LENGTHS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Aug. 1956, p 32

The use of high torque bolts in a testing situation by U.S., railroads is discussed. These bolts were being tested as an alternative to continuous welded rail, to eliminate the problems of transport, laying, renewal which is inherent in use of welded rail. Rail used in 132 lb RE with six hole joints held by 1-1/8 in. bolts. So far, measurements have not given significant results except for the flow of metal at rail ends, plus shipping of rail joints.

039464
FORCE MEASURING CELLS

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

May 1971, pp 499-500, 3 Fig

This article discusses the design of a load cell which was primarily to be used in the measurement of forces present in bridge abutments and piers when measuring traction and braking forces on these structures. Considerations used in prototype design are discussed as well as the formulized production model.

039465
STRESSES IN THE TRACK SUBSTRUCTURE RESULTING FROM TRAFFIC LOADS

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

May 1971, pp 494-498, 3 Fig, 1 Phot

Experimental research has led to findings concerning the interactions between the different structural components of the track under quasi-static loading conditions. The tests were intended to show whether the results found for the quasi-static range can also be regarded as valid under dynamic conditions. Results showed that there is a linear correlation between the measured sleeper reaction and the pressure or stress in the ballast and formation. The results showed a relatively high degree of scatter, amounting to 17.5% for a concrete sleepered track without rail joints, and to 25% for a track on wooden sleepers with rail joints. The maximum vertical stress in the formation decreased in the course of time due to changes in the stress distribution. For certain soils, there is a definite limiting stress. If this stress is exceeded, repeated load applications will lead to a rapidly increasing deformation and to plastic setting. Below this (limiting stress), repeated load applications will merely cause permanent deformations.

039471
PULSATOR TESTS WITH ELASTIC RAIL SPIKES

Birman, F, German Federal Railway Directorate

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Apr. 1970, pp 271-272, 2 Fig, 1 Tab

The article is concerned with a testing program of double and single-shank elastic rail spikes. The tests used these spikes with rail of various widths and heights with inclined loading. Rail was placed on timber cross ties or with steel base plates between the rail and ties. Results of the tests are compared on the basis of vertical and horizontal loading, in terms of laboratory and equivalent track tons translated into tons per day over a period of years to show the resulting permanent gauge widening with the fastening/rail/tie combinations.

039473
SLIGHTLY STAGGERED RAIL JOINTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 94, Feb. 1951, p 201

The staggering of rail joints is logical because it avoids placing two weak spots, the joints directly opposite each other; it reduces the impact at the joints to that of a wheel load instead of an axle-load; and it produces a more uniform vertical continuity of the track. Certain railways in India experimented with short-pitch staggered joints. Graphs obtained with the Hallade track recorder showed that the running over the slightly staggered road was inferior to that over normal square-joint track. Selection of the optimum pitch for the stagger is half the length of the wheelbase of the standard type of bogie fitted to passenger stock. This complies with the condition that the stagger must be less than the minimum wheelbase of any bogie allowed to run over the line, namely, 6 ft.

039484
PROGRESS IN RAIL WELDING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Mar. 1968, pp 177-179, 1 Fig, 4 Phot

The components necessary for rail preparation, rail welding and welded rail dispatch areas are discussed. Also discussed is the economics of using mainly automated equipment where labor costs are high, and using minimal automated equipment where labor is plentiful and inexpensive.

039488
SERVICE EXPERIENCE IN BELGIUM WITH BOLT-SECURED RAIL FASTENINGS

Gunst, G, Belgian National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Aug. 1970, pp 708-709, 1 Fig, 2 Phot

The article discusses testing by the Belgian National Railways of a standard baseplate with a double spring clip to replace fasteners with helical spring washers. This results in greater elasticity between rail and cross ties to absorb vibrations. The absorption of such vibrations can do away with one or two retightenings of fasteners to offset the greater cost of the clip.

039492
FASTENING RAILS TO A CONCRETE DECK

Deenik, UJF, Netherlands Railways
Eisses, JA, Netherlands Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Mar. 1966, pp 230-236, 15 Fig, 3 Phot, 4 Ref

Engineering design criteria for rubber-bonded cork pads on concrete are developed to account for geometry, the compression characteristics of the pads, axle loading and compression spring characteristics. An inspection coach, wagon and modern train with rubber spring wheels were run over the test track and vibrations in the rails and concrete slabs were measured. It was found that soft pads have better damping properties than hard pads for all frequencies, and ballasted track has less satisfactory damping properties than soft rubber-bonded cork pads. From sound level measurements, it was concluded that rubber-bonded cork also produces less sound to be critical in eliminating a very noisy hammer effect caused by separation of the rail and pad.

039496
RAIL FAILURES ON BRITISH RAILWAYS

Dearden, J, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Feb. 1965, pp 148-150, 4 Tab, 4 Phot, 1 Ref

Every rail or portion of rail that has to be removed from a running line prematurely because of a break, crack or other defect has to be reported as a failure; failed welds that are repaired by re-welding in situ without the removal of a rail must also be reported. Information relating to the rail and its conditions of service is coded and punched on computer tape. This enables the failures in any year to be easily and quickly analyzed according to region, rail section, age, traffic carried, class of line, manufacturer or any other feature considered to have or suspected of having an influence on the failure pattern. Failures in tunnels and on water troughs are analyzed separately from failures elsewhere, as are failures at welded joints. Types and causes of failure for 1961-1963 are reported. Comparisons between regions and manufacturing process used to produce the rail are also made.

039513
RESUME OF LONG CAR TRACKING PROBLEMS

Douglass, JR, Louisville & Nashville Railroad

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Technical Proceedings from 1964 Railroad Engineering Conference.

It was necessary to employ a special coupler in the design of the 86'6" Hy-Cube box car for automotive stampings. To permit those cars to negotiate curves it was necessary to use a nonstandard 60-in. "F" shank coupler with a Type "E" head. The coupler carriers have been broken on several of the cars as they were passing over vertical curves of lesser radii than the cars were designed to negotiate. Coupler carriers on other cars coupled to Hy-Cube cars have been literally torn off while negotiating vertical curves. The most prevalent difficulty with the long couplers on cars with long overhangs, is caused by missed couplings. Accidents of this kind smash angle cocks, train line nipples, uncoupling mechanisms and in many cases causes much damage to the center sills, especially to sliding center sills. The answer to longer trains and reduced draw-bar pull may be automatically controlled locomotives spaced in trains.

039524
A RAIL REVIEWAL PROBLEM

Bradwell, RO, Denver and Rio Grande Western Railroad
Love, JB, Denver and Rio Grande Western Railroad

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp 55-61, 4 Tab, 2 App

Included in "Engineering Economic Analysis in Railroad Planning and Operations."

In a period of a few months the frequency of rail end failures in the twenty miles west of Grand Junction increased alarmingly. Intensified inspection and a reduced speed limit have the problem under control. A quick decision needed to be made: to either continue the speed and inspection control, replace the rail, or weld the present rail. Each branch of the decision tree is evaluated with a cash flow anlaysis, discounted for the desired rate of return. The analysis calculations are shown. Based on this analysis, the existing track was welded.

039525
THE REPLACEMENT PROGRAM

Reiner, IA, Chesapeake and Ohio Railway

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp 63-73, 5 Fig

Included in "Engineering Economic Analysis in Railroad Planning and Operations."

A decision analysis is conducted to determine if concrete cross ties should replace wooden cross ties. Tie spacing using concrete is about 4 or 5 inches wider than is required for wooden tie spacing to handle the same traffic conditions. The examples shown indicate that concrete ties are a sound investment in high traffic density, heavy grade and sharp curve territories where sufficient savings can be accumulated in a relatively short period of time. On the other hand, tracks carrying an insignificant amount of traffic cannot produce an acceptable rate of return if they are constructed with concrete ties.

039528
PERMANENT WAY TESTS AND PRACTICE ON THE L.M.S.R.–I

Wallace, WK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, Oct. 1942, pp 420-421, 2 Tab, 6 Phot

Track realignments necessary to accommodate the Coronation Scot, a 90 mph passenger train, are described. A total of 269 curves were eased for a single track mileage of 244. A test using various fastenings is described. Ten track locations, where lateral stress was high and traffic load varied, were selected. The test results are tabulated.

039529
PERMANENT WAY TESTS AND PRACTICE ON THE L.M.S.R.–II

Wallace, WK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, Nov. 1942, pp 489-490, 1 Tab

Joints in tunnel track, experience with continuous welded rail, use of short fishplates, experience with Douglas fir cross ties, and tests using flat-bottom rail are described. These early tests with welded rail indicated that reduced maintenance costs could not offset the added initial costs.

039533
MECHANISATION OF PERMANENT WAY MAINTENANCE AND RENEWAL

Robertson, VAM, British Railways
Mucherie, ML, French National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, June 1949, pp 607-608

The use of specialized equipment for maintenance of the permanent way is reviewed. Activities in various countries are synopsized.

039534
RECENT IMPROVEMENTS IN REINFORCED AND PRE-STRESSED CONCRETE SLEEPERS

Robertson, VAM, British Railways
Gonon, M, French National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, June 1949, p 635

The report summarises the steps now being taken to improve the design of concrete sleepers, and widen their field of use. It includes details of the design and manufacture of concrete sleepers now in use, and a summary of research work undertaken during the past few years.

039537
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE-Pub-25, July 1967, pp 20-25, 7 Fig

Question D72.

Accelerations were analyzed with reference to comfort in passenger bogie coaches and two locomotives were used to ascertain the effects of the guide force on wear and fatigue of the switch fittings. The object of these studies were to discern the influence of the following factors on accelerations and forces at various speeds: size of the angle of impact; radius of curvature of the turnout; transverse stiffness of the track; and characteristics of the vehicle suspensions. An analogue computer and a digital computer were used for making the calculations. Results of the calculations are shown.

039538
RESIDUAL LONGITUDINAL STRESSES IN THE RAIL

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-25, July 1967, pp 19-20

The residual stresses result: from heat effects during the cooling of the rail after it leaves the rolling mill; from trimming, after rolling in the vertical and horizontal directions; and from the plastic deformation of the top surface of the rail by the passage of loads. Several existing methods are compared for determining the residual longitudinal stresses. A test was made by the SNCF on four rails which were removed after 11 years of service (tonnage 11 million tons). Before laying and after removal, the vertical deflections were measured. It is apparent that the longitudinal compressive residual stresses produced by cold rolling at the level of the contact surface give rise to a curvature.

039548
DETAILED INVESTIGATIONS INTO SLEEPER DEFECTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, June 1953, pp 725-726, 1 Tab

In 1950-51, 400,000 failed wooden cross ties were examined and classified as to the type of failure: (1) decay, (2) plate-cutting, (3) splitting, (4) shattering, (5) spike killing, (6) braking (7) ring separation, and (8) accident. Five types of wood were involved, but 85 percent of the sleepers examined were of pine or fir species more universally used then the other two, oak and gum. Plate-cutting, splitting and shattering accounted for about 1/3 each of the total failures.

039551
RAIL FLAW DETECTION BY ULTRASONIC BEAM

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, July 1953, pp 45-46, 2 Phot

The Audigage flaw detector, of Branson Instruments Inc. consists of a small-battery-operated ultrasonic frequency generator and receiver, carried in an 11-1/2-lb. pack on the operator's back, a crystal in a special holder on the end of a long handle, and a pair of headphones. The crystal is applied to the head of the rail and the presence of a crack indicated by a lowering of the continuous tone produced in the headphones by a perfect rail. In a cracked rail the wave is reflected by the flaw, and a change in tone—or loss of tone—is produced in the headphones. The nearer the crack to the head of the rail, the greater is the drop in frequency. The instrument has been in use by London Transport for about three weeks, during which time some 15 miles of rail have been inspected with it. Several minor defects which were not revealed by visual inspection were discovered in sections of rail covered by the fishplates.

039554
BALLAST CLEANING WITH SINGLE-TRACK OCCUPATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Aug. 1953, p 240, 3 Phot

Experiments have been made with methods involving the occupation of only one track when using mechanical ballast cleaners. In the present experiment, the conveyor discharging the dirt, drops its material on to a second conveyor mounted on a rail wagon, which in turn delivers the material into a hopper on a simple steel framework carried on a flat wagon. This framework is of sufficient headroom to permit a low type of dumper to travel underneath it. The dirt is released from the top hopper into the dumper through drop doors and the dumper then travels the length of the train and tips the dirt into wagons standing on the same line. Results to date are most encouraging and an output has been achieved approaching that obtained when screening into wagons on an adjoining road.

039557
TRACK DRAINAGE BETWEEN HARROW AND SOUTH KENTON, L.M.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Oct. 1953, pp 436-437, 4 Phot

The renewal of the formation and the provision of new track drainage between Harrow and South Kenton became necessary when ballast became choked, resulting in the prevention of effective drainage and the formation of slurry which flowed into the track drains. The first stage in the renewal is the removal of track in one line of the natural formation to withstand the loading of traffic. The next stage is the graduation of the formation to a crossfall to the new drainage system. A sand blanket of sufficient thickness to blind the clay and prevent it pumping and fouling the ballast is then laid to the required crossfall, the drainage system is placed, and the track ballast unloaded. The track is then reinstated and fettled up.

039558
PROTECTING RAILWAY SLEEPERS IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Oct. 1953, p 465, 2 Phot

A mastic-type coating, Protext Coat, manufactured by Nox Rust Chemical Corp., has been found to prevent splitting in wooden cross ties. It is fire resistant and easy and cheap to apply. Cost per tie is about 25 cents. Eight to ten years additional tie life is claimed.

039559
GROUTING OF RAILWAY EMBANKMENTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Nov. 1953, pp 547-548, 4 Phot

A new method of stabilizing fissures in clay formations was developed by British Railways. It involves the injection of a neat cement water grout into the clay under pressure. This method differs from that known as track grouting inasmuch as the grout is introduced much deeper below track level from 15 to 17 ft. and at a relatively higher pressure. Cost per linear foot is about 8 pounds.

039560
FASTENING FLAT-BOTTOM TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Nov. 1953, pp 573-575, 5 Phot

The Electric Rail Spike Co. has developed a new spike fastening for flat-bottom track which is claimed to solve rail movement, including creep, spike killing and wear of track components generally. The spike is made from one piece of silco-manganese steel bar, suitably formed to give a laminated shaft and head 5/8 in. square, then hardened and tempered. It is driven until the head makes contact with the rail foot, and thereafter a further amount of some 3/16 in. which flexes the head and puts proportionate (800 lb.) pressure on the rail base. The spikes stand up very well under derailment, and can be used with concrete sleepers in conjunction with a wood insert or for track circuits. The rubber-covered spikes can also be used with cast-iron or steel baseplates.

039562
ORGANIZATION OF TRACK MAINTENANCE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Jan. 1954, p 95

This article covers a report made to the sixteenth Inter– national Railway Congress on a survey of the maintenance policies of fourteen railway administrations. The focus is on organizational aspects of maintenance gangs, and track recording devices.

039564
TRACK MAINTENANCE PROBLEMS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Feb. 1954, pp 150-151, 1 Tab, 1 Ref

This summary of track maintenance problems was obtained from the railway administrators of the International Railway Congress. All the railways consulted are studying possible modifications in the traditional maintenance organization, but investigations are still in the experimental stage, and there are no indications what the final pattern will be. The experiments can be grouped into two categories: (1) Concentration of smaller into large gangs, and the various methods of transport for their mobility, and (b) mechanization. The article summarizes activities and equipment used by various countries in the areas of track recording equipment, speed restrictions and signals and mechanical tools and mechanization problems. Economic and financial aspects are included as well as the use of medium-sized gangs for maintenance.

039566
FLAT-BOTTOM TRACK IN GREAT BRITAIN—II

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Oct. 1944, pp 379-381, 2 Fig, 4 Phot

A description is given of the first 110 lb. flat-bottom turnout installed in Britain, in 1944. Detailed illustrations and photos are included.

039570
RAIL STRESSES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, June 1954, p 623

The existence of tensile stresses in rail heads had been well known for many years; they occur under vertical loading on straight or curved track, at the short middle lengths between successive wheels. The most serious cause of tensile stresses, however, is the net lateral load producing a twisting moment on the outer rail of a curve, generally due to the flanges of the leading bogie and leading coupled wheels.

039573
TIMBER, STEEL OR CONCRETE SLEEPERS?

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, July 1954, p 116

In recent years timber costs have risen so abruptly that railways have had to search for alternate materials for their sleepers. The battering to which a sleeper is subjected under traffic has generally proved too much for the normal reinforced concrete sleeper, but with the introduction of pre-stressing methods, the prospects of concrete in this field are much more promising, especially if some form of resilient cushion is provided between rail and sleeper. The concrete sleeper, though it would appear to outlive its wooden competitor as a rule, is heavier and generally more difficult to handle. Moreover, a road laid with either steel or concrete sleepers is less suitable than a wooden-sleeper track for track-circuiting. It must also be remembered that steel sleepers laid near the sea or in areas where the atmosphere contains corrosive ingredients are subject to serious erosion and deterioration. The relative costs of day-to-day maintenance of wooden, steel, and concrete sleepers are not readily comparable, largely because there are so many different types of fastening used with each.

039575
FASTENING FLAT-BOTTOM RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, July 1954, pp 129-130, 1 Fig, 2 Phot

A half-mile length of track on the Metropolitan Line of London Transport has been laid with a fitting known as the Hey-Back Soleplate fastening. This method of securing the rails to the sleepers will tend to reduce the cost of laying and relaying without increasing the cost of the material involved, and show decided technical improvements over existing practice. It insures a definite increase in economy in track maintenance, is adaptable to any type of sleeper in use, easily and rapidly inspected has as few parts as possible, and is able to be fitted by unskilled labour. The combination of the Hey-Back soleplates with a resilient solepad provides a completely shock-resistant flexible system of fastening without reducing the effectiveness of its anticreep restraint, and also creates a high electrical resistance between rail and earth or rail and rail.

039576
MATERIALS FOR TRACK BALLAST

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Aug. 1954, p 229

It is generally agreed that the ideal ballast is hard stone broken to suitable sizes. The main characteristics of good ballast are that it should be hard, heavy, resistant to crushing, shock abrasion and weathering– especially due to frost–clean, and reasonably binding but loose enough to permit of free drainage. Crushed stone such as granite, quartzite, igneous rock, or trap, has the advantage of being very hard and angular, and even broken limestone and sandstone may also be reasonably hard. Crushed slag has the characteristics of rock, but it induces dry rot in wooden sleepers. Cinders or ashes are the cheapest form of ballast; they provide good drainage, but powder and cake too easily for other than yard or unimportant branches. Their greatest fault is that they quickly corrode the feet of rails and steel sleepers in contact with them. Sand, as well as being cheap, makes a stable lower ballast.

039579
RADIAL ARM EQUIPMENT FOR GAUGING STRUCTURES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Oct. 1954, pp 461-462, 1 Fig, 3 Phot

British Railways have designed radial arm equipment for gauging the clearance of structures near track which consists of (a) the radial arm unit comprising a carrier beam, a graduated disc, and a telescopic arm; and (b) the pedestal unit, upon which the radial arm is mounted; the latter unit registers with the running edge of the rail adjacent to the structure to be profiled. The advantages claimed for this type of equipment are summed up as follows: (a) greater accuracy; (b) speedup of measurements on site; (c) fewer site dimensions required; (d) reduced track occupation; (e) simplicity in computation of results; (f) reduction in drawing office time plotting; (g) constant result from running edge of rail adjacent to structure.

039580
GRINDING TRAIN FOR CORRUGATED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Nov. 1954, pp 520-522, 1 Fig, 4 Phot

A new type of rail grinding train has been constructed, and after trials a train was supplied to the German Federal Railway. Immediately behind the locomotive is a tool wagon, followed by a van containing two diesel units generating 300 kVa., with the necessary ancillary equipment for driving the grinding assemblies. The other three wagons are the grinding cars. They contain the grinding machine sets and the control gear for the grinding operation. Each grinding car contains eight grinding units; four arranged on either side, so that in the complete train 24 grinding units are available, 12 for either rail. To obtain good results a relatively low traveling speed when grinding of 1.8 mph is imperative It is expected that in a full operational year about 2,500 miles of heavily corrugated rail may be ground.

039581
KEEPING DOWN WEEDS AND GRASS ON RAILWAY PREMISES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Dec. 1954, p 656

The present manpower shortage in Britain has aggravated the problem of preventing the growth of, and destroying, weeds and grass on railway premises. Weed-killers may be classified into two main groups: (a) non-selective, comprising materials which kill all vegetation with which they come in contact, and (b) selective, comprising materials which kill weeds only, without damage to the finer grasses. In the control of the growth of grass, maleic hydrazide is claimed to be of great assistance. It will also mix quite well with a 2, 4-D spray so that the whole growth of weeds and grass can be controlled with the one spray.

039582
MECHANICAL REPLACEMENT OF SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Dec. 1954, p 658, 1 Phot

A machine known as TieMaster was designed and manufactured to reduce labor and costs in sleeper renewal operations. It is track-mounted and can be operated without fouling traffic on adjacent tracks. Its primary functions are to remove old sleepers and place new ones in position in the track after clearing away sufficient ballast for this purpose. The actual changing of the sleepers is stated to consume only 30 sec. and requires only one operator and two labourers.

039583
WEEDKILLING TRAIN AND PORTABLE EQUIPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Dec. 1954, pp 717-718, 6 Phot

The weed spraying equipment used by the British Railways in the Western Region is described. The usual formation of the weedkilling train used is: engine; three converted tenders; tank wagons of weedkiller (usually not more than three); operator's living van; and brake-van.

039585
MODERN DEVELOPMENTS IN TRACK MAINTENANCE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 94, Apr. 1951, p 479

After tracing the history of the Permanent Way Institution's instructional and examining organization until its takeover by the railways in 1944, capabilities currently required of personnel in the field are mentioned, especially instrumentation expertise. Increasing use in the future of mechanized track construction and maintenance equipment is forecast, including the crane method of prefabricated relaying and twin-jib relayers. It is predicted that major formation improvements will be required in Clay county, and necessary resources due to nationalization under the British Railways will provide the right methods and materials.

039586
TRACK MAINTENANCE AND RENEWAL

Cookson, EC, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 84, May 1951, p 577, 1 Tab

Excerpts of a paper entitled "Methods of Effecting Economy in Track Maintenance and Renewal" are presented. Topics such as the size of maintenance crews, sleeper comparisons, rail fastenings, and the effect of crane utilization on crew reductions are covered.

039589
CONTINUOUSLY-WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Aug. 1951, p 207

To offset the increased cost of laying welded as compared with bolted rail ($1000/mi) important savings are being effected. The first is in general track surfacing work. The initial 5-1/2 miles of Elgin Joliet and Eastern Railroad welded track, laid in 1943, will not require general surfacing for another two or three years yet, though it carries 20,000,000 gross tons of traffic annually; in the normal course it would need general surfacing every seven years, and joint surfacing, now no longer needed, at much shorter intervals. Also, construction methods, maintenance benefits and costs are discussed.

039591
MECHANIZED APPLIANCES FOR PERMANENT WAY MAINTENANCE–1

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1951, pp 492-494, 4 Phot

The demonstration of the latest types of mechanized equipment used in the maintenance of British Railways permanent ways is described. Included is a discussion of mechanical equipment used for both temporary and permanent maintenance of foundations, with emphasis on methods for improving drainage and/or removing clay to stabilize the foundation from degradation by rain water.

039592
MECHANISED APPLIANCES FOR PERMANENT WAY MAINTENANCE–2

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1951, pp 520-522, 4 Phot

Effect of moving traffic on load-bearing structure formed by ballast, sleepers, and rails is examined and methods used in maintenance are described. Rail creep adjustment, measured shovel packing ballast cleaning and rail lubrication methods are mentioned.

039593
MECHANISED APPLIANCES FOR PERMANENT WAY MAINTENANCE–3

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1951, pp 576-577, 2 Phot

A comparison is made of the manual and mechanical methods of track renewal. The use of cranes for track relaying is emphasized.

039594
MECHANIZED APPLIANCES FOR PERMANENT WAY MAINTENANCE–4

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1951, pp 601-602, 4 Phot

Development of equipment for permanent way depots and for maintenance gangs is described. At a pre-assembly depot, lengths of new track are assembled and loaded, and lengths recovered from a renewal are unloaded and dismantled. On the other hand, at reclamation depots materials received from renewals are stripped, classified, and either reclaimed for use elsewhere, or disposed of as surplus to requirements. Details of these operations are reviewed.

039599
PREVENTING THE FORMATION OF ICE ON CONDUCTOR RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Feb. 1952, pp 157-158, 3 Phot

De-icing developments and procedures in use by the London Transport are summarized. Mention is made of (1) de-icing baths having non-spring rollers and (2) thermostatically-controlled baths.

039600
MODERNISING TRACK MAINTENANCE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Feb. 1952, p 200, 2 Ref

This article is an excerpt of a paper entitled "Productivity on the Permanent Way". In that paper the author describes the essentials of adequate maintenance of the formation and of the upkeep and renewal of the track. In addition, the paper focuses on measured shovel packing and the different methods of laying prefabricated track; (a) using a diesel-electric crane with a streamlined rear profile to clear structures and passing traffic, and (b) with twin cranes having retractable horizontal jibs mounted in tandem.

039602
GAUGING THE USEFUL LIFE OF RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Apr. 1952, p 375, 1 Fig, 1 Phot

A device for determining the useful life of a rail is described. This particular instrument requires no attachment to the rail as do many other devices. The weight of the rail is read directly on a single scale. Also, a cross-section of the worn rail can be produced.

039603
TRACK STABILITY ON THE NETHERLANDS RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Apr. 1952, p 397, 1 Ref

The science of soil mechanics is of greater importance in Holland than in almost any other country because the bearing capacity of the ground is generally low. For the preliminary exploration of the quality of the soil, two standard field tests are made by specially-trained inspectors. The first involves the measurement at intervals of the resistance to pressure when and as a cone of standard diameter and angle is forced down into the ground. The other is the sampling of the soil taken from borings at different depths; the samples are subsequently dried out and examined. Three track construction and stabilization works were in hand in 1950. A new 6-1/2 mile double line had to be constructed between Rotterdam and Nieuwerkerk, mainly over polder land 15 ft. below sea level. The second work was the strengthening of the formation under the double-track main line between Gouda and Oudewater where it is on embankment over peaty subsoil. In the third operation though an electrified and reballasted, traffic was maintained by laying a temporary track at one side complete with overhead conductor.

039606
DISNEY RESILIENT RAIL CHAIR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Apr. 1952, pp 460-462, 5 Fig, 4 Phot, 1 Ref, 1 App

These chairs were installed nine years ago on the double-line 350-ft. steel central span of the Victorian Bridge over the St. Lawrence and extensometer tests have shown "important reductions in impact stresses" in the superstructure. Other advantages claimed for this chair and its fittings include the elimination of sleepers and their renewal; of ballast, its cleaning, maintenance, and waterproofing; reduction of vibration, bridge dead load, and construction depth; also of excavation in tunneling. Moreover, the positive resilient grip on the rails minimizes wear between track and components, provides uniform distribution of stress, limits vibration, and ensures greater cleanliness and a truly-aligned track, as well as greater safety. It eliminates track maintenance, is economical and secures a long-enduring road and trouble-free operation.

039611
FASTENINGS FOR FLAT-BOTTOM RAILWAY TRACK–1

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, July 1952, pp 44-46, 6 Fig, 6 Phot

Since the introduction of the 109-lb. and 98-lb. flat bottom rail on British Railways, considerable trial and experiment has taken place with different types of baseplates and fastenings, with a view to ascertaining the most economical and efficient types for general use. Characteristics of the various types now in general use or undergoing tests on British Railways are described.

039612
FASTENINGS FOR FLAT-BOTTOM RAILWAY TRACK–2

Railway Gazette (Temple Prss Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, July 1952, pp 67-69, 6 Fig, 6 Phot

Specific design features of rail fastenings are described and illustrated. The following types are covered: (1) elastic rail spikes, types "A" and "T", (2) Macbeth spike anchors, type "2" and "3", (3) spring clips and bolts (4) mills loose jaw and taper key, and (5) Hey-Back fastenings.

039614
RAIL-END DEFECTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Aug. 1952, pp 199-200

Of all steel rail defects, probably the most difficult to detect are those which occur at the rail-ends and are concealed by the fishplates. The major cause is the pounding and vibration to which rail-ends are subject because of the gap between the rails over which the rolling load must pass. This may encourage the development of corrosion fatigue cracks from any sharp edges, such as those of the fishbolt holes or in the fishing angles of the rails, where stresses are concentrated. In the course of ordinary inspection, the only way to discover whether or not a rail is cracked at the end is to take off the fishplates but this is a costly operation from the labour point of view. In the United States certain railways are now supplementing the regular patrolling of their tracks with Sperry or other detector cars by supersonic testing of rail-ends. One of the problems arising from such inspections has been to decide at what stage of development a crack becomes sufficiently serious to demand the removal of the rail from the track. To remove all rails in which small cracks are found would appear to be an unjustifiable costly proceeding. The present practice of classifying the cracks and removing from the track only rails that have cracks of over a certain length, would appear to be reasonably safe, and far less costly than the indiscriminate removal of all rails showing the slightest sign of cracking.

039615
THE LAVAL LONGITUDINAL CONCRETE SLEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Aug. 1952, pp 239-240, 3 Phot

The Laval track consists of two longitudinal rows of reinforced concrete blocks, one under each rail. The blocks measure 1.3 m long 0.7 m wide, and 0.16 m deep. Each block weighs about 750 lb. Between successive blocks there is a space of 0.2 m in which steel tie-bars are fixed to the rails for retaining the correct gauge and the 1 in 20 cant of each rail. Details of track design and installation are examined.

039616
MAUZIN TRACK INSPECTION CAR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Sept. 1952, pp 294-296, 1 Fig, 3 Phot

This vehicle was designed to detect measure and record graphically all variations in true alignment, top and cross-level and curvature of the running rails under loaded conditions. The French National Railways have built three of these cars; two are in constant use in France and the third works regularly outside France. The equipment consists of a special eight-wheel bogie, situated midway between the normal running four-wheel bogies of the vehicle and sharing equally the weight of the vehicle. Thus a total of 16 wheels is available to form a reference plane and detect all vertical variation. Similarly, six disc-mounted feeler shoes which follow the contour of the running edge of the rail reveal any lateral displacement of the track. Vertical irregularities on each line of rails are detected by recording the difference between the height of one wheel and the average height of all eight wheels on that side of the vehicle. Alignment is determined from versines which are measured on each line of rails over a 10 m. chord by means of three disc-mounted feeler shoes bearing laterally against the rails. Gauge is measured by two disc feeler shoes bearing on opposite rails at two points on a line at right angles to the center line of the track. Variations are measured full scale.

039622
SOIL MECHANICS AND THE CIVIL ENGINEER

Toms, AH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

p 24, -244, 1 Fig, 1 Phot

The most satisfactory methods to be adopted in the stabilization of troublesome banks and cuttings can be decided only after a proper examination of the site by means of borings or trial holes. Should bridges, tunnels or other structures be involved, the engineer will need to know at once what earth pressures will be exerted on the structures and also what bearing pressures can be adopted without risk of either complete shear failure or excessive settlement or other movement due to subsequent consolidation of any compressible strata. The fields in which railway engineers are most in need of knowledge are: inexpensive waterproof coatings or carpets which can be used on the side slopes of banks or cuttings to prevent the penetration of rain, and which will be sufficiently resistant to frost, heave or other effects of weather; corresponding methods of treating the formation; swelling pressures of clays and active pressures on retaining walls and other similar structures and whether appreciable plastic movement of a foundation on clay can take place at pressures below those calculated, which are based on ultimate shear strength.

039624
CREOSOTING OF TIMBER

Chamberlain, R

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 78, Apr. 1943, p 433

The article, digested from a lecture, discusses the preservation of sleepers and other forms of railway timber by the "full cell" process. Other methods of treatment and a description of Baltic Redwood and its felling, haulage, transport, and manufacture into sleepers are also dealt with, however, as well as a typical creosoting depot and its activities. The laying of the sleepers and chairing processes are given.

039625
THE STEEL RAIL, PAST, PRESENT, AND FUTURE

Allen, CJ, London and North Eastern Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 78, June 1943, p 557

The author makes a plea for more adequate research into problems concerning the manufacture and composition of railway rails. It is suggested that a joint committee of experts be formed from many railways to pool ideas for rail research. Cooperation should be sought from the manufacturers and information from all railways should be pooled to advance the technology to decrease rail defects.

039627
A NEW FATIGUE DEFECT IN RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 79, July 1943, p 38

The shelling defect has been most commonly encountered in the 131-lb standard flat-bottom section, though it has been reported in some degree in all sections from 100 lb. upwards. The first manifestation of the trouble is the appearance, on the running surface of the rail near the running edge of dark spots, which indicate the presence of horizontal planes of separation of the steel within the rail-head; these may occur at a number of different levels in the same rail. The shelling is the result of wheel action on the rail causing failure of the metal, either by direct stress exceeding the elastic limit, or by loss of ductility which is the outcome of constant reversals of stress. Factors which may influence the relative severity of the shelling are the inclination of the rail, the superelevation, the bearing pressure exerted by the wheels, the radius connecting the flanges and the treads of the wheels, and the radius of the gauge corner of the railhead.

039628
RAIL CORRUGATIONS

Burgess, JH, Queensland Government Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Aug. 1943, p 134

Methods by which this defect has been minimized on the Queensland Government Railways are discussed. The correction of railjoint dip, closing in of joint sleepers, and provision of clean elastic stone or gravel ballast has made an even top and a springy rail which has reduced the wheel-rail contact stress so much that rail rippling and corrugation is no longer a major problem. The greatest cause of overstress is the solidity of the rail bed which reduces tremendously the depression of the rail under wheel press and thus increases the local intensity of the stress. Other causes are open and dipped rail joints, easily deflected rail ends at joints, pumping sleepers, and track out of gauge and level. The metallurgical treatment of the rail steel, rolling and work effect when shaping, finished shape of the head, and chemical constituents of the metal, are very important. Higher strength rails such as sorbitic or chromium-steel rails oven-cooled will reduce the defects considerably. Long rails assist. There should be sufficient ballast to give an even bearing on the sub-grade. Elasticity of the whole track is most important and here sleeper spacing with depth of rail is to be considered for correct proportioning.

039636
RAIL WEB FAILURES

Code, CJ, Pennsylvania Railroad

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, Feb. 1955, p 162

Out of 30,881 failures of new rails in U.S.A. tracks in 1942-51, and removed during that period because of defects, 13,554, or 44 percent, were web failures. The great majority of the latter were failures within the area of the rail joint. Laboratory and track tests showed that many web failures could be explained by corrosion-fatigue but not by corrosion alone. Various factors increase the web stresses at rail ends. One is poor or irregular fit of fishplates; loose or worn fishplates or loose fishbolts have a bad effect, as they are liable to cause greater impacts to develop under the rolling load. Excessive gaps at the rail-joints or battered rail ends similarly tend to increased impacts.

039638
CLEARANCE OF SNOW AND ICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, Feb. 1955, pp 219-221

This article compares what has been done by European and North American railways to combat snow and ice. For snow clearance all railways seriously affected use ploughs which may be either of the ordinary steel-blade type for pushing snow aside, or of the rotary type. While the rotary type is more effective in deep drifts, it is more expensive in capital, maintenance, and operating costs. In addition, it is comparatively slow in operation. For removing packed snow and ice flame guns and steam lances are used in Great Britain. Electric point heaters are used in Great Britain, U.S. and Germany. Sheds and screens are used for avalanche protection in Switzerland and France.

039639
IMPROVED WEEDKILLER TRAIN FOR BRITISH RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, May 1955, pp 509-511, 3 Phot

As normally operated, the train is composed of eight vehicles. There is a machinery and equipment vehicle, which does the actual spraying, and next to it, a messing and accommodation van. The remaining six vehicles are rail tank wagons. The machinery and equipment vehicle is a converted Southern Region luggage van, 32 ft. in length. This is divided into two compartments, the larger of which, 18 ft. times 7 ft. 8-1/2 in., contains the main pumping and spraying equipment, and the smaller storage space for tools and loose equipment, as well as a work bench. The van is vacuum fitted. Weedkiller solution is drawn into the machinery van from the tanks by a 4-in. pump driven by belt from one of the axles of the van. The outside booms have four nozzles each and spray on the cess and "six-foot" on double track or cess, "four-foot," and cess on single track. The normal rate of application of weedkiller solution is 280 gal. per mile over a total width of 16 ft. The total capacity of the train is 15,000 gal. The normal crew is four.

039650
RAIL-MOUNTED TRENCH DIGGING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 330-332, 2 Phot

A diesel-powered machine for cutting trenches for drains alongside the permanent way is undergoing tests by the Civil Engineers Department of the Western Region, British Railways. The machine is mounted on a framework which rests in a cradle pivoted on a specially adapted railway wagon. The machine has a maximum cutting depth of 6 ft. 3 in. below rail level, and the boom can be set at any depth between this and ground level. The bucket width is 18 in. which can be increased to 21 or 24 in. by the fitting of side cutters. Speed is continuously variable up to 6 ft. per min.

039652
TRACK MAINTENANCE IN JAPAN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, 3 pp, 1 Fig, 3 Phot

Due to heavy rains, extreme temperatures, excessive curves and grades, very heavy traffic and narrow gauge, track maintenance problems are intensive in Japan. Despite the use of greater depths and larger quantities of widespread stone ballast, closer-spaced sleepers, heavier rails, improved fittings and fishplates, and stronger joints generally, and a rapid extension of rail-joint welding, maintenance continues to be difficult. A rail-replacing machine and a mechanical ballast tamper are described. Both machine methods are labor intensive yet give more uniform results and are easier on sleepers than manual methods. The machines are designed to save time, since maintenance time is usually available in periods of less than 40 minutes between train traffic.

039653
EXPERIENCE WITH WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 343-344

The railroads in the U.S. in the early 1950's began substituting 78-ft. rails for the 39 ft. standards. The 78-ft. rails decreased the number of joints by 50 percent, which justified the longer rail on the basis of a corresponding savings on maintenance. The same equipment can be used to lay both size rails. Weld grinding to reduce the bulge at the weld is discussed. The repair of continuously welded rail is described.

039656
HEAVY-DUTY SANDER GRINDER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 389, 2 Phot

The 7-inch Heavy-Duty Optional-Speed sander grinder weighs only 14 lb. and delivers 90 percent more power than a previous, heavier model. The machine is available in three models with spindle speeds of 4,200, 5,200, and 6,000 rpm. The high-speed model can be used for grinding down welds on railway rolling stock.

039657
RECOVERY OF SPENT PERMANENT WAY BALLAST

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 390, 1 Fig, 1 Phot

Ballast recovered from the track is generally fouled by clay, oil, grease, ashes from locomotives, and spillage from wagons. A plant is now in use on British Railways to recover and re-grade spent stone ballast in a condition equal to that of newly quarried material by using a large volume of water for agitating and screening. A flow diagram of the plant is shown.

039660
PRESERVING TIMBER SLEEPERS IN THE TROPICS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Nov. 1955, p 534, 2 Phot

In 1929, keruing and kempas sleepers were laid on lengths of track of the Malayan Railway tracks. Their estimated service life is 28 years, and they are reported in good condition as of 1955. Preservation with Tanalith, followed by creosote-oil treatment gave both timmbers a service life claimed to be 10 years longer than that of chengal sleepers. Tanalith gave complete immunity to termite and fungal attack; but in a humid tropical climate extensive splitting of the timber can be caused by the alternation of prolinged rains with a long, hot, dry season. The creosote-oil treatment seals the timber, and reduces the strain between the dry and shrunken surface and the moist interior.

039664
FASTENING RAILS TO CONCRETE SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, Apr. 1956, pp 232-233, 1 Fig, 2 Phot

A new method of fastening rails to concrete sleepers has now been installed experimentally. The new type of fastening embodies certain features of German practice in conjunction with the use of a grooved rubber pad. The fastening is essentially of the clip type, the clip itself being secured by means of a long screw run into a corrugated wood plug cast in the concrete sleeper. The rail sits on a grooved rubber pad. The form of the wide V-shaped grooves, together with the hardness of the rubber selected, gives a very satisfactory load-deflection characteristic of the pad. Rubber has also been applied at both ends of the clip and rubber-bonded cork has been used under the head of the screw.

039668
THE SAFE LIFT OF RAILS EXAMINED

Wise, S Lindsay, D Duncan, IGT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 112, Jan. 1960, pp 64-65

The rail sections considered are the 109-lb. fb and rBS 95-lb. bh rail, both in common use on British Railways. Among the conclusions reached by the authors is the fact that the rail sections standardized by British Railways are of sufficient strength for long life under existing steam traffic where maintenance is good and corrosion not severe. But, they believe that rail life should be governed by the type, speed, and quantity of traffic carried rather than by loss of weight. Furthermore, they suggest that any practical way of altering rail joints to increase their life should be investigated and that the development of special joints for the ends of welded rails would appear necessary irrespective of any stress-relieving requirement.

039672
CONCRETE SLEEPER INSULATION ON SOUTH AFRICAN RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, Apr. 1960, p 396, 1 Phot

Large orders have been placed for two types of concrete sleepers suitable for neoprene pad insulation so that the programme of laying long-welded rails on concrete sleepers for main-line track may be carried out without hampering electrical signaling developments. One fastening uses a neoprene insulation pad, and a natural rubber resilient pad, togehter with a steel baseplate, coachscrews, and clips. Another has an alternative method of fastening of the Fist type. This also uses a neoprene pad between the rail and the concrete, but the fastening is a special spring-steel clip held in position by a bar that passes through the sleeper. This bar is insulated from the concrete with a phenolic resin compound. Experimental use of the pads has established the expectation of a five-year life for the pads at the minimum.

039673
WORK-HARDENING BOLT HOLES IN RAIL ENDS

Wise, S

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, Apr. 1960, pp 511-512, 1 Fig, 3 Phot

Analysis of rail failures has shown that the most frequently occurring type of failure is that classified as "4d" which takes the form of radial cracking from one or both boltholes known as star cracking. Various methods of improving the fatigue strength of drilled rails have been tested. The greatest improvement has been obtained by work-hardening the surface of the holes, by intially drilling undersize followed by broaching or drilling drifting with a spherical tool to the required size. The work hardening has resulted in increasing the fatigue strength of the rail by 50 percent, a figure which is maintained after exposure to corrosion. No trouble was experienced in workhardening any of the holes, including those where the axis is inclined to that of the rail.

039674
USE OF WEEDEX IN CHEMICAL WEED CONTROL ON BRITISH RAILWAYS

West, RL, Fisons Pest Control Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, Apr. 1960, pp 422-424, 3 Phot

The future of chemical weed control on British Railways lies in the use of the insoluble specially synthesized compounds. It is within the power of Weedex and Weedex "A" to give a high standard of weed control, both on the track and in the cesses, by single treatment at intervals of 12 months or more, without the necessity of supplementary handweeding. A revision of the spray programme and the introduction of modern technique of application will give a much better return, in terms of efficiency, on the money spent on chemical. Efficient chemical weed control is cheaper than handweeding. By taking full advantage of modern chemicals, improved application techniques, and scientific planning, a higher standard of weed control can be obtained at a far lower cost.

039676
LONG-WELDED RAILS ON BRITISH RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, June 1960, p 644

Prior to installing long welded rail, British Railways conducted a thorough 5 year investigation of the factors and potential saving to be realized. Among other things, a formula was derived to predict the buckling load of any type of track under any conditions. Additionally, it was found that concrete sleepers were more suitable with long welded rail than wooden ones. Details on how the British accomplished their modernization—began in 1955—are provided.

039678
STRENGTHENING TUNNEL LINING WITH STEEL PLATE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, June 1960, p 738, 2 Phot

The activity of lining a 400-foot long 70-year old tunnel with steel plate is briefly described.

039687
AN INVESTIGATION OF WELDING USED RAIL WITHOUT CROPPING

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

ER-41, Res Rpt, Dec. 1963, 15 pp, 9 Fig

An investigation was made of welding used rail without cropping by the electric flash pressure process. If such a procedure were found to be satisfactory, it would save the cost of cropping the rail prior to welding and the scrapping of the cropped rail ends. The following conclusions were reached: the fatigue strength at the bolt holes has been reduced and the possibility of a progressive fracture developing from the bolt hole has been increased as a result of the electric flash pressure weld; the presence of bond wire holes or welds on the side of rails that are butt welded offers another possibility for the development of a progressive fracture; use of two half joints on each side of the weld has no appreciable effect on the fatigue strength at the bolt hole with respect to possibility of development of a progressive fracture from the hole; the use of special washers with high strength bolts is effective in removing the stress concentration effect of the bolt hole but is not considered practical; and the foregoing indicates that more satisfactory service performance can be expected from butt welding used rail if the rail ends are cropped before welding.

039688
AN INVESTIGATION OF CROPPING RAIL BY WET AND DRY ABRASIVE WHEEL METHODS

Kannowski, K

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

ER-42, Eng Rpt, Feb. 1964, 13 pp, 14 Fig

Since standard power hack saws were not adequate in supplying rail for an oxyacetylene pressure butt welding plant, wet abrasive wheel methods of cropping relay rail were investigated. A general purpose Obear wet wheel cut off machine was used on 80 lb. old rail. From the observations of the cross sections it was concluded that the wet abrasive cropping is acceptable. A metallurgical investigation of rail cross sections cropped by a dry abrasive cutting method was also undertaken. Comparing the results of the investigation of in track cropped rail sections in 1961, which had martensitic structures of 0.046 in. to 0.086 in. depth, with the results of the present investigation which has 0.013 in. to 0.020 in. depth at the worst, it can be concluded that a large improvement has been made in dry abrasive rail cropping.

039691
CAPABILITY OF FASTENERS TO RESIST RAIL OVERTURNING

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

ER-77, Tech Rpt, Nov. 1967, 14 pp, 11 Fig, 4 Tab

The purpose of the investigation was to determine the overturning resistance of the rail fastened to either wood or prestressed concrete ties when subjected to various loading conditions. No effort was made to include the torsional resistance of the rail. The procedure used in testing the rail on the wood ties was accomplished by fastening a short piece of 136 lb. rail and tie plate to a new treated oak tie by four spikes in pre-bored holes. The rail on the prestressed concrete tie was fastened by two bolts and two AREA Specification clips with a 3/16 in. polyethylene plastic pad between the rail and concrete. It was found that rail on the prestressed concrete ties is capable of carrying considerably more lateral load than the rail fastened to wood ties with spikes. An analytical study conducted at the Research Center indicates a definite relation between the wheel lifting off the rail, wheel climbing the rail and the lateral and vertical loads on the rail. The results of the analytical study shown on Fig. 11 indicate that all values of P(sub v)/P(sub L) smaller than 0.78 have no significance as the wheel will climb the rail and thus relieve the lateral load component on the rail. Lateral wheel loads as large as 30,000 lb have been recorded and for this condition, the analytical study indicates the wheel will not climb the rail until the vertical component of the rail load is 23,400 lb or lower. It was concluded that the method of fastening the rail to the prestressed concrete ties, as recommended in the Preliminary Specification for Design, Materials, Construction and Inspection of Prestressed Concrete Ties, is satisfactory for the imposed lateral forces.

039792
WEIGHTS OF RAILS

Peters, R, London North Eastern Region

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Dec. 1939, p 805, 2 Phot

Callipers used to measure rail-head wear were redesigned to allow for side wear. The callipers are made in a scissors pattern and are illustrated in use.

039904
RAIL FAILURES ON BRITISH RAILWAYS

Dearden, J, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Nov. 1957, pp 509-511, 3 Fig, 3 Tab

The article is a survey of the kind of rail failures on the British Railways which lead to rail removal. Tables include failures by type and cause, rail failures by year, and frequency of failure between plain rail and switch/crossing rails. Effects of methods of manufacture, environments and seasonal conditions are also discussed.

039905
EXPERIENCE OF UNDULATORY WEAR OF RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, July 1958, pp 42

The results of a survey of 21 responding railroads from Europe and Africa on the subject of rail corrugation are presented. The types of corrugations are mentioned as well as possible causes. Means to eliminate or reduce the occurrence of these problems is also covered.

039906
RESILIENT PADS ON PERMANENT WAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, July 1958, pp 70-71, 2 Fig, 1 Phot

The need for resilient fastening between rails and concrete cross ties is discussed. Parameters to be considered in the design of pads and fastenings is included. The loading of fastenings and pads under load is also considered in detail.

039907
TRACK GAUGE AND FLANGEWAY WIDTHS FOR OPERATION OF DIESEL POWER ON CURVED TRACK

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 591958, pp 1011-17, 4 Fig, 1 Tab

This is the final report on recommendations for widening gauge on curves for diesel operation where the use of steam power has been discontinued. Once the gauge has been closed to suit diesel operation, future designs of locomotives should be built, if possible, to operate with the same gauge as for the six-wheel truck diesels. Where a railroad has sharp curves in its main and branch lines, consideration should be given to providing more than 3/8-in. lateral play per axle in the longest diesel truck in order to have gauge wider than standard on the minimum length of curved track. Where railroads operate six-wheel truck diesels with the 15-feet 6 inches wheel base no further gauge widening is required for any of the passenger and freight cars having six-wheel trucks or eight-wheel trucks as used on some of the large or long depressed-center cars.

039926
FLEXIBLE RAIL CLIP FOR F.B. TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Feb. 1953, p 234, 1 Fig

The basic R.N. (Ressorts du Nord) clip and its modifications for use with insulated and welded rail and all types of cross ties are described. The clip consists of a heat-treated, manganese-chrome, spring-steel blade which is doubled back on itself and drop-forged so as to form an upper and lower leaf connected by a rounded portion in the shape of a spring "eye". The R.N. clamp for wooden sleepers differs from the clip already described in having a longer blade, so as to be less stiff and prevent fatigue of the coach-screw. The combination of rubber soleplates and R.N. fixings has been proved to afford a very strong and secure anchorage of the rail on sleepers of all kinds, resistant to the vibrations of express traffic.

039930
THE CASE FOR HEAVIER RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, May 1953, p 585

Railways which today are in course of making a change in their motive power from steam to electric or diesel-electric locomotives are faced with the problem of the most economic type of track to adopt for the future and particularily the weight of rail. The Association of American Railroads Central Research Laboratory considered that the gross tonnage of traffic carried over any given route determined rail life for more than the type of motive power used. The Engineer of Standards and Research on the Denver and Rio Grande Western Railroad thought that diesel operation results in considerably less stressing of the rail than operation with steam. The Long Island Rail Road contended that part of the maintenance economies credited to the heavier rail ought by rights to be attributed to other track improvements often made at the same time including heavier soleplates, longer fishplates, increased rail anchors and new better ballast. The general concensus would appear to be that diesel units impose less strain on the track than steam locomotives of comparable power.

039931
REPAIRING UNUSUAL SLIPS ON WESTERN REGION MAIN LINE–2

Slee, J, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, May 1953, pp 624-626, 3 Fig, 2 Phot, 2 Ref

The cause of the slip at Sonning was known exactly and, paradoxically, this meant that the ways of dealing with it were numerous. The method decided on is described and other methods, with the reasons for their rejection, touched on briefly. The object of the method chosen was to fix the slipping mass to the solid stratum beneath. The prime cause of the slip at Twyford was the hydrostatic head which had collected in the sand lens. This was reduced to an economic minimum by the use of 6-in. dia. cast-iron pipes, with perforated ends, which were built into the buttresses, the perforations being at the level of the sand lens. This article shows how a new cutting may be threatened by the existence of permeable strata, which are below the limit of excavation. If a preliminary investigation has been carried out and the presence of a permeable stratum found, the correct slope of the new cutting can be found using the calculation methods proposed in this article.

039932
DOUBLY-FLEXIBLE RAIL-TO-SLEEPER FASTENINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Mar. 1954, pp 357-358, 1 Tab, 4 Phot

A grooved rubber pad or soleplate was designed by the French to protect concrete sleepers from shattering under impact of heavy traffic. To keep rail, solepad and sleeper in intimate contact, yet able to absorb vertical impact, a spring clip flexible in two directions was also designed. Experience with these fastenings and soleplates indicated long maintenance free service. A doubly-flexible fastening for wooden sleepers also was designed and experience with it is described.

039933
PENNSYLVANIA RAILROAD CLEARANCE CAR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Apr. 1954, p 386, 2 Phot

The Pennsylvania Railroad has introduced a specially designed car for the measurement of track clearnace. It is usually made up into a short train consisting of a locomotive, the clearance car, and a crew coach. The car has now been in service for three years. Aluminum rods, 3 ft. long, and steel tipped, project from the sides and roof of the car in the form of an arch. As the train moves slowly towards a structure to be measured the rods are brushed backwards by contact to conform to the contours of the structure. The rods, 126 in number, are each capable of giving readings to 1/8 in. Graphs show the profile and clearance of the structure measured. The clearance car can cover an average of 100 miles of track each day. The time taken for measurement is about five minutes for a bridge and 30 minutes for a tunnel a mile long.

039934
GRINDING TRAINS FOR CORRUGATED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Apr. 1954, p 426

Measures taken by the Federal Railway to eliminate roaring rail, in so far as it has been established that corrugation is the cause, include rail grinding trains. The first of two such trains was put into service last month. The rail grinding trains, hauled by diesel locomotives, are equipped with generators, compressors, fuel cisterns, workshops, and living accommodation, and are designed to move at 2 mph with their grinders in action. As the damage caused by rail corrugation is estimated at DM 20-30 million a year this development is watched with considerable interest.

039935
SUCCESSFUL STABILIZATION OF A RETAINING WALL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Apr. 1954, pp 492-495, 2 Fig, 4 Phot

Because of unusual difficulty in maintaining the level and line of the rail tracks at a spot between Brighouse and Elland, Yorkshire, where the railway runs 42 ft. above the River Calder, British Railways, North Eastern Region has stabilized the retaining wall which supports the tracks. Efforts undertaken to effect this strengthening are described. The scheme provided for continuous steel sheet piling to be driven in front of the toe of the retaining wall throughout the length adjacent to the river, to be followed by the provision of mass concrete between the piling and the wall, taken down to a level some 3 ft. lower than the foundation level of the old wall.

039936
MECHANIZATION OF PERMANENT WAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, May 1954, pp 596-597

To allow most economical use of mechanical equipment, British lines are classified in three categories: (1) lines with intensive traffic moving at high speeds, where no weekday occupation, day or night, can be obtained: (2) medium-traffic lines, where adequate occupation can be obtained on weekdays or weeknights; and (3) light-traffic lines where machine can be transported freely from place to place by rail or road. On open running lines in the first category, routine maintenance is likely to remain manual, but major repair and renewal works must be as fully mechanized as possible—with ballast-cleaners, cranes, track-lifting and tamping machines—so as to leave the track in nearly-perfect condition. On medium-traffic lines in the second category which are of sufficient mileage to make it economical, there are likely to be minimum-strength length gangs, the bulk of the maintenance being carried out by fully-mechanized gangs. On light-traffic lines in the third category accessible for the distribution of mechanical equipment, expensive highpowered on-track machines probably could not be justified except for renewal works.

039937
INCREASING THE LIFE OF SLEEPERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, May 1952, p 593

A protective coating on the exposed surface of creosoted sleepers was shown to increase the life of the sleeper. The efficiency of each coating compound tried has been judged by its ease of application, its adherence to the creosoted sleeper, and the ability of the coating to remain in a plastic condition in all weather conditions. The behaviour of the coatings under test has varied considerably, some having almost eliminated cracking and splitting, but others having had next to no effect.

039941
FLAT-BOTTOM TRACK IN GREAT BRITAIN—I

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Oct. 1944, 5 pp, 3 Fig, 8 Phot

A comparison was made of the physical characteristics of installed 95 lb B.S. bull head, 100 lb. B.S. bull head and 110 lb. B.S. flat bottom rail. This was done to provide the information necessary for financial comparison of these competing approaches taking into consideration initial cost, maintenance cost, life, and scrap value of rails and components. Detailed description of the installed rail, fastenings, etc. is provided.

039943
STEEL RAIL FAILURES

Herwig, V, German State Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, July 1939, pp 52-56, 2 Fig, 4 Tab

Rail failures occurring on the German State Railway from 1928 to 1937 are summarized. The German testing program for selecting rail steel is compared with that used in Great Britain. Various types of breakages are examined according to rail weight, track classification, proximity to rail joints, as well as breakages in rail head, web and flange. The data are tabulated.

039944
RECENT PROGRESS IN RAILWAY WELDING PRACTICE

Bondy, O

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Nov. 1940, pp 484-488, 3 Fig, 3 Phot, 28 Ref

The article is a review of the different areas where welding has been successfully used in the construction of rail vehicles, railstructures, bridges and rail. As part of the latter, details of electric flash butt welding and oxy-acetylene rail butt welding are also discussed and illustrated. Girder alteration by welding at a railway station and bridge design using welded structures are shown.

039948
TRACKS WITHOUT BALLAST FOR UNDERGROUND LINES IN URBAN CENTERS

International Union of Railways, Office of Research and Experiments, Utrecht, Netherlands

ORE Pub No. 23,24, Rpt 2, 6 pp, 7 Fig

Question D 87

The article discusses a testing program to determine the feasibility of using non-ballasted track for underground railways. Problems of noise level, vibration, as well as tunnel characteristics are among those variables to be considered in the program.

039952
THOMAS STEEL FOR RAILS

Srinivasan, M

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, Jan. 1956, pp 98-100, 1 Fig

The process adopted by a steel factory in France which supplies considerable quantities of Thomas rails to the French National Railways and to railways in several other countries is described. The chemical composition of the Thomas rail steel is shown and is compared to the British standard. The physical tests for the steel ingots and the internal controls are briefly described. The service performance of the Thomas rails is discussed.

039964
SYSTEM OF RESILIENT RAIL MOUNTING

Varga, OH Jebsen, LA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Nov. 1956, pp 528-530, 2 Fig, 2 Phot

The Seetru resilient-grip mounting bolt has been applied to railway track fastening problems resulting in a new rail mounting system for all types of sleepers, espically concrete sleepers. This method of rail fastening combines positive location for the rail (both against longitudinal slipping and lateral displacement) with an essential measure of resilience. The rail foot is carried on a compact and rigid baseplate, which, in turn, rests on a rubber pad of equal size placed direct on the surface of the sleeper. The rail is secured to the baseplate by means of two simple, strong clips and two bolts. The rail is tied to the baseplate with great strength, through direct metal to metal contact, and this can be made more than adequate to hold the rail against any longitudinal slipping, even under arduous conditions of heavy train braking. Laterally, the rail is firmly located between the ribs of the baseplate, clips, and bolts together form essentially one single, rigid, assembled structure.

039968
SNOW PRECAUTIONS IN THE SCOTTISH REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Nov. 1956, 2 pp, 3 Phot

Three different designs of snow plow are described. One design is an all-steel nose plow. The second is an all-steel heavy-duty snow plow which can deal with drifts of snow of 5—8 ft. deep. The third design an all-steel heavy duty snow plow, is complete with equipment to protect the locomotive cab and tender from snow displaced when forcing a passage through deep drifts. It can clear snow drifts up to 12 ft. deep.

039969
FRENCH NATIONAL RAILWAYS RAIL GRINDING TRAIN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Dec. 1956, pp 667-668, 4 Phot

This train operates at a speed of 24 to 28 mph but in order to remove corrugations of a maximum depth of 0.02 in. from 60 to 120 runs have to be made over the section of line from which corrugations are to be removed. The train is normally moved by two locomotives, one at either end. There are two rail grinding vehicles in the train separated from the locomotives by runners and from each other by two locomotive tenders; these two tenders provide water to lubricate the grinding blocks and to cool the surface of the rails. Each vehicle is equipped with 16 grinding shoes. There are two groups of four grinding shoes on each side of the vehicle. Each block measures 15 in. long by 2.36 in. wide, and the effective grinding material on each block when new is 5.9 in. thick. On the average, the blocks have to be replaced after each 120 miles. The abrasive block is made of aluminium oxide grit. The grinding shoes are brought into contact with the rail and a total pressure of 4 to 5 tonnes applied to the 16 shoes. This pressures is gradually increased to 10 tonnes the speed of the train being maintained constantly at 24 to 28 mph. To get the best results from the economic point of view it is desirable for the train to cover, while working, at least 62 miles each day.

039970
RESEARCH BY U.I.C. INTO TYPES OF CONCRETE SLEEPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, May 1960, p 596, 1 Phot

The object of the tests is to compare in near-identical conditions: (1) The behavior in the track of various types of concrete sleepers and their fastenings; (2) behavior of track sections equipped with different types of concrete sleepers; and (3) costs of track-laying and maintenance operations. Periodical measurements, generally at six-monthly intervals, are taken of an Amsler track-recording coach; longitudinal levels to show general settlement; smoothness of riding; state of the surface of rails and welds creep, if any, of the long rails; movement of rails on pads or pads on sleepers; tension and condition of fastenings; any signs of cracking or spalling of the sleepers; and mechanical performance of the insulating components. Additional measurements are to be taken occasionally of the grading and shape of the ballast; Mauzin coach records; weight of particular sleepers; noise level; and static and dynamic track depression.

039972
APPLICATION OF RUBBER FOR BRIDGE BEARINGS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publ No. 23, Rept, July 1966, pp 16-17, 1 Fig

Question D60.

The report discusses the testing of rubber bearings in railroad bridge structures under dynamic stresses. Included in the testing were dynamic, static and tests at extreme temperatures. The tests showed that the modulus E of a bearing has no constant value; it depends on the loading, whereas the modulus G is practically constant. Static compression tests to failure generally gave high results except for the type of bearing with perforated reinforcing steel plates. The tests to determine the coefficient of friction gave the remarkable result that it is greater under low loads than under high loads. The tests on the various types of bearings have shown that repetition of vertical loading has a very much worse effect than repetition of shear loading.

039979
DOGSPIKE HOLDING POWER OF DOUGLAS FIR SLEEPER

Kakekawa, H

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 12, No. 1, Mar. 1971, pp 54, 1 Fig

The report covers testing to determine the suitability of Douglas fir as a material for cross ties. Tests revealed that the dogspike resistance of Douglas fir averaged 2.1 t, differences being the results of differences in growth ring width. As the ties age the resistance decreases by 40% in five years.

039980
THE RAIL SHELLY CRACK IN JAPAN

Nakamura, R Owaku, S Enomoto, N

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 3, Sept. 1965, pp 34-44, 21 Fig, 1 Tab

Investigation into the growth mechanism of shelly cracks and a method of prevention is reported. Examinations included track condition, materials quality, loading condition and friction and wearing phenomenon of affected rails. It was found that in the ordinary contact condition, the contact stress between tyre and rail is so large that plastic flow is caused. With the progress of plastic deformation, steel becomes hard and its elastic limit rises. After these changes, rail surface becomes fit for ordinary wheel load. Though before this time the progress of plastic flow nearly stops, the crack grows through the fatigue due to rolling with slide. It was also found that the existence of ferrite in the surface layer seems to take part in the growth of the crack. As a first step in preventing shelly cracks, rail steel should be strengthened against fatigue. Water decreases the wear of rail and accelerates the development of crack. These conditions promote the growth of the crack due to the rolling fatigue. Secondly, though the decrease of stress is difficult to realize in general, the decrease of lateral force and the decrease of contact stress by decreasing the difference of both curvatures in contact part of wheel and rail are found effective. Thirdly, as it is clear that the existance of water is unfavourable, total stop or restraint of watering is very effective. Since the same effect is achieved by oiling, it is necessary to be careful not to oil excessively.

039981
EFFECTS OF VARIOUS SHAPES OF DOG SPIKES ON THEIR WITHDRAWAL RESISTANCE

Kakegawa, H

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 2, June 1965, pp 46-47, 2 Fig

One method of improving the holding power of dog spikes is to modify the shape of the spikes. An experiment was undertaken to test the modified spikes. The paper briefly describes the experiment performed. The standard dog spike used by JNR was designated A-type. The other designations represented proposed modifications. The average holding powers of the spikes tested after repeated pulling are as follows; beech blocks—A 2,253, B 2,119, C 2,030, D 2,263, E 2,256, F 2,384 kg. Hinoki blocks—A 2,041, B 1,983, C 2,060, D 2,060, E, 2,048, F 2,244 kg. It can be concluded that the modified spikes proposed are not better than the standard dog spikes specified by the current JNR standard.

039983
SOME EXPERIMENTS ON SHELLING CRACKS IN RAILROAD RAIL (NO. 1) TWO DIMENSIONAL PHOTOELASTIC EXPERIMENTS ON A MODEL HAVING A FINE EDGE CRACK UNDER CONTACT LOAD

Enomoto, N Tanaka, N

Railway Technical Research Institute (Japanese National Railways, Kunitachij Box 9, Tokyo, Japan)

Vol. 3 N3, Sept. 1962, pp 34-37, 6 Fig, 3 Ref

The shelling cracks grown in the head of rails are said to be fatigue cracks which are produced by excessive rolling pressure of wheels passing over them. The detailed mechanism of failure, however, has not yet been made clear. To find whether the growth of cracks be due to repeated shearing stress or mainly to repeated tensile stress is necesary both for clarifying the mechanism of shelling and for selecting the rail material. Two dimensional photoelastic investigations were carried out on half planes having a fine edge crack to which a contact load was applied and the fringe patterns at the end of the cracks were observed. When a semicircular model is pressed to a model which has an edge crack inclined at an angel of 30 degree to the contact surface, there grows a tangential force along the fracture surface when the contact load comes above the crack. When the contact load has an inclination toward the crack the tangential force along the fracture surface has a tendency to increase. When a semicircular model is pressed vertically to a model which has a vertical edge crack and the contact load comes adjacent to one side of the crack, there acts the largest tangential force along the fracture surface and the shearing stresses concentrate at the end of the crack, but the tensile stress does not appear. It is supposed from the above facts that the direction of a shelling crack in rail developing under contact loading will be affected by the shearing stresses solely or at least predominantly.

039984
A STUDY OF SUBGRADE PRESSURE OF RAILROADS

Miyako, J

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 3, Sept. 1962, pp 28-33, 11 Fig

For the purpose of refining the procedure of subgrade pressure evaluation, subgrade and rail pressure under traffic loading was observed in an attempt to form a clearer and firmer conception of subgrade pressure acting on railroad subgrade. Details of measurements of subgrade and rail pressure are provided and 11 conclusions drawn. Also covered are the following topics: theoretical derivation of rail pressure from rail deflection analysis and subgrade pressure as illustrated by the model of track system.

039985
A VERY LONG RAIL LAID ON BRIDGE

Fukazawa, Y Onishi, A

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 1, Mar. 1962, pp 26-31, 14 Fig, 1 Tab

The authors describe theoretically the axial force of rail (tensile or compression) caused by temperature change, showing restrictions imposed on construction of a bridge in a long rail section. It was concluded that the design of suitable fastening for a bridge under very long rail and the proper construction and maintenance of approach tracks adjacent to abutment will be of prime importance in future. Longitudinal force acting on the bridge shoes being obtained, we can apply the present theory if the coefficient of adhesion is below 30 percent.

039986
CONTACT PRESSURE BETWEEN WHEEL AND RAIL AND ITS INFLUENCES ON MECHANICAL PROPERTIES OF RAIL STEEL

Ito, A

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 1, Mar. 1962, pp 21-25, 8 Fig, 2 Tab, 7 Ref

Since it was felt that there was still some uncertainty regarding various investigations on the very high contact pressure between wheel and rail and in relation to failures occurred in the heads of rails. It was decided to obtain additional data on the phenomena. This article addresses the following: contact pressure between rail and wheel, plastic deformation of rail steel due to local compression hardness distribution under running surfaces of used rail, and work-brittleness of rail steel.

039987
GROUND VIBRATION DUE TO TRAIN PASSAGE—ON EFFECTS OF RAIL JOINT GAP

Kobayashi, Y Kawamata, J Kumagai, K

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, June 1967, p 119

Ground vibration due to train passage is described referring to the results of a measurement carried out between Matsukawa and Kanayagawa on the Tohoku Truck Line in October 1964. The main purpose of the measurement was to study effects of rail joint gap on the noise and ground vibration. Results can be summarized as follows: (1) Horizontal vibration caused by an expansion joint is smaller at 2.8 m from the track center than at 5.8 m. (2) The dominant frequency of horizontal displacement due to the joint with the gap of 15 mm is lower than that of the expansion joint and the joint with the gap of 5 mm.

039988
TRACK SURFACE AND CAR DERAILMENTS

Railway Age (Simmons-Boardman Publishing Corporation, 30 Church Street, New York, New York, 10007)

Vol. 85, No. 17, Oct. 1928, p 794

Tests under laboratory conditions to determine the effect of warped track surface as a cause of derailment of freight cars and the flange pressure required to turn the trucks under freight cars have led to certain conclusions contrary to the accepted beliefs of many competent engineers and railroad officers. Among the definite conclusions indicated by these tests may be mentioned the following: That a rigid and a flexible track are equally effective in resisting a tendency to derailment caused by warped track surface; that center-plate resistance plays little part in the total resistance which must be overcome in turning trucks on curves, and that grease lubrication of center plates has no appreciable effect on truck turning resistance. It is interesting to note that, in general derailment occurred with less depression than super elevation of the outer rail. In general, it is evident that side-bearing clearance is the most important single factor, so far as the car is concerned, affecting derailments caused by warped track surface, and it is evident that flexibility of car structures plays no small part in keeping cars on the track where side-bearing clearance is small or altogether absent.

039993
TRACK IRREGULARITIES–JNR STUDIES IN SEARCH OF NEW TOLERANCES FOR TRACK MAINTENANCE

Kitaoka, H, Japanese National Railways

Japanese Railway Engineering (Japan Railway Engineers' Association, P.O. Box 605, Tokyo Central, Tokyo, Japan)

Vol. 7, No. 3, Sept. 1966, pp 10-13, 1 Fig, 4 Tab, 1 Phot

This article is a discussion of the investigation by JNR to determine maintenance standards for the track structure under demands for higher speeds and more frequent trains. The parameters which are used in determining standards are included as well as field tests of these standards.

039999
FIELD AND LABORATORY INVESTIGATION OF SLOPE FAILURE OF RAILROAD CUTS IN STIFF CLAY, SOUTHWESTERN, IOWA

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-ER-11, Feb. 1961, 18 pp, 6 Fig, 2 Tab, 6 Ref

This report is concerned with the predictability of slope failures based upon research conducted on three sites of the Chicago, Rock Island, and Pacific Railroad. As a result, the authors suggest that the safety factor can be predicted when slope dimensions, ground water conditions and soil shear strength are known. The Swedish methods of Slices was utilized in the slide analysis.

040000
SPEED OF TRAINS THROUGH TURNOUTS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-ER-14, Aug. 1961, 14 pp, 4 Fig, 5 Tab

This report discusses testing by the AAR to determine standard turnouts which would give maximum comfort at maximum speed. Field tests used #24 frogs with 39 ft. switch points at 50 mph and #20 frogs with 30 ft. swtich points at 40 mph. It was concluded that the frog/switch speed combination gave the maximum lateral accelerations expected in high speed running.

040007
THE MECHANIZATION OF CURVE REALIGNMENT

Schubert, E

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 13, No.2, Feb. 1964, pp 45-49, 6 Fig, 10 Ref

A new procedure is described for the mechanization of curve realignment without the necessity of resurveying or re-staking the curve, by the use of a track lining machine. This method can be used for the realignment of transition curves. Particular emphasis is placed on the theoretical basis of the method. The method divides the curve into equal small parts. A comparison is then made of the height of the arc over the chord of each part.

040011
RECENT EVOLUTION IN ON THE RAIL INSPECTION ON THE S.N.C.F.

French Rail News (Federation des Industries Ferroviaires, 12 rue Bixio, 75007 Paris, France)

No.1, 1969, pp 12-13, 9 Phot

Ultrasonic probing enables an operator, shifting a transductor over the surface of the railhead, to assess the extent of a crack. Rail inspection by ultrasonic apparatus employs two methods: vertical probing by a straight line transductor where the steel is subjected to a longitudinal beam of waves; and oblique probing by a transductor subjecting the steel to a refracted beam of transversal waves forming an angle of 65 degrees to 70 degrees with the vertical. The transversal fatigue cracks due to rail-head fatigue often causing railbreaks are detected by oblique probing. The present permissible speed at which the transductors are made to move along the rail is 12 km/h. The annual number of rail-breaks on the inspected lines which was about 1,100 has fallen to under 400, the majority of breaks being due to defects non-spottable by probing.

040026
RESEARCH INTO STRESSES IN TRACK

Eisenmann, J, Munich Technical University

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No. 1,2, Feb. 1971, pp 64-70, 9 Fig, 2 Tab, 8 Ref

The extensive investigations that have been made in the past few years into the stress conditions obtained in the track structure (from rail to sub-structure) have resulted in positive evolution of the design and dimensioning of rails, ties and ballast bed. The results of this research are detailed, showing by graphs and tables the stresses in rail heads and flanges. The service requirements for the various sizes and strengths of rail are described.

040027
DEVELOPMENTS IN THE QUALITIES AND SERVICE CAPABILITIES OF PRESENT-DAY RAIL STEELS

Heller, W, Fried Krupp Huttenwerke AG

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No. 1,2, Feb. 1971, pp 71-78, 8 Fig, 1 Tab, 6 Phot, 13 Ref

The service requirements are discussed for steel rails, which are constantly increasing to bear the heavier axle loads and higher speeds, and with increased resistance to wear, fatigue and fractures. The progress in the manufacture of rails is related, including the improvements in profiles, dimensions, quality and physical properties, as shown by tables and charts. The forseeable limiting area of tensile strength for self-hardening alloy steel for the rails is given as 192,-000-206,000 psi. Improved resistance must be developed to wear, plastic deformation crushing and fractures in the rail head, by raising the tensile strength, yield point and fatigue limit.

040028
STEEL TIES FOR FIRST CLASS TRACKS

Schmedders, H, August Thyssen-Hutte AG
Bienzeisler, H, August Thyssen-Hutte AG

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No. 1,2, Feb. 1971, pp 88-92, 5 Fig

There is a revival of interest in steel ties due to newly designed shapes and improved manufacturing processes. The new ties have a higher moment of inertia and greater strength. Annealing after the cold working insures greater fatigue resistance and reduces the likelihood of cracks developing. Advantages of steel ties include: long life, the possibility of re-use later in secondary lines, and the reclamation possible after a derailment. Under switches, the longer lengths of steel ties are more easily provided. On electrified lines, steel ties provide an ideal grounding connection. The better quality of steel makes the welding process more usable for fastening the rail holding plates to the ties without the possibilities of fractures.

040031
THE INFLUENCE OF BALLAST BED THICKNESS AND TIE SIZE AND SPACING ON SUB-STRUCTURE LOADING

Eisenmann, J, Munich Technische Hochschule

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 8, Aug. 1970, pp 309-317, 11 Fig, 3 Tab, 1 Phot, 11 Ref

The steady increase in axle loading of railway vehicles and in train speeds not only cause greater stressing of the rails, but also higher loading of the sub-structure. Test results and theoretical considerations show the influence that the size, shape and spacing of the ties, the thickness of the ballast bed and depth of the formation, have on the loading of the sub-structure. Conclusions included the following: a ballast bed over a bad substructure that will carry 20 tons axle load, when over a good substructure, cannot carry more than 25 tons axle load. For axle loads of 30 tons, a protective layer over the substructure and a deepening of the ballast bed are necessary. With regard to the stresses on the ballast bed from an axle load of 25 tons to 30 tons, the tie spacing must be made smaller and with longer ties, the depth of the ballast bed and the thickness of the protective layer over the road bed can be kept to lesser limits.

040032
RADIATION PROBES FOR SOIL MECHANICS INVESTIGATIONS IN RAILROAD CONSTRUCTION

Cabos, HP, Bundesbahn-Versuchsanstalt, Minden
Spang, J, Bundesbahn-Zentralamt, Munchen
Werner, K, Bundesbahn-Zentralamt, Munchen

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 8, Aug. 1970, pp 326-336, 9 Fig, 3 Phot, 7 Ref

The German Federated Railways have been using the Gamma Ray radiation probes for soil mechanics investigation for railway road beds since 1960. This article describes types of probes used, depth, injection and contact and explains the measuring techniques. The apparatus used in these investigations is described and some of the results obtained are given.

040034
A WAY OF ELIMINATING WATER-LOGGED AND MUDDY TRACK FORMATIONS

Flandorfer, J, Bauabteilung Der Osterreichischen Bundesbahnen

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No.9, Sept. 1970, pp 386-388, 2 Fig, 2 Phot

With normal cross-sections of the ballast bed and formations, the sub-structure normally insures sufficient drainage of the track bed. However, under unfavorable ground conditions, water may not drain away properly, with detrimental results for the track. This article describes a new method of providing the necessary drainage to prevent the accumulation of water and mud in the track bed.

040037
TRACK MAINTENANCE ON HIGH SPEED RAILWAYS

Birmann, F, Bundesbahn-Zentralamt, Minden

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No.1, Feb. 1971, pp 55-64, 10 Fig, 5 Tab, 4 Phot, 15 Ref

The results of six years of operation of the Tokaido Line of the Japanese National Railways, the 200-210 km/h high speed, single purpose line for passenger service, are given in detail as relating to track alignment and level deformations and maintenance requirements of the track structure to keep it within the necessary limits for safety and comfort. This work has been found to be much higher in amount and cost than first envisioned, and instead of the nightly freight runs first planned, the track maintenance work is now scheduled for the night hours. The number of trains run on this line has now increased to 85 pairs daily, with a loading of 60,000 tons per day on the track structure. The details of the construction of this track is tabulated, including the type of rail, ties and ballast bed. For this line, 160,000 tons of ballast are required yearly. Track maintenance, which approximates 50% more than anticipated, is compared with that on the German railways, where, with the mixed operation of heavy freight trains at 80 km/h and 200 km/h passenger trains, such maintenance is about 30% higher than on the lower speed and lesser load lines.

040038
CLEANING OF EFFLUENTS BY THE ELECTRO-FLOTATION PROCESS

Brecht, W

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No.4, Apr. 1971, pp 167-169, 2 Fig

To further improve the method of cleaning railway shop effluents containing waste oils to conform to the governmental requirements before discharging them into the drainage sewers, a new method has been evolved for the removal of heavy oil and washing by-products in these effluents. This process is based on a physical-chemical process, accomplished by an electro-flotation method. The good results of a recent eighteen month test at the Karlsruhe repair shops of the German Federal Railway are described. The detailed description of the plant and its operation are given also.

040041
STATUS OF COOPERATIVE RESEARCH ON WOOD TIES BETWEEN THE RAILWAY TIE ASSOCIATION AND THE AAR RESEARCH CENTER

Somogy, C Magee, GM

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

#R-111, Res Rpt, 6503-7112, Dec. 1971, 123 pp, 36 Fig, 11 Tab, 4 Phot, 1 App

Tie space was studied analytically using Talbot's formula, in laboratory tests using hydraulic pulsating loading jacks, and using test track on a field test. Cross ties of three cross sections, 6 x 8 inches, 7 x 9 inch, and 8 x 10 inch, and three lengths, 8 ft, 8.5 ft. and 9 ft. for a total of nine combinations, were used for all three tests. The study of the effects of tie size and spacing showed that irregularities in track cross level and rail surface are a function of the characteristics of the ballast and roadbed rather than of the tie arrangement. There is no evidence that the long ties are more effective in prevention of center binding, because the shortest ties so far show no evidence of center binding. It seems probable that the cross section and spacing of the ties will be determined by the bending strength required to avoid tie breakage at the center of the track or under the rail. Further service use will indicate whether the increased tie plate load with the wider tie spacing used in some test sections will result in an increased amount of tie plate cutting into the ties.

040043
CRITERIA FOR TRACK GEOMETRY DESIGN AS RELATED TO MODERN EQUIPMENT

Hillman, AB

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

1970, p 414

A proposal is being considered for establishing standards for the minimum tangent distance between reverse points of various degrees of curves to permit negotiation of the curves by long, box cars having 68-ft. truck centers and coupler force less than 200,000 lb. A list of tangent lengths with corresponding degrees of curvature are shown.

040057
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS (UIC 54 AND UIC 60 RAIL PROFILES) FACTORS AFFECTING THE CONSTRUCTION OF COMMON AND OBTUSE CROSSINGS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

Intrm Rpt, Oct. 1966, 26 pp, 16 Fig

Question D72

The present document studies the choise of a geometry and a construction for common and obtuse crossings. The choice of geometry, for safety and for comfort, takes account of the incidence of high speeds and heavy axles on common and obtuse crossings, and the consequences, on obtuse crossings, of a current tendency towards the reduction of wheel diameters. The choice of construction is of prime importance with speed and tonnage. Two methods of construction, one of which has the advantage of a long experience, are described with their respective characteristics.

040058
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS (UIC 54 AND UIC 60 RAIL PROFILES) ADDITIONAL REQUIREMENTS CONCERNING THE DESIGN OF SWITCHES AND CROSSINGS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

Report No 5, Oct. 1968, 14 pp, 5 Fig

Question D72

This report deals with requirements concerning the design of switches and crossings. It studies the installation of junction work in the general alignment of tracks notably concerning: their installation on curve, the effect on couplings, loading gauge, cant and speed of negotiation in curved or winding situations. It shows a method for choosing optimum forms of certain items of ironwork affecting safety against derialment (switch toes and crossing noses). Finally, the document defines economic conditions in the selection of constituent parts.

040059
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS (UIC 54 AND UIC 60 RAIL PROFILES) RESULTS OF THE ENQUIRY INTO THE GEOMETRICAL PRINCIPLES AND THE PRINCIPLES OF CONSTRUCTION OF SINGLE SWITCHES AND CROSSINGS FOR STANDARD TRACK ACCORDING TO THE POSITION ON 12TH APRIL 1963

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

Report No 4, July 1967, 59 pp, 26 Tab

Question D72

Survey data was gathered from various railroad administrations concerning the geometrical designs of existing switches and crossings and data about their manufacture and construction. All data are presented in tables for ease of comparison.

040060
GUIDING PRINCIPLES FOR THE DESIGN OF POINTS AND CROSSINGS (UIC 54 AND UIC 60 RAIL PROFILES). GENERAL PRINCIPLES TAKING INTO CONSIDERATION THE INCREASE IN SPEED AND AXLE LOADS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

Report No 6, Apr. 1969, 27 pp, 17 Fig, 45 Ref, 1 App

Question D72

The report summarises developments which have been published in the five preceding documents on this topic. Conclusions regarding the entire study are divided into three ranges of speed in relation to three criteria: security, comfort and maintenance: first for V where security appears to be the most restrictive condition; second for 40 less than V less than or equal to 160 km/h where comfort seems to be the most restrictive and which decides the limit of speed on a turnout according to the actual design of the switches; third: for V greater than 160 km/h where maintenance and layout assume the greatest importance in proportion to the cost they involve in the general economy.

040061
STUDY OF RAIL RAILURES IN THE TRACK–STANDARD RAIL FAILURE STATISTICS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

Interim Rpt No 1, Apr. 1965, 22 pp, 9 App

Question D88

The main object was to define the type and form of presentation of rail-failure information to be supplied by various ORE Member Administrations so as to permit the better use of such information—and to draw some concrete conclusions. Committee D 88 found great difficulty in identifying a suitable denominator to which the rail failures could be related for purposes of comparison between administrations. In the absence of a more reliable denominator rail failures were related to the kilometres of track concerned with the type of failure being compared. This should enable administrations to decide whether their present policies in regard to choice of rail section, steel quality, rail welding, joint design, track maintenance policy, rail renewal frequency (only to quote the main factors), require any alteration.

040063
INCREASE IN SERVICE LIFE OF REINFORCED CONCRETE TIES

Railroad Transport (Railroad Transport Editorial Board, USSR, 3a Sadovaya - Chernogryazskaya, Moscow 174, USSR)

No.7, 1964, pp 5, 8 Fig, 1 Tab, 1 Ref

Translation of Russian journal article accomplished by G. G. Guins at Chesapeake and Ohio Railway Company

After some eight years of experience of mass application of reinforced concrete ties in Russia it has been found various ORE member administration so as to permit has been 3—3.5 times that of the intermediate ties. Successful remedial actions have included limiting irregulatities in welded joints to .3mm per running meter, use of heavier rail (P-56 vs P-50) and maintenance of sufficient foundation width and ballast depths.

040064
ON RESISTANCE OF TIES TO MOVEMENT

Railroad Transport (Railroad Transport Editorial Board, USSR, 3a Sadovaya-Chernograskaya, Moscow 174, USSR)

Translation of Russian journal article by S. G. Guins at Chesapeake and Ohio Railway.

Some 900 tests on displacement in the transverse direction to the centerline of the track laid on wooden ties and with ballast in normal state were conducted in Russia. The curve obtained between force and displacement shows continuous increase of force with displacement reaching a maximum of 946 klg. for the displacement of 5 cm. A second series of tests was conducted near a structure that supplied an anchor point permitting to apply pull on three ties simultaneously. In displacement of ballast up to .75 cm the resistance increases rapidly and continues to increase up to 2.75 cm displacement. At the end of movement equal to 5 cm the force reaches 486 klg. The resistance of the ballast in the shoulder decreases from 51 klg. for 75 cm displacement to 18 klg. at 5 cm. These experiments indicate that the ties have a tendency to wedge between the ballast and the base of both rail strings with results that a force of 2500-3000 klg. is required to move them either in or out.

040079
DYNAMICS OF RAILWAY TRACK SYSTEMS AND THEIR ECONOMIC CONSEQUENCES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Jan. 1970, pp 19-24, 5 Fig, 8 Tab, 5 Phot

British Railways has adopted concrete sleepers and continuous-welded rails as the best means to provide a high performance low annual cost track. Assessing the dynamic loading effect of different axles at different speeds on a less than perfect joint has been done and has produced a very close confirmation between field measurements and a previously calculated formula. Over 50 percent of the rail breaks occur in rails which are not more than ten years old, by which time none have reached the replacement stage due to loss of weight. Maximum bolt-hole stresses occur at the second running-on bolt, but rail-end failures start at the first bolt-hole. The joint consideration of the track and vehicle circumstances has resulted in the design of a three-axle bogie which not only increases the payload by 9 tons for a 2-ton increase in tare weight but reduces the axleload to 13-1/2 tons at an extra cost of less than 2,000 lb. a vehicle. While welded track requires higher installation costs the reduction in day-to-day attention is very marked. Taking 1969 prices, the costs per mile are: (i) long-welded rails on concrete sleepers, 29,000 lb; and (ii) jointed rails timber sleepers, 25,000 lb. But the "equalized" cost per annum is affected by the relative lives and is considerably less for long-welded rails.

040080
LOADING OF LIGHT RAILS

Kesson, JM, East African Railways and Harbours

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 114, Jan. 1961, pp 35-36

Highlights of a paper presented at a meeting of ICE. The author describes cases of known damage to rails and sleepers caused by excessive loading and reviews some investigations which have been carried out into the problem. It is suggested that further attention to rail design is needed to ensure that the maximum loading benefit is obtained. There is a need for establishing the maximum loading and best arrangement of locomotive axles for any given weight of rail. One of the conclusions reached by the author is that use of the continuous elastic-support theory as a means of assessing the safe loads and stresses caused on the track by locomotives is useful in designing the axleloading and layout, but with heavy axleloads the curve effects on rail-fillet stresses become the critical factor. With smaller wheel diameters the local railhead stressing effects must also be watched.

040082
STABILITY OF LONG-WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Aug. 1961, pp 180-181

In 1953 an exhaustive testing programme was initiated by the Civil Engineering Laboratory to investigate the conditions and factors affecting the stability long-welded rails, mainly pertaining to British Railways field conditions. To study the factors involved in track buckling, lateral deflection was induced on a 120-ft. length of track mounted on rollers with a distance between lateral reaction points of 20 to 106 ft. It was soon seen that conventional deflection formulae did not apply, especially in respect of overall stiffness of track, and that this varied with the length deflected, amount of deflection, sleeper-spacing, type of rail fastening, and rail section. These preliminary investigations took no account of the effect of ballast. To obtain information on the behavior of sleepers, rails, and fastenings simultaneously, a lateral bending test was devised for deflecting a 30-ft. section of track under lateral point-loading. Various sleeper-spacings and types of fastening were used and suitable formulae were evolved. The effect of ballast was investigated in a series of tests to ascertain its resistance to the lateral and longitudinal movement of both timber and concrete sleepers. In the main buckling tests on a 120-ft. test-bed, a length of track was subjected to thermal stresses in such a way as to simulate the central portion of a length of long-welded rail which does not move with changes of temperature. Loss of load in the track when buckling occurred as a result of rail expansion could be calculated from the gauge readings and the alignment of the buckled track.

040086
COMPACTED ASPHALTED BALLAST ON THE RHAETIAN RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Nov. 1961, p 513, 3 Phot

The preparation of a solid base of rolled and asphalted gravel as a support for block concrete sleepers has been provided in Switzerland on the second track of the metre-gauge Rhaetian Railway line from Chur to Reichenau. Two 4-in. layers of rolled asphalted broken gravel were in turn spread and rolled, and on them were laid R.S.-type block-concrete sleepers carrying continuous-welded rails. Levelling was done by packing with a mixture of fine gravel and asphalt. The first cost of this track is stated to be little greater than that of conventional track.

040094
MECHANICAL LINING OF TRACK

Schubert, E, Austrian Federal Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 121, Aug. 1965, pp 617-619, 5 Fig

This article describes the Plasser and Theurer Limited mechanical equipment and procedures for alignment of track. Over 100 of these machines are in use in Britain, Germany, Austria, the United States and other countries, and are being used on bull-head as well as flat-bottom rail.

040110
DYNAMIC TESTS ON RAIL FASTENINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, June 1964, pp 496-498, 3 Fig

Concrete sleepers are used throughout the Pakistan Western Railway system. Over 70,000 have been cast and have proved entirely satisfactory except that the fastenings tend to become loose in time. Three fastening were withdrawal tested. A dynamic test on fasteners is presented and the dynamic test apparatus is shown.

040112
COMPUTERIZED DATA PROCESSING OF TRACK GEOMETRY RECORDING

Coombs, DH, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, July 1966, pp 560-562, 3 Fig, 3 Phot

The British Railways system of automatic assessment of the records produced by track-condition recording cars is described. The mechanical movements of the pens of the recording trolley are converted to electric pulses, which are measured on a floating datum in the case of the versines and twist. All measurement and evaluation is electronic and in no way impairs the production of the standard track-record graph. All the information on the print-out and the date of the recording are reproduced on a punched tape which is subsequently processed by a central computer to produce future work programmes for tamping and lining machines. This is done by extrapolating the trend of deterioration revealed by the fault counts to predict the content and order of priority of future maintenance work loads on the tracks.

040120
RELATION BETWEEN TRACK IRREGULARITIES UNDER TRAIN LOADS AND NO LOAD

Ikemori, M

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4 N2, June 1963, pp 48-50, 4 Fig, 1 Tab

Track irregularities were measured under train load conditions using a new high speed inspection car, Maya 341. The sizes of the irregularities were compared with the sizes measured under no load conditions with a light weight, Yoshiike type, inspection car. A unique rule connecting measurement under load versus no load conditions could not be formulated. Relationships are established for load versus no load conditions in a mathematical model.

040122
DYNAMICS OF RAIL FAILURES IN THE TRACK

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

ORE PU-25, Rpt, July 1967, pp 33-35

Question D88

The propagation conditions of the following defects were studied: transverse cracks in the head; horizontal cracks in the head; and starcracking at fish-bolt holes. The main object was to attempt to determine the length of time after the appearance of detection of the failures during which the rails could be left in the track before dangerous failure became imminent. Laboratory tests failed to determine this time factor. Field test results from the Paris suburban railway are briefly described for the three types of defects. Laboratory measurement of transverse defects showed the electric method gave more accurate results than the ultrasonic method using pulse echoes.

040138
TESTS WITH BALLAST-LESS TRACK

Ensner, K, Bauabteilung Der Generaldirektion Der SBB
Simon, W, Bauabteilung Der Generaldirektion Der SBB

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No.1-2, Feb. 1970, pp 33-36, 7 Fig, 1 Phot, 1 Ref

Maintenance work on the ballasted track bed in tunnels must be done at great disadvantage, therefore, research has been directed towards the design of a ballast-less track bed. A 210 meter long stretch is described of such a bed in the Boezberg Tunnel. This design has concrete ties laid upon suitable rubber cushioning over a reinforced concrete bed. The results of the tests of this track structure as to bending stresses, track level depression, rail stresses and noise levels are shown in graph form, and comparisons are made with similar test results in the ballast bed structure. Further development is necessary before a rapid program of changing to a ballast-less structure is indicated.

040139
DEVELOPMENT TRENDS IN SWITCH POINT DESIGN

Simon, W, Bauabteilung Der Generaldirektion Der SBB
Schumaker, G, Bauabteilung Der Generaldirektion Der SBB

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No.1-2, Feb. 1970, pp 26-32, 7 Fig, 2 Phot, 2 Ref

On the Swiss Federal Railways, with a total track length of 6,686 Km, there are a total of 14,669 switches, for an average 455 meters of track per switch. The Swiss Railways have had to engage in the development of switch designs to provide higher speeds for their train movements through switches. The design is described of the geometry of switch points and turnouts, with diagrams of four long radius switch turnouts from 900 m radius to 2200/3800 m radius. The design of various switches are shown. There is shown the arrangement of a switch lay-out on a ballastless concrete bed. The present maximum speed of trains, 140 km/h, is not foreseen as likely to be increased, so the development of switches capable of accepting trains at speeds of 125 to 140 km/h has become necessary, in order to maintain the flow of traffic as rapid as possible. In this development, the rail profile has been increased from 49 kg to 54 kg per meter.

040140
THE TAMPING OF TIES

Schubert, E, Osterreichischen Bundesbahnen

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 17 No.9, Sept. 1968, pp 389-392, 7 Fig

A ballast bed must keep the rail deflections at minimum under the train loading, must not retain water, and must permit the underneath soil to dry out quickly, and must hold the track in stable alignment. To achieve this condition, not only is cleaning of the ballast essential, but also, proper tamping of the ballast around the ties is required. The various methods of tamping are described, with an evaluation of the effectiveness of each process. Tests have proven that the asynchronous method of operation of the tamping machines, combined with the compacting between and at the ends of the ties, provides the more nearly uniform homogeneity of the ballast bed desired under the ties.

040141
THE PROBLEMS OF TRACKWAY AND SIGNAL TECHNIQUES FOR RAIL

Kuemmell, KF, Deutschen Bundesbahn

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 17, No.2, Dec. 1968, pp 506-512, 3 Fig, 1 Tab, 6 Ref

The problems relating to high speed travel are outlined. For speeds up to 250 km/h, the conventional form of track structure, with ties on the ballasted road bed, will suffice, using the presently available equipment and motive power systems. The following improvements in the present rail permanent way are suggested for attaining the full benefit in travel time reduction from the high speed operation: strengthening the present track structure system; improving the soil foundation under the track structure; improving the track with consideration for the centrifugal forces of vehicles on curves; elimination of close track spacing; elimination of railway road crossings; and equipping the high speed sections with continuous train control.

040142
DEVELOPMENTS AND EXPERIENCE WITH THE THERMIT SYSTEM WITH PARTICULAR REGARD TO WELDING OF DIFFERENT RAIL STEEL QUALITIES

Ahlert, W, Elektro-Thermit GmbH

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18, No.12, 2, Dec. 1969, pp 468-520, 18 Fig, 6 Tab, 27 Fig, 16 Ref

The application is discussed of the Thermit welding process to rails, on the influence of the rail material on the quality of the weld, on the temperatures occurring in the rails during and after welding, on the changes in structure and hardness of the rail material adjacent to the welds as a result of the thermal processes. Detailed measurements show the expansion and contraction in the rail zones heated during Thermit welding, and the cooling behavior of various rail and Thermit steels, as well as possible damage to the welds and heated rail sections. The results of measurements of internal stress in the rail welds, with and without coilar respectively complement the test data obtained in the laboratory. In addition to the practical experience derived from the many millions of rail welds, they are a valuable contribution to the metallurgy of rail metals, which should be taken into consideration in the development of new rail profiles.

040146
RAILWAY TRACK STRUCTURE WITHOUT TIES OR BALLAST

Birmann, F

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18, No.8, Sept. 1969, pp 293-305, 11 Fig, 17 Phot, 27 Ref

Three different types of concrete track bed were designed and built. Results of tests of rail deflections, both vertical and lateral, under dynamic loading are given and shown on charts. The static vertical deflections of the three types of track beds are compared with that of the standard tie and ballast road bed, over a period of 19 months service. The economics of the concrete railway road bed indicate that the cost reflects about an 18% increase over the standard tie and ballast structure. A comparison of the vertical and lateral accelerations of a locomotive and car, measured at the start of the tests over the concrete bed track structure and 8 months later show no marked change in their values over the 8 month period. The uniform and small settling did not increase beyond the initial values. Good riding quality of the trains passing over these sections at 200 km/h continued throughout the test. The shelling damage to the rail laid on the concrete rail bed is not higher than on the conventional track structure.

040159
THE USES OF TRACK INSPECTION INFORMATION IN RAILWAY ENGINEERING

Way, GH

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 711970, pp 767-774, 6 Fig

Track inspection techniques are described. The purposes of the inspection is to develop a maintenance program; detect emergency track defects; evaluate methods, machines and material; and control work quality. Emphasis is placed on the analysis of data collected during the inspection.

040160
AUTOMATED TRACK INSPECTION ON THE SOUTHERN RAILWAY SYSTEM

Crane, LS, Southern Railway
Kaelin, CR, Southern Railway

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 711970, pp 775-785, 5 Fig, 2 Phot

Described are the track inspection system used on the Southern Railway System, the track rating index used in processing the data, and the benefits derived from automated track inspection. The inspection car does not negate the importance of track maintenance personnel, but rather places greater emphasis on their role. A rapid inspection technique, an accurate picture of track quality, and a well run, the digital gauge printout and the annotated charts are Extensive tests were planned for evaluating heavy-duty rail fasteners, concrete tie designs, and maintenance practices in 1970. The track inspection vehicle was to play a vital efficiently. The Gauge Data Reduction Program is a tool test sections and effecting a relative comparison with control sections of conventional track.

040161
DIGITAL PROCESSING OF TRACK GEOMETRY DATA FOR MAINTENANCE PLANNING

Woll, TP, Federal Railroad Administration

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 711970, pp 785-797, 8 Fig, 3 Phot

The concepts for data processing described in this paper and the resulting preferred formats for the presentation of track geometry data resulted from discussions with knowledgeable people within the railroad industry. Data on 450 miles of track geometry are recorded by the test cars in less than 8 hours. The analog chart data is then scrutinized and edited. Within 48 hours after the test run, the digital gauge printout and the annotated charts are ready for review by the maintenance engineer. By use of digital computer processing, a vast amount of track data can be collected and reduced into meaningful form quickly and efficiently. The Gauge Data Reduction Program is a tool actively providing maintenance engineers and key management personnel with information to direct the planning of maintenance-of-way activities. The crosslevel program, presently under development, will be providing information on another key track parameter.

040162
CANADIAN NATIONAL RECORDER CAR

Maughan, RG, Canadian National Railways

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren, Chicago, Illinois, 60605)

Vol. 711970, pp 798-813, 11 Fig, 6 Phot

A description of how the recorder car works is given and the data produced by the car and how the data are used are described. The instrument panel and various instruments in the car are photographed. Sample output is shown. From the output changes in track quality are observed by placing data produced from consecutive runs side by side.

040163
STRESS DISTRIBUTION IN TRACK STRUCTURE

Hardy, RM, Alberta University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 691968, pp 924-940, 8 Fig, 3 Phot

This study was made on the Sangudo Subdivision in the Mountain Region of the Canadian National Railways in Western Canada. During an upgrading program on the line, the question was raised whether the ballast could be improved sufficiently so that the performance of the track structure with the existing 60-lb rail would be comparable to what could be expected with 100-lb rail with more or less standard ballast thickness and quality. The test program was laid out to assess the performance of the track structure in terms of the rail stresses, the deflection of the ballast and the deflection of the subsoil. Five variables were included: weight of rail, thickness of ballast, density of ballast, quality of ballast with the performance of crushed gravel being compared to that for pit run gravel, and weight of traffic. The raw data are presented and tentative conclusions are drawn.

040165
ENGINEERING TRACK RECORDER CAR

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 711969, pp 161-169, 8 Fig, 4 Phot

The Canadian National Railways have developed a track recorder car which measures and records condition of track. Track measuring and recording equipment has been installed in a converted passenger car which is equipped with two six-wheel trucks. This car is capable of testing track when operated within the speed range of 20 mph to 100 mph. This car is equipped to measure and record the surface conditions of each rail, cross level and gauge. Photographs show the instrument panel and the equipment installation. Sample output is illustrated.

040170
STRESS DISTRIBUTION IN THE PERMANENT WAY DUE TO HEAVY AXLE LOADS AND HIGH SPEEDS

Eisenmann, J, Munich Technical University

American Railway Engineering Association, 59 East Van Buren, Chicago, Illinois, 60605

Vol. 711969, pp 24-59, 27 Fig, 2 Phot

The stress distribution in the rail head in the vicinity of the contact surface between rail and wheel and in the ballast can be calculated using the half-space theory. Experiments carried out proved the validity of Boussinesq's solution for this case. The study of the stress components in the rail head shows that high normal principal stresses directly act in the contact surface while the shear stresses vanish. The normal stresses, identical with the principal normal stresses, are about equal in all three directions. Although the extreme values of the compressive stresses exceed the ultimate tensile stress of steel, no failure occurs because the shear stresses vanish. Tensile bending stresses in the rail head and in the rail foot are shown. A test track constructed of prefabricated concrete slabs was built up near Nurnberg in November 1967. Measurements taken at this test track show that the scattering of stresses in the rail is quite small. The standard deviation for the stress at the rail foot is as low as 5 to 10 percent.

040172
PERMANENT WAY WORK–A PROGRESS REPORT

Butland, AN, British Railways Board

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 701969, pp 814-822, 2 Fig, 1 App

Track maintenance techniques used by the British Railways are described and maintenance schedules are shown. Maintenances costs are shown as a function of track design, maximum speed, and number of trains per day.

040173
1964 EARTHQUAKE DAMAGES TO THE ALASKA RAILROAD

Cook, IP, Alaska Railroad

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 661965, pp 750-755, 7 Phot

The 536-mile Alaska Railroad, which operates from two tidewater ports, Seward and Whittier, on the north Pacific Coast, through to central interior Alaska suffered intense damage. Some 200 miles of railroad were totally immobilized. All communication with line points were disrupted. The damage was such that it was impossible to use the railroad to reach the distressed areas. In excess of 110 bridges were rendered unserviceable; miles of track were warped out of line and rails twisted. Landslides accounted for over 2 1/2 miles of lost grade, leaving rails suspended in mid-air. The port and terminal facilities at Seward were all but wiped out by a combination of seismic action, tidal waves and fire. Whittier fared somewhat better, but was far from operable. Two hundred and twentyfive pieces of rolling stock were either lost or badly damaged. The Railroad property loss was estimated at $35,000,000. Photographs of some damaged areas are shown. Railroad repair problems are briefly discussed.

040177
STUDY OF RAIL FAILURES IN THE TRACK–STUDY ON THE DYNAMICS OF RAIL DEFECTS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

INTERIM REPORT NO, 2, Oct. 1965, 14 pp, 5 App

Question D88

The following rail defects were investigated: star-cracking at holes within fishplate limits; horizontal cracks in the head; and transverse cracks (kidney-shaped fatigue crack) starting within the head. The report also formulates some observations on the dynamics of each of the defects, namely: irregular development of star-cracks; checking or "stagnation" of horizontal cracks in the head; propagation of transverse cracks, according to an exponential law. The report concluded that the irregular development of star cracks depended on a large number of factors, of which the condition of the rail-joint and the maintenance conditions appeared to be the most important. The same was true in the case of horizontal cracks in the head at the rail-end.

040178
STUDY OF RAIL FAILURES IN THE TRACK–MEASUREMENTS IN THE TRACK OF THE SIZE OF INTERNAL TRANSVERSE RAIL FAILURES– STUDIES OF THE SNCB CONCERNING THE DYNAMICS OF FAILURES IN THE RAIL-ENDS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

INTERIM REPORT NO, 4, Oct. 1966, 14 pp

Question D88

This report deals with the tests for assessing the extent of transverse cracks of internal origin in the rail-head; these tests were made in the ORE track at Villeneuve-Triage marshalling yard. The studies were concerned with test methods and instruments used and an evaluation of the results obtained by each method considered. It was found that for the determination of the extent of transverse failures of this order of magnitude and for those which should be examined in the track within the scope of studies of the dynamics of rail failures, both the ultrasonic and electric procedures can lead to comparable results, which are, moreover, nearer to reality.

040179
STUDY OF RAIL FAULTS IN THE TRACK–STANDARD RAIL FAILURE STATISTICS 1965 RAIL FRACTURES CAUSING DERAILMENTS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

FINAL REPORT NO 5, Apr. 1968, 27 pp, 8 Fig, 5 Tab

Question D88

This report provides an account of rail failures for 1965 compiled by nineteen Administrations. The report also includes a study on broken rails having caused derailments. A primary distribution of the failures bases on their location is failures at rail-ends, failures away from rail-ends, and butt-weld failures. The principle rail defects classified according to their cause are failures attributable to manufacturing defects, failures attributable to service, failures which may be attributed either to manufacturing defects or to service, and failures due to butt-welding or thermit-welding and rebuilding of surfaces.

040184
VERTICAL RESILIENCE OF RAIL ATTACHMENT FOR TRACK WITH CONCRETE TIES

Hvostick, GC

Railroad Transport (Railroad Transport Editorial Board, 3a Sadovaya-Chernogryazskaya, Moscow-174, USSR)

41967, pp 3-6, 5 Fig, 8 Tab

English translation of Russian Article.

Stiffness of concrete tie track can be reduced by introduction of resilient pads under the rail; yet, if too much flexibility is introduced, there is danger of losing stability of the rail. Thus arises the problem of selecting optimal resilience of the pads. The system of the interaction of wheel and rail can be represented as a system with six degrees of freedom. Selection of values for the various parameters is quite complex. The author assumed the masses of various components taking part in the oscillation to be proportional to their deflection under a single concentrated force. It was concluded that: the reduction of joint stiffness for more universally used track reduces dynamic effect of wheel to rail action, reduces stresses in wheel and acceleration input to the car, the recommended value of stiffness is of the order of 100 x 10 to the third power Klg/cm, and the values of inertia force can be considered as a linear function of speed.

040185
APPLICATION OF PERT TO ANALYSIS OF CLASSIFICATION YARD

Kusnetsov, VI Buchkov, UV

Railroad Transport (Railroad Transport Editorial Board, 3 a Sadovaya-Chernogryazskaya, Moscow-174, USSR)

41967, pp 6, 7 Fig

(Translation from Railroad Transport, Issue 4, 1967 article by V.I. Kusnetsov and U.V. Buchkov)

PERT analysis was applied to a yard outside Moscow. This yard was characterized by tracks of insufficient length, congestion, and low priority as far as possible mechanization. It was therefore decided to apply PERT to improve operating practices and thus the performance of the yard. It was found that an essential factor in the successful use of network planning of yard operation is advance knowledge of the arrival of trains and their consist.

040189
REVIEW OF A RUSSIAN ARTICLE CONCERNING THEIR APPROACH TO TRACK DESIGN AND MAINTENANCE

Railroad Transport (Railroad Transport Editorial Board, 3a Sodovaya-Chernogryaskaya, Moscow-174, USSR)

21965, 2 pp, 1 Tab

Translation of Russian article prepared by S.G. Guins

Three means of reducing track maintenance are being instituted in Russia in order to counter the 30-60% reduction in productivity of gangs caused by heavy traffic. It is estimated that each kilogram of rail weight reduces cost of track maintenance by 1.4-1.6%. Therefore use of the lightest size P-43 is being discontinued. New standards of track design utilizing welded rail would reduce maintenance of way by 14-20%. A 5 cm. increase of depth of ballast in 20 x 10 to the 6th power ton/klm. areas reduces labor cost by 5-7% and an annual reduction of stone by 500,000 cubic meters.

040206
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS

Cramer, RE, Illinois University, Urbana

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 65 N, 84, Feb. 1964, pp 525-529, 2 Tab, 3 Phot

The failure analysis of eight rails is reported. Three failed due to transverse fissures from shatter cracks; three failed due to transverse fissures from hot torn steel; and two failed by compound fissure from overheated ingot. This last mode of failure had not previously been recognized.

040207
INSULATED RAIL JOINT DEVELOPMENT AND RESEARCH–SECOND PROGRESS REPORT

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 65 N, 84, Feb. 1964, pp 560-572, 2 Tab, 7 Phot

A new rail joint design to reduce maintenance is being laboratory tested. The AAR design, in which the joint bar, insulation, armor and thimbles are all molded and bonded into an integral unit, has the following advantages: the high modulus of steel to keep the deflection to a minimum; integral construction of the bars and insulation for reduction of movements and play; steel armor bonded to insulation takes the abrasive forces and distributes bearing pressures over greater areas; and armor and rubber protect the bars from the "notching" action of the rail ends to give better fatigue life.

040208
METALLURGICAL EFFECT OF RAIL-CROPPING METHODS

Hall, VE

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 65 N, 84, Feb. 1964, pp 573-576, 3 Tab, 3 Phot

The results of a questionnaire, returned by 24 of 36 railroads, regarding uses of cropped rail and methods used for cropping are reported. Micrographs are shows of the grain structure and hardness resulting from cutting using a friction saw. The cutting caused the metal to flow. If cropped rail is to be used for welded rail by the flash-butt welding process, the heat effect of the cutting is of no consequence.

040210
INVESTIGATION OF FAILURES OF WELDED RAILS AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University, Urbana

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 65 N, 84, Feb. 1964, pp 611-614, 1 Tab, 4 Phot

Three weld failures are reported in 115-lb rail. One was caused by poor fusion in the weld. The second was believed caused by a flake of mill scale caught between the rail ends during welding. The third failure was a web crack through the head on both sides of the weld. Thirteen bend test are reported, which were made on full-section rails.

040211
INVESTIGATION OF WELDED RAILS AT THE AAR RESEARCH CENTER

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 65 N, 84, Feb. 1964, pp 615-629, 1 Tab, 25 Phot

Results of the investigation of 13 welded rail failures are reported. Two were oxyacetylene pressure butt welds and 11 were flash butt welds. Five defects were in the rail before welding; the remainder were in the weld itself.

040213
DISCUSSION ON STRESSES IN RAILROAD TRACK

Talbot, AN, Illinois University

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 36, pp 957-958

The inspection tests of rail-joints in track made for the purpose of learning the source of the wear of the joint bars and the rail, the places of wear, information bearing on the mutual interaction of the worn bars and rail when under load and when the bolts are newly tightened, and other information relating to the stability and maintenance of the rail-joints have given desirable information. The occurrence of high stresses in the unloaded worn joint bars in track due to the tightening of the bolts was found to be as great as 30,000 and 40,000 lb. per sq. in. and in a few cases as high as 60,000 lb. per sq. in. The stresses were fairly proportional to the amount of the lateral bending put into the bar by tightening the joints, measured from the loose condition. The instruments designed and built to facilitate the measurement of profiles and shapes and straightness of joint bars and rail and their position with respect to each other in the joint have proved satisfactory.

040250
CRACKS AT RAIL ENDS

Magee, GM

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

e4083, Oct. 1947, 7 pp, 5 Phot

The occurrence of cracks at rail ends in the upper fillet and at the first bolt hole were investigated by the Engineering Division Research Staff. It appears that the development of these cracks is related to the use of rail joint packing, consisting of a mixture of wood flour and oil. The accompanying photographs are typical of the cracks found; the corrosive attack is clearly indicated. Seven railways have reported the development of these cracks where joint packing has been used. Others have removed rail joints where the packing was applied and found no cracks. It seems evident that in some instances the rail joint packing has contributed to the development of rail end cracks, and the indications are that a corrosive effect has either so lowered the fatigue strength of the steel that crack developed or that stress corrosion cracking has developed in the areas of high tensile stress in the upper fillet and around the first bolt hole.

040251
LETTER ON OCCURRENCE OF CRACKS IN RAIL ENDS

Magee, GM

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

e7191 File IV-3-C, Oct. 1948, 3 pp, 2 Tab

Results of a survey on inspection of rail joints with and without rail joint packing are presented. Table A includes those railways which report the development of fillet or bolt hole cracks where the packing has been used. Table B includes those railways which report no cracks. The Corrosion Research Laboratory of the Illinois Institute of Technology has been conducting tests with rail joint packing to determine whether stress corrosion cracks can be produced in accelerated laboratory tests in specimens of rail steel. These tests included both new packing and user packing removed from rail ends that had developed cracks. It has not been found possible to produce stress corrosion cracks with extracts from either the new or used packing in the accelerated laboratory tests. Accordingly, it has not been possible to determine that any chemical action of the joint packing is responsible for the cracks that have developed in service.

040302
THERMITE WELDING PRACTICES OF RAIL IN THE UNITED STATES

Kannowski, KH, Illinois Central Railroad

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 691968, pp 914-916

The alumino-thermic welding method for joining the ribbons has become practical. Improved thermite welding methods have been introduced which produced rail joints meeting the quality of electic-flash butt-welded rail joints and oxyacetylene pressure butt welded rail joints. The alumino-thermic or thermite reaction is a strongly exothermic self-propagating reaction, where finely divided aluminum reacts with a metal oxide. A mixture of aluminum and iron oxide produces sufficient heat to weld steel, the filler metal being produced in the reaction. The reaction takes place at 5,000 F and produces a filler metal at 3,5000 F which, in entering the rail gap, welds and fuses the rail ends. This filler metal is pure iron with a low hardness, which has to be enriched with alloys and high carbon steel to produce a rail-quality filler metal.

040334
A METHOD FOR RELATING TEST TRACK DATA TO THE REAL WORLD

Luebke, RW, Chesapeake and Ohio Railway

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 736-740, 5 Fig, 3 Ref

The purpose of this discussion is (a) to develop a method by which test track data can be related directly to any railroad's rock and roll problem, and (b) to provide a means for objectively evaluating the railroad's requirements for 100,000 in-lb to unload the wheels of a high cube car and create a potential derailment condition. The rate of energy buildup on the number of joints required to unload the wheels defines the car's susceptability to derailment. The rate of energy buildup also allows test track data to be related to the real world. By determining the distribution of low joints in the curved territory over which the equipment must operate, and the relative probability of derailment thus generated, the test track data can be used to objectively evaluate the needs of any railroad for rock and roll devices.

040339
COMPUTERIZATION OF HIGH AND WIDE CLEARANCES

Laden, HN, Chesapeake and Ohio Railway

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 691968, pp 814-830, 1 Fig, 11 Phot

The clearance problem considered is limited to dimensional restrictions to movement. Weight distribution and axle-load restrictions are ignored. The operations of a typical railroad Clearance Bureau are outlined and the phases which would be simplified by the use of a computer are identified. Several photoelectric detector installations for measuring the clearance are photographed. The functions of the Mechanical and Engineering Departments regarding clearances are briefly described. The SCOPE car used to collect information for updating clearance records is shown and described. The flow chart of the digital computer program is illustrated.

040398
DYNAMIC MEASUREMENT OF ABSOLUTE TRACK PROPERTIES

Cass, R, Canadian National Railways
Berthiaume, PP, Canadian National Railways
Kalita, RE, Canadian National Railways
St. Louis, L, Canadian National Railways

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

69-RR-6, Conf Paper, Apr. 1969, 7 pp, 13 Fig, 3 Phot, 2 Ref

Contributed by the Railroad Division of the ASME for presentation at the IEEE-ASME Joint Railroad Conference April 15-16; 1969, Montreal Quebec, Canada

A transducer developed to mount on the truck of a standard railway coach is the basis of a special track evaluation car. The practical application of this facility to track maintenance is described. Rail profiles are shown of track of good, intermediate, and poor quality. The SR and cross level values are shown in the figures.

040413
QUALITY OF RAILS AND MEANS OF GUARANTEEING IT—FALLING WEIGHT TESTS AND DEFINITION TESTS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 5, Apr. 1963, 2 pp

The main object of these tests—was to define and to standardize the conditions of use of the falling weight tests laid-down in UIC Leaflets 860-1-0 and 860-2-0, for the acceptance of rails of current quality and rails of nontreated steel of a quality resistant to wear. It was concluded that a falling weight test, irrespective of its type, is not representative of the fatigue behavior of rails in the track, but it was considered advisable to retain for the time being, such a test on complete pieces of rail, to make it possible to detect and eliminate brittle rails with a large degree of probable success and to maintain each rail production within a truly characteristic and correct scatter range.

040414
QUALITY OF RAILS AND MEANS OF GUARANTEEING IT—CONDITIONS OF USE FOR TECHNICAL SPECIFICATION UIC 860-1

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 2, Mar. 1962, 3 pp

Question D45.

The conditions of application of UIC Specification No. 860-1 were investigated relative to dimensional tolerance, falling weight test, tensile test piece, and detection of piping. Initially, rail tolerance measurements indicated that the majority of mill-produced rails were not acceptable, but if specified tolerances were strictly adhered to, it was felt the price of rail would increase greatly. Since users were reasonably satisfied with currently produced rail, the tolerance applicable to web thickness, inclination, and openings of the fishing angles were relaxed. When UIC Specification No 860-1 was initiated in 1954, it constituted the first step towards the standardization of the falling weight test. The Committee now offers a choice between two methods of carrying out the falling weight test; one method involves two successive blows applied to the test pieces rolled from a certain number of ingots, the other involves one blow and is applied to test pieces rolled from every ingot. Because of the nature of the steel used for wear-resisting rails, the corresponding UIC Specification 860-2 has been drafted to include a tensile test piece of 10 mm diameter.

The Committee to propose the standardization of the 10 mm diameter test piece. One result of this decision is that the minimum elongation will have to be raised from 12 to 14% in the case of ordinary rails. This test has been found to be not very accurate and of limited interest, since in reality it only permitted the revelation of piping in the rail without offering the possibility of its true appreciation. The Committee therefore sought another test for inspection purposes which would reveal piping in an indisputable manner. After considerable research, they have decided on a test which consists of the examination of the polished slice of rail intended for the macrographic (sulpher print) test.

040415
TECHNICAL AND ECONOMICAL STUDY OF TESTED TYPES OF CONCRETE SLEEPER–BEHAVIOR OF ORE TEST SECTIONS–EFFECTS ON DERAILMENTS ON CONCRETE SLEEPERS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 4, Apr. 1968, 6 pp, 1 Tab

Question D 22.

This report examines train derailments on concrete sleepered track. It is based on 40 derailment reports furnished by 8 European Administrations. It was that reinforced concrete sleepers have a certain degree of fragility and the damage observed in case of derailments, caused by the impact of derailed wheels, is generally considerable. It has, however, become apparent that the presence of concrete sleepers has never led to the derailment of axles, which would not have been derailed in the case of wooden sleepers. The repair involves more work than that in wooden-sleepered tracks and the resumption of the traffic at reduced speed often takes more time.

040416
BEHAVIOUR OF THE METAL OF RAILS AND WHEELS IN THE CONTACT ZONE–RESIDUAL STRESSES IN THE RAIL (CONTINUED) STUDY OF THE WORK-HARDENED ZONE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 6, Oct. 1970, 58 pp, 36 Fig

Question C53

This report contains the results of measurements taken to study the work-hardening caused by traffic, and more especially the changes in the residual stresses in the rails near the running tread which constitute an important factor in the study of rail fatigue phenomena. About 5 mm below the surface the work-hardening is very large, and the rail is the center of a hydrostatic pressure zone extending down to a depth of approximately 10 mm, this then changing into a tensile one with a maximum at about 15 mm. This may explain why the fatigue cracks (of the kidney-shaped flaw type) tend to originate at a depth of 10 to 20 mm but do not develop in the upper highly compressed zone. Furthermore, the residual-stress fields vary from one section of the rail to another, probably as a result of the oscillations of the wheel-loads due to short-wave rail corrugations.

040417
BEHAVIOUR OF THE STEEL AT THE POINT OF RAIL-WHEEL CONTACT– INTRODUCTORY STUDY ON THE CAUSES OF SHELLING CRACKS IN RAILS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Document No. 1, Oct. 1961, 10 pp, 9 Ref

Question C53.

This report reviews pertinent literature on the subject of shelling cracks in rail head. From the research conducted at the University of Illinois it is concluded that shelling cracks in rail heads are primarily due to fatigue under repeated rolling action. Obvious methods of reducing the development of shelling cracks would be to reduce wheel loads on the rails, to use larger diameter wheels or to use stronger rail steels. Future research should be directed towards the closing of the gap between standard fatigue data and the fatigue phenomenon as it occurs under contact stresses due to rolling action. At the moment, the prime difficulty in correlating tensile or torsion and rolling contact fatigue data stems from insufficient knowledge of stress distributions modified with respect to elastic theory by plastic deformation.

040420
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS

Area Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 66, Bulletin 591, Feb. 1965, pp 447-453, 7 Fig, 1 Tab

During the period 13 failed control-cooled rails were submitted to the AAR Research Center for metallurgical examination. All the specimens submitted were checked for metallurgical quality by means of cross sectional and longitudinal macrographs. Failures included, shelling, transverse fissures, base seam, and bolt hole fissures. Photographic evidence illustrates each type of failure.

040421
SHELLY RAIL STUDIES AT THE AAR RESEARCH CENTER

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 66, Bulletin 591, Feb. 1965, pp 484-493, 7 Fig, 2 Tab

Rolling-load test results obtained in a cradle-type machine are listed. Macrographs are presented to reveal cross-sectional qualities of shelly rail. Slow-bend test results are tabulated for flame and induction-hardened rail. It can be noted that all of the rails tested showed excellent results and that no effective stresses were set up between the head and web due to flame and induction hardening.

040422
SERVICE AND DETECTED FAILURES OF BUTT-WELDED RAIL JOINTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 66, Bulletin 591, Feb. 1965, pp 509-513, 3 Fig

During the period 14 service and detected failures of butt-welded rail joints were submitted for examination to the AAR Research Center. Macrographic and Microscopic examinations of the welds and of both rails adjacent to the joint were made. Since the majority of the butt welding rail in the United States is done by means of the electric flash process, the failures reported in Table 1 are predominantly in the welds produced by this process. Because of the thermal shock produced by this process in the relatively short heated portions at the ends of the rail, failures occur in rails with heavy segregation or fish tail which, before welding were in a homogeneous state, but opened into a discontinuity during the welding.

040423
CONSTRUCTION AND PROTECTION OF ROADBED ACROSS RESERVOIR AREAS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 66, Bulletin 591, Feb. 1965, pp 524-532, 4 Fig, 2 Tab, 3 Ref

The construction and protection of roadbed across reservoir areas present many problems that are not encountered in normal roadbed construction. These problems can be subdivided into three sections. Determination of Wave Heights, Construction of Embankment and Roadbed, Construction of Embankment Protection. Extensive treatment is given to the first of these sections. The term "reservoir area" as used in this report also includes lakes, natural and artificial river pools, and other inland waters on which waves may be generated.

040424
PART 2–USE OF SOIL-CEMENT CONSTRUCTION FOR BANK PROTECTION ON LEVEES AND EMBANKMENTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 66, Bulletin 591, Feb. 1965, pp 532-535, 4 Fig

Once soil-cement was developed for dam facings and bank protection on levees and embankments, the application also appeared suitable for railroads where relocations and bank protection are required. This report is based on an inspection of several dams using soil-cement construction. No specific railroad applications were available for inspection.

040425
INVESTIGATION OF SERVICE AND DETECTED BUTT-WELDED RAIL JOINT FAILURES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 372-383, 18 Fig, 1 Tab

In the period between October 1, 1965, and October 1, 1966, sixteen failures, service and detected, in butt-welded rail joints were submitted to the Association of American Railroads Research Center for a metallurgical examination. To date, the investigation has been completed on 9 of these 16 failures, in two oxyacetylene pressure butt weld: It is believed that a result of improper welding practice. Failure in an electric-flash butt weld was attributed to the presence of an electrode burn introduced during the welding process. In other electric-flash butt welds it was disclosed that the rail ends were cropped with a petrogen torch and that the time between cutting and welding ranged from a few days to several weeks. This time lapse is of concern because of the incipient cracks that may form and further develop on subsequent heating operations. A second possible cause for these failures is that the amount of rail cropped from the ends of these secondhand rails was insufficient to remove existing bolt-hole cracks that extend back into the web. In still other electric-flash butt welds, heavy segregation patterns were found.

040426
ROLLING-LOAD AND SLOW-BEND TEST RESULTS OF BUTT-WELDED RAIL JOINTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 383-396, 16 Fig, 2 Tab

In the period from October 1, 1965, to October 1,1966, sixteen rolling load tests and six slow bend tests were conducted on butt-welded rail joints at the Association of American Railroads Research Center. The joints were made by the thermite (Thermex Metallurgical, Exomet and Orgotherm), submerged-arc and oxyacetylene pressure-butt-welding process. The rolling-load tests were made on a 12-in-stroke rolling-load machine. Welded specimens were tested for various reasons including: (1) to determine the quality of the submerged-arc-welded rail joints, (2) to evaluate 115-lb thermite welded rail joints made by the Exomet process, (3) to determine the seriousness of making butt welds from rails with hairline cracks of (pipe) in the web. (4) to investigate the possible detrimental effects of a collar that was not removed from an Orgotherm thermite welded rail joint. The slow bend tests were made with the rail resting on supports 4 ft. apart and loaded at 2 points, one on each side of and 6 in. from the weld. These tests were made with the rail base down, thereby subjecting the head to a compressive stress and the base to a tension stress. For satisfactory service performance a minimum of 1.5 in. of deflection and 140,000 psi modulus of rupture are being used as tentative criteria for oxyacetylene and electric-flash pressure butt welds. A summary of the slow bend test results is provided.

040427
BUTT WELD FAILURES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, p 397, 1 Tab

A record of failures in various types of butt-welded rail is presented and briefly analyzed. On the basis of failures per 100 weld years, the failure rates for the oxyacetylene pressure butt welds and electric flash pressure butt welds are low, and about the same, for new rail. It should be noted, however, that the average service period of the oxyacetylene pressure butt welds is 68 percent longer than that of the electric-flash pressure butt welds. For relay rail, the performance of the oxyacetylene pressure weld is somewhat better than that of the electric-flash pressure weld. The failure rate in thermite welds is substantially higher than that for either of the two pressure processes.

040428
RAIL FAILURE STATISTICS COVERING (A) ALL FAILURES, (B) TRANSVERSE FISSURES, (C) PERFORMANCE OF CONTROL-COOLED RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 418-436, 10 Tab

These statistics are based on the rail failures reported to December 31, 1965, and are submitted as information. They include the service and detected failures reported by 45 railroads on all of their main-track milage, which constitutes approximately 90 percent of the main track of Class 1 Railroads in the United States. The accompanying tables and diagrams indicate the extent of control of the transverse fissure problem that has been obtained by the use of control-cooled rail and detector car testing, give data on the quality of each year's rollings for the various mills, and show the types of failures that are occurring on the various railroads as related to the mill producing the rail. Also included are data reported on all failures in rail of all ages and sections.

040429
EVALUATION OF LINDE'S EXPERIMENTAL 936-89 WIRE FOR BATTERED RAIL END BUILD UP USE

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 437-452, 16 Fig, 1 Tab

An investigation to evaluate Linde's experimental 936-89 cored wire for rail end build up was conducted based on rolling-load test results, hardness survey results and a metallurgical examination to determine the quality of the weld. Information supplied by Linde relating to the welding procedure indicates that prior to welding, all joints were preheated to 700 F. A Tempil stick was used to determine the preheat temperature. Immediately following the preheat the joints were welded using 425 amperes, 27 volts. Sample rail joint were resurfaced at the butt edge to bring the deposit closer to the edge.

These welded, battered rail end sample joints were subjected to rolling-load testing in the 12-in-stroke rolling-load machine. Testing of one sample was discontinued after the joint had been subjected to 4,002,200 cycles in the rolling-load machine because of excessive batter. Testing specimen 154 C was subjected to 2,000,000 cycles in the rolling-load machine. This test was discontinued because of a failure, originally starting as a progressive-type failure from a bolt hole, and later resulting in a head and web separation when the bolts were tightened to a desired tension. Speciments cut from joint 154 A show a normal heat pattern and good weld-metal deposit penetration. A good weld-metal deposit penetration was noted.

040430
INVESTIGATION OF INSULATED RAIL JOINTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 458-460

A comprehensive investigation was undertaken to determine the most appropriate and significant laboratory testing procedure for evaluating the merits of insulated rail joints. The investigation decided upon consisted of three phases. First, a new 3M plastic insulated joint for 136 RE rail was instrumented with strain gages to measure the flexural strains developed in the top and bottom of the two bars at midlength and 6 in each way from midlength. Since the strain would be zero at the bar ends, this gave five points along the length of the bar to establish the shape of the bending moment curve. These bars were then placed in main-line track on the Santa Fe. and measurements were taken of joint bar flexural strains developed under a number of passing trains, including passenger and freight. In the second phase of the investigation, another pair of the same type of 3M plastic joint was similarly instrumented with strain gages and placed in a rolling-load machine in the laboratory. Increments of loading were applied, and it was found that a wheel load of 15,000 lb. gave the same range of flexural strain in the bars at midlength as the maximum range measured in the track installation. The third phase of the investigation is a laboratory study with the objective of determining the effectiveness of different designs of insulated joint to support the rail ends and minimize joint tie tamping requirements. It would be expected that the more flexible the insulated joint, the more load would be thrown on to the supporting ties and more frequent tamping would be required. Accordingly, two lengths of 132 RE rail, each 10 ft long were supported in a special laboratory setup under a hydraulic loading machine on 11 ties plates spaced 20 apart. Two load cells were placed between the rail base and each tie plate to measure each tie reaction. Results were not avilable at the time of this publications.

040431
METALLURGICAL EXAMINATION OF FOUR ELECTRIC-FLASH BUTT WELD SERVICE FAILURES SUBMITTED BY THE FLORIDA EAST COAST RAILWAY

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 460-462, 4 Fig

An investigation was made to determine the cause of four electric-flash butt welded rail joint service failures. These four failures are representative of a group of 13 or more failures that occurred in a short period after laying. From the results of this investigation it is believed that these failures are not related to the quality of the rails or the soundness of the welds. It was later disclosed that the rail ends were cropped with a petrogen torch prior to welding. Information was also received that the time between cutting and welding could range from a few days to several weeks. It is possible that incipient cracks formed during cropping of rail ends. Once these incipient cracks have formed, further development of the crack can occur on reheating, such as during the welding operation. A second possible cause for these failures is that the amount of rail cropped from the ends of these secondhand rails was insufficient to remove bolt-hole cracks that extend back into the web. From this investigation it is believed that these failures can be attributed to (1) cutting the rail ends with a petrogen torch, (2) incomplete removal of existing bolt-hole cracks, or a combination of both these factors.

040432
SHELLY RAIL INVESTIGATION, ROLLING-LOAD AND SLOW-BEND TEST RESULTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 477-487, 3 Fig, 2 Tab

Two methods presently employed for improving shelling resistance is the addition of alloying elements and the heat treating of rail. The rolling-load tests in a cradle-type machine are designed to evaluate these methods of improving the resistance to shelling. Rolling-load test results obtained from these cradle-type machines for the period between October 1, 1965, and October 1, 1966, are shown. The S-13 series were initiated to compare the effects of welding prior to flame hardening and flame hardening prior to welding. The electric-flash butt welds were made from secondhand 132-lb HF rail and flame hardened by the Hammon process. Specimens S-13A and S-13C failed after being subjected to 389,800 and 656,900 cycles, respectively. As a result of this performance, rolling-load tests were conducted on welded joints made from 132-lb HF secondhand rail having no flame hardening applied. These joints, S-13E and S-13J, shelled after being subjected to 1,088,000 and 1,163,000 cycles, respectively. Rails flame hardened by the Linde process developed shells after being subjected to 1,254,400 and 844,900 cycles in the cradle-type rolling-load machine. During this period there were no slow-bend tests.

040433
USE OF PORTABLE SEISMIC EQUIPMENT FOR SUBSURFACE EXPLORATION

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 502-503

The development of portable refraction seismograph equipment for use in relatively shallow subsurface exploration is comparatively recent. However, the theory on which the equipment operates has been successfully used for many years. Some of the uses to which this equipment can be put are: to determine thickness of strata—soil or rock, profile and ripability of rock; depth to rock, location and size of sand and gravel deposits, discontinuities of soil or rock such as soft material pockets, saturated zones, and voids, elevation and extent of subsurface water; and economics of location for utility routes, highways and railroads. In one specific instance, it was used to locate potential sink holes near track caused by cavities in underlying soil or gypsum bedrock.

040434
RAILROAD VEGETATION CONTROL A. TERMINOLOGY

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 68, Bulletin 605, Feb. 1967, pp 514-521

This article covers reasons for controlling vegetation, methods employed, uncontrollable factors which affect results and railroad related factors in vegetation control. Methods are described for controlling weeds, grasses and brush. Some of the uncontrollable factors that affect the results of vegetation-control programs include: soil type, species of vegetation, rainfall, temperature, and sunlight. Railroad related factors include the kind and condition of track, financial commitment, degree of control desired, and company policies.

040438
BEHAVIOUR OF THE METAL OF THE RAILS UNDER THE REPEATED ACTION OF THE WHEELS–RESIDUAL LONGITUDINAL STRESSES IN THE RAIL (PART 1)

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 4, Oct. 1966, 11 pp, 6 Fig, 8 Ref

Partial Copy, Question C53.

The residual stresses result: from heat effects during the cooling of the rail after it leaves the rolling mill; from trimming, after rolling in the vertical and horizontal directions; and, from the cold rolling of the top surface of the rail by the passage of loads. The object of this report is: to lay down a method for the determination of residual stresses, and to supply the results obtained by applying such a method in some special cases.

040439
BEHAVIOUR OF THE METAL OF RAILS AND WHEELS IN THE CONTACT ZONE–TENTATIVE STUDY OF STRESSES IN A RAIL BY PHOTO-ELASTIC AND EXTENSOMETER MEASUREMENTS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 5, Oct. 1969, 6 pp

Question C53.

A simplified rail in an elastic field was studied by photoelastic measurements on a 1/3 scale model and by extensometer measurements. It is concluded that the simplified rail model can be used for bending stress only. The model considered the rail resting directly on the ballast, ignoring the incorporation of cross ties.

040456
INVESTIGATION OF SERVICE AND DETECTED BUTT WELDED RAIL JOINT FAILURES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, No. 619, Feb. 1969, pp 681-698, 1 Tab, 25 Phot

Eight service failures and three detected failures in butt welded rail joints were investigated by the AAR between October 1967 and September 1968. A summary is given of the causes of failure, type of weld, size of rail, date of rolling, and the fabricator. Photographs of the rails at the point of failure are shown.

040457
RESULTS OF ROLLING-LOAD TESTS OF BUTT WELDED RAIL JOINTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, No. 619, Feb. 1969, pp 699-711, 1 Fig, 1 Tab, 10 Phot

Between October 1, 1967 and September 30, 1968 fifteen butt welded rail joints were tested on the rolling-load machines at the AAR. The rails were tested to a maximum of 2,000,000 cycles, or to failure, of repeated loading. The rolling-load tests are tabulated. For the failed rails the damage points are shown.

040458
BUTT WELD FAILURES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, No. 619, Feb. 1969, p 712, 1 Tab

A summary of the butt weld failures accumulated up to December 1967 is tabulated. On the basis of failures per 100 weld years, the failure rate for the oxyacetylene pressure butt welds is slightly higher than for the electric flash pressure butt welds for new rail (0.0072 to 0.0046). The average service period of the oxyacetylene pressure butt welds is 48 percent longer than that of the electric flash pressure butt weld. For relay rail, the performance of the electric flash pressure weld is somewhat better than that of the oxyacetylene pressure weld.

040459
INVESTIGATION OF FAILURES IN CONTORL-COOLED RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, No. 619, Feb. 1969, pp 718-733, 1 Fig, 1 Tab, 17 Phot

Between October 1, 1967 and September 30, 1968 six service failures and one detected failure in control-cooled rail were investigated by the AAR. A summary of the failures is given and each failure is described and photographed.

040460
RAIL FAILURE STATISTICS COVERING (A) ALL FAILURES, (B) TRANSVERSE FISSURES, (C) PERFORMANCE OF CONTROL-COOLED RAIL

Faries, DT

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, No. 619, Feb. 1969, pp 734-754, 4 Fig, 10 Tab

These statistics are based on the rail failures reported to December 31, 1967, and are submitted as information. They include the service and detected failures reported by 45 railroads on all of their main track mileage, which constitutes approximately 90 percent of the main track of Class I railroads in the United States. The annual statistics for 1967 are itemized separately along with being included in the totals for previous years.

040461
SHELLY RAIL INVESTIGATION–RESULTS OF ROLLING-LOAD AND SLOW-BEND TESTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, No. 619, Feb. 1969, pp 772-780, 2 Tab, 5 Phot

Addition of alloying elements and heat treating rail are used to improved the shelling resistance. Cradle-type rolling-load tests are conducted by the AAR to evaluate these methods. Rolling-load test results obtained from these cradle-type machines for the period between October 1, 1967 and September 30, 1968 are shown.

040462
INVESTIGATION OF SERVICE AND DETECTED BUTT-WELDED RAIL JOINT FAILURES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 423-428, 1 Tab, 6 Phot

The results of the investigation of five butt-welded rail joints of the seven failures reported from October 1964 to October 1965 are discussed. Three of the five failures were service failures and the other two were detected failures. Photographs of the damaged rails are shown.

040463
BUTT-WELD-FAILURE STATISTICS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 436-437, 2 Tab

Failure statistics are shown from 1962 to December 1963 and to December 1964. The failure rate in thermit welds is substantially higher than for either oxyacetylene or flash-pressure butt welded rail.

040464
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 446-451, 1 Tab, 9 Phot

Investigation of six of eight failures in control-cooled rail reported from October 1964 to October 1966 are complete by the AAR and are discussed. Five of the six failures were service failures attributed to martensite formation or hot torn steel. The detected failure resulted from shelling.

040465
RAIL FAILURE STATISTICS COVERING (A) ALL FAILURES, (B) TRANSVERSE FISSURES, (C) PERFORMANCE OF CONTROL-COOLED RAIL

Faries, DT

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 451-472, 4 Fig, 10 Tab

These statistics are based on the rail failures reported to December 31, 1964. They include the service and detected failures reported by 47 railroads on all of their main-track mileage, which constitutes approximately 90 percent of the main track of Class I railroads in the It is pointed out that Verigo's equation for calculating 1964, are reported as annual totals along with being accumulated with figures from previous years.

040466
INSULATED RAIL JOINT DEVELOPMENT AND RESEARCH–THIRD PROGRESS REPORT

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 478-482, 1 Tab

The results of rolling-load tests on 15 AAR-Veelcaboned joints are given. Two 132-lb joints completed the 2,000,000 cycles without failure. One permali insulated joint was tested, but failed after only 600 cycles. Results are tabulated.

040467
RAIL CROPPING USING THE OXYGEN-GASOLINE (PETROGEN) CUTTING TORCH

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 483-489, 2 Tab, 9 Phot

Hardness checks of the cropped area revealed excess cementite and a hardened heat-affected zone. This method of cropping rail for oxyacetylene pressure butt welding is not recommended unless the cementite and heat-affected area is removed by other means. Because of the large quantity of metal removed (washed-out) during the electric-flash butt-welding process, cropping by an oxygen-gaoline torch may be acceptable, but if cementite becomes entrapped in the weld interface during the welding process, a weld failure may result. If cementite becomes entrapped in a weld produced by a thermite welding process, it will act as a stress raiser which promotes fatigue failure. In rail torch-cut for application of joint bars, the presence of cementite on the rail faces may promote head and web separations.

040468
RAIL CROPPING BY THE WET ABRASIVE CUTTING METHOD USING A 26-IN. N.C.G. NO. 310 CUT-OFF WHEEL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 489-492, 5 Phot

Photomicrographs reveal the depths of transformed (untempered martensite) metal to vary from 0.017 to 0.024 inches for the three rails which were cropped by the wet abrasive cutting method. This layer would wash out during electric-flash butt welding. Tests will need to be performed to determine the effect of this layer on rails welded by oxyacetylene welding.

040469
SHELLY RAIL INVESTIGATION–RESULTS OF ROLLING-LOAD AND SLOW-BEND TESTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 500-508, 3 Fig, 1 Tab, 12 Phot

The rolling-load test results obtained in the cradle-type machine on tests conducted between October 1, 1964, and October 1, 1965, are shown. During this period there were no slow-bend tests conducted. The cycles to failure under a wheel load of 50,000 lb. are given for 36 specimens; for the majority of these specimens, hardness values are reported.

040470
SLOPE PROTECTION

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, No. 598, Feb. 1966, pp 529-532, 1 Tab

Slope protection by diverting or controlling surface drainage, by vegetation, surface blanketing and slide detector fences is discussed. Various suitable seeds and rates of application are tabulated for ground covers. Detector fences are particularly valuable where falling rocks, snow and ice hazards are present.

040471
INVESTIGATION OF SERVICE AND DETECTED BUTT WELDED RAIL JOINT FAILURES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 574-588, 23 Fig, 1 Tab

In the period between October 1, 1966, and October 1, 1967, there were seven service and no detected failures in butt welded rail joints investigated by the metallurgical laboratory of the AAR. A summary of these service failures is tabulated. Investigation 136-22 involved an electric flash butt welded joint that failed in service. The rails used in the fabrication of this joint were 112-lb RE sections rolled July 1942. This failure could be attributed to an entrapment introduced during the welding process. Investigation 136-25 involved a rail, part of a continuous welded string, that failed in service. This rail was identified as a 140-lb PS section rolled in 1959. This failure can be attributed to these electrode burns which were introduced during the welding process. Investigation 136-27A, B, and C involved three electric flash butt welded joints that failed in service. The rails used in the fabrication of these joints were 132-lb RE sections rolled in August 1965. These electric flash butt weld failures can be attributed to pipe and heavy segregration. Investigation 136-31 involved an Orgotherm thermite welded rail joint that failed in service. The rails used in the fabrication of this joint were 115-lb RE sections rolled in June 1966. This failure could be attributed to the presence of a martensite formation that resulted from a heavy grinding of the thermite weld collar after the weld metal had cooled. Investigation 136-34 involved an electric flash butt welded joint that failed in service. The rails used in the fabrication of this joint were 136-lb RE sections rolled in 1967. This failure could be attributed to the presence of this cementite.

040472
RESULTS OF ROLLING-LOAD AND SLOW-BEND TESTS OF BUTT WELDED RAIL JOINTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 589-597, 11 Fig, 1 Tab

In the period between October 1, 1966 and October 1, 1967, 22 rolling-load tests were conducted on butt welded rail joints but no slow-bend tests were conducted. These butt welded rail joints were made by the oxyacetylene and electric flash butt welding process. The rolling-load tests were made on a 12-in-stroke rolling-load machine. Investigation 214 (samples A through F) was conducted to determine the seriousness of hairline cracks (segregation and pipe) on oxyacetylene pressure butt weld quality. Five of the six joints withstood 2,000,000 cycles of repeated loadings without failure, which is considered a run-out, and one joint (214E) failed after 897,100 cycles. A macroscopic examination made on transverse sections cut from the end of each rail prior to welding indicates that this failure originated from a fishtail. Investigation 220 (samples A through F) is a continuation of the problem presented in investigation 214 but was conducted to determine the effects of hairline cracks on joints from rails of heavier sections. It was found that fatigue of the failed specimens originated in the fillet between the head and web and can be attributed to a shear drag introduced while removing the weld upset. Investigation 226 (samples A and B) was conducted to evaluate two electric flash butt welded joints from which the upset metal had been ground from the top and sides of the head and bottom and sides of the base but not removed from the web. An examination of the fracture surface to determine the fracture mechanics indicates that this failure originated in the fillets between the web and upset metal. Investigation 230 (samples A and B) was conduced to evaluate oxyacetylene pressure butt welded joints made with a new type of welding head. Joint 230A failed after 33,500 cycles of repeated loading and joint 230B withstood the 2,000,000 cycle minimum requirement without failure. This failure can be attributed to the lack of fusion at the weld interface.

040473
PROGRESS REPORT ON ANCHORAGE OF CONTINUOUS WELDED RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 600-617, 16 Fig, 2 Tab

Measurements were made on a test installation for the study of rail anchorage for continuous welded rail. The purpose was to obtain data on (1) the effect of train movements on rail anchorage forces (static before and after) and (2) the relation between rail anchorage force and tie movement. This installation was on tangent track with 115 RE continuous welded rail. All weight bars were loosened for the first train to obtain zero readings and a 100-lb force was applied to eastbound anchors (anchors to restrain easterly rail movement). All westbound anchors had the bolts adjusted to just be in contact. The joint gap and rail temperature were measured periodically. Also, the rail position lengthwise of the track was measured at each of 7 test locations. These measurements were then repeated after each of four trains had passed to show the change that had been effected by the train passage. Tests were also made to determine the resistance or force required to move the ties in the ballast. Specific results from the various tests are presented in several tables. Truck housing dynamic recording equipment was driven to the test site and information was recorded under all trains during a two-day period. The recording equipment consisted of 12-carrier amplifiers and a direct writing oscillograph. Ten channels recorded the longitudinal rail forces exerted through rail anchors to the weigh bars on the ties. The remaining two channels, connected to extensometers, were used to measure the longitudinal movement of the rail and tie with respect to the reference pipe.

040474
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 620-631, 19 Fig, 1 Tab

In the period between October 1, 1966 and October 1, 1967 there were seven failures in control-cooled rail, three service and four detected, investigated by the metallurgical laboratory of the AAR. Investigations 132-10A and B involved two rail specimens both having a detected transverse discontinuity in the head. These transverse discontinuities were detected by a detector car. Rail specimen 132-10A was identified as a 100-lb RE. This failure should be classified as a transverse fissure from hot torn steel. Rail specimen 132-10B was identified as a 132-lb RE. This failure should be classified as a detailed fracture from a shell. Investigations 132-12A and B involved two rail specimens both having a detected internal imperfection in the web. These internal imperfections were detected by a detector car and a hand test. Both rail specimens were identified as 132-lb RE. It was noted that both these rails have a pipe, and a non-metallic entrapment (slag) commonly associated with pipe, in the web. Investigation 135-16 involved a rail that failed in service. This rail was identified as a 112-lb RE. A photograph of the fractured faces showed a fatigue ring development. This fatigue ring development (detail fracture) started from a longitudinal separation close to the running surface of the rail head, then turned downward to form a transverse separation at a right angle to the running surface. This failure should be classified as a detail fracture from a shell. Investigation 135-28 involved a service failure that resulted from a derailment. This rail was identified as a 112-lb RE. This failure was caused by an impact force of unusually high magnitude that is believed to have been the result of a derailment. Investigation 135-29 involved a rail that failed in service. This rail was identified as a 115-lb RE. This failure was attributed to the presence of a base seam in conjunction with a high impact loading at subzero temperatures.

040475
RAIL FAILURE STATISTICS COVERING (A) ALL FAILURES, (B) TRANSVERSE FISSURES, (C) PERFORMANCE OF CONTROL-COOLED RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 632-651, 4 Fig, 10 Tab

These statistics are based on the rail failures reported to December 31, 1966. They include the service and detected failures reported by 47 railroads on all their main-track mileage, which consititutes approximately 90 percent of the main track of Class I railroads in the United States. The accompanying tables and diagrams indicate the extent of control of the transverse fissure problem that has been obtained by the use of control-cooled rail and detector car testing, give data on the quality of each year's rollings for the various mills, and show the types of failures that are occurring on the various railroads as related to the mill producing the rail. Also included are data reported on all failures in rail of all ages and sections.

040476
SHELLY RAIL INVESTIGATION–RESULTS OF ROLLING-LOAD AND SLOW-BEND TESTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 699-707, 5 Fig, 1 Tab

The S-15 series was initiated to evaluate rail heat treated by the flame-hardening process. Rolling-load test results for specimens S-15A through S-15W were reported last year and are included in this report for information. Specimens S-15W, S-15X, S-15E-2 and S-15F-2 are all secondhand 132-lb head-free rail heat treated to 3/16 in depth. Specimens S-15G-2 and S-15H-2 were not heat treated (secondhand 132-lb head-free rail) and used as control samples. The S-16 series was initiated to evaluate rail heat treated by the Linde process. During this period there were no slow bend tests.

040477
INFLUENCE CHART FOR MOMENTS IN RAILWAY RAILS

Martin, GC

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 69, Bulletin 612, Feb. 1968, pp 710-718, 9 Fig

This report contains a graphical method of analysis for determining the moments in a railway rail. The method, based on a beam on an elastic foundation analysis, requires use of an influence chart and requires the wheel loading configuration under consideration to be drawn to a scale of 1 inch equals 1 foot and then be placed on the chart. Coefficients taken from the chart are then used to determine the moment at a given point in the rail. Changes in the track properties or finding the moment at another point in the rail are accomplished by changing the position of the scaled wheel loading configuration on the chart and noting new coefficients.

040479
RAILWAY SNOWFIGHTING

Parkes, GR

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 307, Part 5, 65-66, pp 415-478, 1 Fig, 27 Phot

Pushplows used in England, the United States, Canada and Sweden are described and illustrated. Rotary plows are described, such as the Leslie-type used in the U.S. and Europe, and types using other principles including the Bros Sno-Flyr (American), the Sicard Blower (Canadian), the Rolba Rotary Plough (Swiss), the Schmidt-Wyhlen Plough (German) and the Kisha Seizo Kaisha Plough (Japanese). Miscellaneous types of equipment include jet-engined blowers, snow melters, gas, infrared and electric point and switch heaters, and snow fences.

040502
ULTRASONIC TESTING OF RAILWAY COMPONENTS

Wise, S, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 321, Part 1, 68-69, pp 77-110, 12 Fig, 8 Phot, 4 Ref

Ultrasonic testing has expanded to the stage where it is a vitally important inspection method for two major railway components, axles and rails. It is likely that the use of the method will extend in many other fields. The success with which ultrasonic testing is now practiced is dependent upon three factors. They are: a thorough understanding of the type and position of flaws likely to occur in the component and the significance of flaw size; a sound knowledge of the principles underlying the use of ultrasonics for this purpose; and, a testing organization which can put sound techniques, well-trained men, and well-maintained instruments of the right type to work.

040510
TWO-VIBRATOR TYPE SEARCHING UNIT AND ITS APPLICATION TO ULTRASONIC FLAW DETECTOR

Mano, K

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 4, Dec. 1962, pp 11-13, 2 Fig, 7 Phot

In order to detect flaws located closely near surface in a metal material using a ultrasonic flaw detector, a two-vibrator type searching unit was invented. One of the two vibrators is a transmitter and the other a receiver. This unit can be used to inspect Thermit welded part of rails. Two-vibrator type searching unit is applied to an audigauge type flaw detector for use in rails. The unit can detect big flaws if they exist more than 1 to 5 mm apart from surface. In case of small flaws, they can be detected if their distances from surface are more than 5 mm.

040511
REPEATED SHOCK TEST OF RAILWAY TRACK

Satoh, Y Hirata, G

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 2, June 1963, pp 42-45, 6 Fig, 2 Phot

By means of a repeated shock tester for track, the dynamic properties are studied of the test track. Test tracks were selected one on a wooden tie section and the other on a concrete tie section. There were laid 50 kg PS rails, wooden ties without tie-plates or prestressed concrete ties with a spacing of 60 cm. Ballast was crushed stone with a depth of 25 cm and a shoulder width of 35 cm. Before every test the ballast was tamped. To know the pressure on rails, bending stress was measured. Displacement of rail depression was calculated on the data of measurements by the velocity vibrometer. Dynamic force upon rails was calculated on the data of rail bending stress. This force exceeds the centrifugal force under 1400 to 1900 rpm and this is considered to be caused through resonance.

040512
BUCKLING STRENGTH OF RAILWAY TRACK (REPORT 3)

Numata, M

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Dec. 1960, pp 78-79

A theoretical formula is presented for the buckling strength of railway track with welded joints. The minimum value of buckling strength is commonly adopted as the buckling strength for designing the track construction, on the assumption that it represents the statistic value of track irregularity.

040514
THIRTEENTH PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 56, No. 521, Feb. 1955, pp 938-951, 1 Fig, 3 Tab, 18 Phot

Twelve tests of new 132 RE headfree bars with ground easements averaged 403,610 cycles in the rolling-load tests. Fourteen of the bars failed. Twelve tests of used 132 RE headfree bars, reheat treated by oil quenching at 1500 to 1550 deg F, after grinding easements, averaged 761,870 cycles. Twelve tests of used 132 RE headfree bars, reheat treated by oil quenching at 1500 to 1550 deg F and tempering at 800 deg F after grinding easements, averaged 484,-980 cycles. The ground easements from 1/32 to 7/64 in. in depth were effective in eliminating or reducing gouging by the rail ends. Tests on four 112 K2 headfree bars which failed in service indicated yield points below AREA specifications and Brinell hardnesses below 200 on the tensile specimens.

040515
THIRTEENTH PROGRESS REPORT ON SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 56, No. 521, Feb. 1955, pp 954-959, 1 Tab, 14 Phot

One specimen of a chromiun-vanadium rail, heat treated to 490 Brinell hardness gave a rolling-load test of 21 million cycles. Ten specimens of high-silicon rails gave rolling-land tests that averaged 2,307,000 cycles. Two specimens of 140-lb. chrome-vanadium alloy rail, gavc rolling-load tests that averaged 3,625,000 cycles. One shelling crack started at a segregation streak in the rail. Rolling-load tests to produce detail fractures from shelling indicate that both chrome-vanadium alloy rails and heat-treated carbon-steel rails resist the production of detail fractures better than standard carbon-steel rails. All rolling-load tests to produce shelling indicate that rails with higher hardness, with corresponding increase in mechanical strength, give longer laboratory rolling-load tests.

040516
THE EFFECT OF STRESS RAISERS AROUND A BOLT HOLE ON THE FATIGUE LIFE OF A RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 56, No. 521, Feb. 1952, pp 960-975, 4 Fig, 2 Tab, 14 Phot

A universal fatigue testing machine was obtained and a bending fixture was designed. The function of the machine is to apply a vertical vibratory force to any specimen. The alternating force is applied 1800 times a minute to an elastic test specimen, and can be adjusted between zero and 5000 lb. The 132-lb. RE section was used because it represents the heaviest of AREA sections, and the 140-lb. PS section was used because it had a bolt hole location in the heavier web area. The severity of the defects varied from light to heavy drill gouges, and from light to heavy burrs, as well as the location of the brand one the edge of the hole. The effect of the stress raisers on the fatigue life of the rail sections is very pronounced. All these stress raisers around the bolt hole were produced in the manufacturing process. The statistical data indicates that a bolt hole drilled with a dull or improperly sharpened drill through a brand reduces the fatigue life of the rail by 50 percent.

040518
REVISION OF MANUAL

Hollingsworth, RJ

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 420-431, 2 Tab

This committee has completed the task of collaborating with ASTM Committee A-1 to make ASTM and AREA specifications for low-carbon steel tie plates, hot-worked high-carbon steel tie plates, and soft-steel track spikes the same in requirements and similar in format. At the same time it was decided to rearrange the AREA specifications for high-carbon steel track spikes and steel drive spikes (which the ASTM does not have) to make them conform also to the new format. In addition to their rearrangement, all these specifications have been revised to permit the use of steel made by the basic-oxygen process.

040519
TRACK TOOLS

Peterson, CE

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, p 432

This committee is making a study of the following subjects: Snap-on Ratchet Track Wrench. The committee suggested that it be designed as a double-end socket wrench having a thin-wall socket with a single-action ratchet in one direction. The ratchet should be fitted around the center of the double-end socket where the handle will engage it. There have been a number of failures of aluminum track jacks. Therefore, a canvass is being conducted. From the data received, a study will be made to determine necessary changes in design, metallurgy, specifications, etc., to correct the situation. An investigation will be made on the use of lightweight metals for the AREA track level and gauge. Wear limit of striking and cutting tools. A study will be made on the economy of reclaiming tools that have worn down to the specified wear limit.

040520
STANDARDIZATION OF TRACKWORK PLANS

McCowauthy, CJ

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 433-434, 2 Ref

This committee submits the following report of progress in connection with the standardization of trackwork plans. Plans for five new standard turnouts were submitted and approved for recommended practice. Also published and issued for inclusion in the Manual were the various other AREA plans incorporating revisions in switch details. A study was made of the method used in calculating the recommended maximum speeds of trains through level turnouts. The AAR research staff made a study as a result of this investigation on standardization of turnouts. The formula developed by them used the angle of impingement at the point of switch, and an experimentally determined maximum lateral acceleration for comfortable riding, to develop the permissible speed through the switch. Speeds calculated by this method were compared to the recommended speeds now in the Manual and were found to be similar. Revision of a plan covering swtich stands was recommended.

040521
DESIGN OF TIE PLATES

Pelton, LA

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 434-440, 2 Fig, 2 Tab

This is a final report, on the service test in which seven designs of tie plates for the rail base of 6 in. were subjected to 379 million gross tons of traffic. The test results indicate good uniformity in plate cutting under the 14-in. and 14 3/4-in. plates on the inner rail of the 6-deg curve, but that the 14 3/4-in. plates with 1/2-in. eccentricity had the best performance on the outer rail. The 13-in. plates have performed reasonably well and should be adequate, particularly under medium traffic or with 5 1/2-in. base rail. The 12-in. plate is indicated to be inferior for heavy traffic, particularly on the curve and tangent with softwood ties.

040522
INVESTIGATION OF FAILURES OF WELDED RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 451-459, 2 Tab, 8 Phot

Six failed welds were sent to this laboratory for evaluation. One electric-flash butt weld failed after about two years in service because of a fatigue fracture starting at near midheight of the rail web at a small ball of the molted sparks which ordinarily fly away as the rails are being heated but which in this case became trapped in the weld. Another electric-flash butt weld had also been in service about two years when it failed because of a fatigue fracture starting in the rail web about 3/4 in above the rail base. These two failures can be attributed to a combination of three circumstances: High tensile stresses due to cold weather. Stress concentration at the small imperfections in the welds. Stress concentration due to the flash under the rail bases. Four additional failures are described. Eleven bend test results are reported.

040523
INVESTIGATION OF FAILURES IN CONTROL COOLED RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 500-508, 1 Tab, 7 Phot

Photographs and discussions are included on the following types of rail failures: transverse fissure from shatter crack; transverse fissure from hot-torn steel; transverse fissure from inclusion; detail fractures from shelling; fracture from welded engine burn; three weeping cracks from grinding; detail fracture from porous bond weld.

040524
RAIL FAILURE STATISTICS COVERING (A) ALL FAILURES, (B) TRANSVERSE FISSURES, (C) PERFORMANCE OF CONTROL-COOLED RAIL

Faries, DT
Kannowski, K, Association of American Railroads

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 500-508, 4 Fig, 14 Tab

These statistics are based on the rail failures reported to December 31, 1961, and are submitted as information. They include the service and detected failures reported by 50 railroads on all of their main-track mileage which constitute approximately 90 percent of the main track in the United States and Canada. The accompanying tables and diagrams indicate the extent of control of the transverse fissure problem that has been obtained by the use of control-cooled rail and detector car testing, give data on the quality of each year's rollings for the various mills, and show the types of failures that are occurring on the various railroads as related to the mill producing the rail.

040526
COMPARISON OF SOIL DENSITY AND WATER CONTENT DETERMINATIONS WITH CONVENTIONAL AND NUCLEAR EQUIPMENT

Peckover, FL, Canadian National Railways

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 546-553, 3 Tab, 8 Ref

Compaction control of earth fills and grades is based on density and water-content measurements at the site of the work. To assist in appraising the relative usefulness of both conventional and nuclear equipment this report presents the results of an investigation in which their performance and economics are compared. Eight practical locations in the Toronto Ontario area were chosen for testing. Four sites were in various till soils and four in other soil types used for fill. At each location between three and six complete tests were run within a distance of a few feet. Each test was planned to measure soil density and water content with all three types of equipment under as identical conditions as possible. Results of this investigation of interest to railway engineers concerned with earth fill operations were summarized as follows: (1) Control measurements of soil density and water content can be made by conventional tests or by relatively new nuclear equipment. (2) The nuclear method of test has the advantage of giving final test results on the site.

040553
THE CHAIRMAN'S ADDRESS–MAINTENANCE ON THE MOVE

Emerson, AH, British Railways

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Part 11970, pp 3-34, 10 Fig, 15 Phot

The following topics are discussed: maintenance control, Including cost control, and centralized records office procedures; electrification; design of diesel and electric locomotives and freight cars; and track and vehicle maintenance equipment.

040556
EXPERIMENTS ON THE SETTING OF RAILWAY BALLAST UNDER REPETITION OF LOAD

Sato, Y

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Sept. 1960, p 75

Four types of ballast were laid a top 30 cm layer entirely composed of standard crushed stone; upper 20 cm composed of crushed stone and lower 10 cm of standard screened gravel; upper 10 cm of

crushed stone and lower 20 cm of screened gravel; and 30 cm entirely composed of screened gravel. Comparison between the Grade 1 crushed stone with size distribution as produced and the one with size distribution modified by screening to 30 to 50 mm indicated that the setting rate of the ballast composed of the latter was 21% slower than that of the one of the former. Comparison between the wooden and the concrete ties used in the experiment with reference to both types of ballast revealed that the ballast setting under concrete ties was 50% less than under wooden ones. A ballast of screened gravel with coarse sand fillings was compared with the one of the same material minus sand. It was found that the setting rate of the former was very much slower than that of the latter; it means that good stability will be gained if the cavities are well filled.

040557
LATERAL BALLAST RESISTANCE AND STABILITY OF TRACK IN EARTHQUAKE

Sato, Y

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 1, Mar. 1970, pp 3-6, 3 Fig, 4 Tab, 1 Phot, 3 Ref

The behavior of the railway track in earthquake was studied through experiment and theoretical analysis. The experiment was performed with real tracks in the RC-box placed on the vibrational table of 5 times 5 sq m in dimensions. The conclusions are as follows: against the earthquake acceleration with which railway structures are designed, 83% of the static lateral ballast resistance of track is maintained in the track on the Shin Kansen and 78% in the track with PC-ties and crushed stone ballast on the narrow gauge lines. The long weld rail track holds the safety factor at least 1.15 for the buckling due to temperature rise in the earthquake with the same acceleration mentioned above.

040558
ALLOWABLE LIMIT ON LATERAL PRESSURE ON RAILWAY TRACK

Sato, Y

Japanese Railway Engineering (Japan Railway Engineers' Association, P.O. Box 605, Tokyo Central, Japan)

Mar. 1964, 4 pp, 8 Fig, 2 Tab, 1 Phot

Three kinds of tests were conducted on the test sections, where tracks conformed closely to standards for Class A, Class B, and Class C lines respectively. The first test was to measure the strength of spikes for sleepers sampled out of the test sections, the second test to measure pressure on several spikes under the lateral pressure and wheel load imparted to the rails by a lateral pressure test car, and the third test to measure the shift of spikes on all sleepers in the test sections after conducting a loading run by the lateral pressure test car. The car used as the lateral pressure test car is a two-axle freight car equipped with a special additional axle below its center, which can exert both lateral and wheel loads of variable amounts by means of compressed air. Based on the distribution of the lateral pressure caused by rolling stock and that of strength of spikes, the permissible limit of lateral force has been established at the level at which 1% of the spikes are stressed to their proportionality limits.

040559
TRACK STRUCTURE FOR HIGH SPEED RUNNING

Hoshino, Y

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Apr. 1960, pp 37-46, 6 Fig, 1 Tab, 6 Phot

Numerous experiments on gradual growth of track irregularities show that the vibration with very large acceleration of the track, which occurs by the shock of running wheels, brings an extreme reduction of load bearing power of the ballast, and that the ballast surface suffers settlement under train loads. The amount of ballast settlement is proportional to the load, the number of repetition and the acceleration of ballast vibration, and the acceleration increases proportionally to the train speed. By using 70 kg rails, with sleepers wider by 20% than the present ones and rubber pads having one half of the present coefficient of spring; the track destruction caused by the same train load becomes 35% of that of the present standard track. By decreasing spring coefficient of rubber pad on a concrete sleeper by one half, ballast vibration becomes as small as 40% of that of the present one. The method of fastening a rail elastically to a sleeper using rubber pads and metallic springs has already been standard for a concrete sleeper, but as the action of load at the portion of fastening was not hitherto known well, the design should be regarded as rather empirical.

040561
MEASURING ACCURACY OF MECHANICAL TYPE TRACK INSPECTION CAR

Kishimoto, S Takeshita, K

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, June 1968, pp 113-117, 6 Fig, 2 Tab, 3 Ref

Mechanical type track inspection car YA210 has a measuring chord length 4.6m, its measuring accuracy being 19%. The accuracy has been improved to 12% by means of softer restoring springs. YA210 may be used up to the speed of 72km/h. There are prospects of constructing a mechanical type track inspection car with a measuring accuracy 10% and a measuring chord length 10 m. The new mechanical type track inspection car will have an integral type measuring equipment for superelevation of track, and a mechanical type automatic data processing equipment.

040563
LENGTH OF TRANSITION SPIRALS–A REVIEW OF RESEARCH REPORT ER-37

Code, CJ, Pennsylvania Railroad

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 651964, pp 881-884

Changes to the AREA formula for lengths of spirals are suggested based on the elevation change and expected velocity. It is suggested that design of the curve should limit the unbalanced lateral acceleration for trains to 0.10 g, which is applied at a maximum rate of 0.03 to 0.04 g per second. The mathematical formula using a rate of 0.04 g per second for the length of the spiral is 1.22 E (sub u)V, where E(sub u) is the unbalanced elevation. The unbalanced lateral acceleration of 0.1 g is then reached in 2.5 seconds.

040564
PREVENTING RAIL FAILURES IN TRACK

Magee, GM, Association of American Railroads

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 641962, pp 47-55, 8 Phot

U.S. and German rail inspection cars are briefly described and illustrated. Rail head defects are determined by a combination of induction and ultrasonic examination. A separate examination for web

defects is conducted at joint bars by ultrasonic inspection. Some 20,000 defective rails are replaced each year with sound rails before service failure occurs. It is estimated that these replacements avoid derailment expense of 200 million dollars at an inspection cost of 6 million dollars.

040565
SPECIAL REPORT ON FIELD TESTS ON CONTINUOUS WELDED RAIL ON GREAT NORTHERN RAILWAY

Ferguson, R, Association of American Railroads
Schinke, R, Association of American Railraods
Leitze, LW, Great Northern Railway

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 60, No. 549, Feb. 1959, pp 642-653, 7 Fig, 2 Phot, 3 Ref

The maximum stress developed in the rail due to temperature, bending and braking of the train will be well below the yield strength of the rail steel. Its average yield strength is approximately 70,000 psi. The temperature stress measurements show the maximum compressive stress averages 13,300 psi at a rail temperature of 126 deg. This occurred with the rail temperature approximately 65 deg above the laying temperature with the rail at 40 deg below zero the temperature stress would be approximately 20,000 psi tension. Adding to this a bending stress in the base of the rail of 27,300 psi and a longitudianl tensile stress of 3,120 psi developed in the rail under jackknifing locomotives, gives a maximum combined tensile stress of 50,400 psi. There are no experimental data available on the amount of compressive forces necessary to buckle a section of track. However, it appears that the buckling forces that were measured due to braking were very nominal.

040566
TESTS TO DETERMINE THE EFFECT OF REMOVING THE BULGE FROM THE BOTTOM OF THE RAIL BASE ON THE STRENGTH OF ACETYLENE PRESSURE BUTT WELDS

Kannowski, K, Association of American Railroads

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 556, Feb. 1960, pp 898-904, 2 Tab, 7 Phot

Eight specimens were welded from 3-ft lengths sawed from two 115 RE Inland rails, and welded in the normal fashion. On four of the specimens the bulge was left on the base and on four of the specimens the bulge was ground off. A ninth specimen was cut from a 78-ft length from a previous welding run leaving the bulge on the base. Slow bend tests were made. There was considerable variation in the maximum load before fracture and especially in the energy for fracture. Observation of the fractured surfaces showed smooth areas predominately in the base and web indicating that full fusion had not been obtained in the welding process. The results obtained in the drop tests showed the same lack of complete fusion in the appearance of the fractured area. It is concluded that there is no significant difference in the strength of the weld whether or not the bulge on the base of acetylene pressure welds is removed by grinding or left on as has been the past practice.

040567
PHYSICAL TESTS OF NORMALIZED AND NOT-NORMALIZED OXYACETYLENE PRESSURE-BUTT-WELDED 115 RE RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 556, Feb. 1960, pp 905-914, 2 Fig, 4 Tab, 13 Phot

The welds were made using three 39-ft rails, according to the normal procedure with the exception of not normalizing eight of the welds. The rolling-load tests were made using 48,000-lb and 60,000-lb wheel loads. The data indicate that all the failures produced in the rolling-load tests were from causes other than the effects of normalizing or not normalizing. The slow bend test of two normalized and two not-normalized oxyacetylene pressure butt-welded rails made. The results indicate a trend toward greater load, energy absorption and deflection in favor of the not-normalized tests. The drop tests of two normalized and two not-normalized oxyacetylene pressure butwelded rails were conducted. Again no significant difference can be found in the data for the normalized compared with the not-normalized welds.

040568
BONDING OF RAILS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 556, Feb. 1960, pp 915-925, 1 Fig, 1 Tab, 4 Phot

The strength in static bending of rails bonded by conventional brazing or by a unique brazing technique involving the use of fiber metal shims ranges up to a maximum tensile fiber stress at failure of 71,800 psi. Work to date has been done using mild steel fiber metal shims, with and without copper foil on either side of the shim to supply molten filler metal. Since this technique yielded a joint strength as high as 63,900 psi, the superior technique of employing rail steel fiber metal shims preimpregnated with copper could yield strengths comparable to those of pressure-welded rail.

040569
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 63, No. 570, Part 1, Feb. 1962, pp 503-511, 1 Tab, 14 Phot

Eleven control-cooled rail failures were analyzed and the results of the analysis are tabulated. The following types of rail failures are described and photographed: transverse fissure from inclusion; split web at electric flash weld; fatigue of switch point; detail fracture at bond wire weld; fracture from deformed tie plate; and vertical and horizontal split heads from fishtail defects.

040570
SERVICE TESTS OF HEAT-TREATED AND ALLOY-STEEL RAIL

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 63, No. 570, Part 1, Feb. 1962, pp 533-545, 1 Fig, 7 Tab, 8 Phot

The results of service tests conducted by five railroads are reported. The rail types included in the tests were: 115-RE columbium-treated, chrome-vanadium alloy rail, 132 RE heat-treated rail, 140 RE high-silicon rail, 155 PS high-silicon rail, and 115 RE head-treated rail. Areas of heavy shelling and continuous flaking are illustrated.

040571
SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 63, No. 570, Part 1, Feb. 1962, pp 546-553, 1 Fig, 1 Tab, 17 Phot

High-silicon chromium-vanadium rails have given extremely high rolling-load tests of almost 12 million cycles. Basic-oxygen standard carbon-steel rails have given an average of 3,106,500 cycles in six tests. Another rolling-load test of rails containing columbium is reported which ran 2,458,100 cycles. Rolling-load tests are reported on six flame-hardened rails produced by the Union Pacific process. The tests ran from 11 million to 3 million cycles. End-quench hardenability curves are given for four rail steels to furnish information on the quenching characteristics of low-alloy rail steels.

040572
INVESTIGATION OF FAILRUES IN CONTROL-COOLED RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 62, No. 5631961, pp 593-597, 2 Tab, 6 Phot

A summary is given of the failure analysis of 32 failed control-cooled rails. Photographs of failures due to detail fracture from shelling, horizontal split head from fishtail, and head and web separation failure, are shown.

040573
SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 62, No. 5631961, pp 630-634, 1 Tab, 12 Phot

Four rolling load tests of high silicon-vanadium rails averaged 1,850,000 cycles. Two similar tests of high silicon-chromium-vanadium rails ran 1,682,000 and 5,805,400 cycles. One more test of standard carbon rails flame hardened by the Union Pacific Railroad ran 11,501,100 cycles. Two rails containing 0.047 percent columbium ran 2,051,000 and 2,304,800 cycles, and the rails developed excessive flow at the gauge corner. Pictures are shown of induction-hardened rails from service. This method of treatment did not prevent early shelling failures. Five specimens were tested to develop detail fractures from shelling.

040574
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 5561960, pp 835-844

Seventeen types of defects were found in 25 failed rails. The largest group consisted of four piped webs. The following defects are illustrated: transverse fissure from hot-torn steel; transverse fissure from large inclusion; vertical split head from fishtail structure; fracture from welded engine burn; vertical and horizontal split head from fishtail structure; vertical split head from porosity in hand-made butt weld; corrosion at junction of web and base, and vertical split webs from fishtails.

040575
RAIL FAILURES STATISTICS, COVERING (A) ALL FAILURES; (B) TRANSVERSE FISSURES; (C) PERFORMANCE OF CONTROL-COOLED RAIL

Code, CJ

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 5561960, pp 845-866, 4 Fig, 8 Tab

These statistics are based on the rail failures reported to December 31, 1958. They include the service and detected failures reported by 59 railroads on all of their main-track mileage. The tables and diagrams indicate that extent of control of the transverse-fissure problem that has been obtained by the use of control-cooled rail and detector-car testing, give data on the quality of each year's rollings for the various mills, and show the types of failures that are occurring on the various railroads as related to the mill producing the rail.

040576
SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 5561960, pp 874-881, 1 Tab, 20 Phot

Two rolling load tests were made on a high-silicon rail which ran 1,944,400 and 1,480,000 cycles. A standard carbon-steel rail gave unusually long tests of 4,371,000 cycles. These specimens deformed considerably before the shelling cracks were visible on the side of the rail head. Two induction-hardened 50-kg rails from Japan gave rolling-load tests of 517,400 and 718,300 cycles. One double-flame hardened specimen ran 4,185,000 cycles in the rolling-load test. This is a much higher test than previous flame-hardened specimens. Single flame-hardened rails ran from 1,490,000 cycles to 3,403,800 cycles, which are also very high rolling-load tests for flame-hardened rails. Two rails with high manganese and high silicon were tested. The rolling load tests varied from 1,792,400 cycles to 3,260,500 cycles. Three specimens were tested to develop detail fractures from shelling. They developed failures at 2,007,400; 5,204,900 and 4,492,200.

040577
ROLLING-LOAD-TEST RESULTS OF WELDED ENGINE-WHEEL BURNS ON RAIL SUPPLIED BY THE SEABOARD AIR LINE RAILROAD

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, No. 5561960, pp 891-896, 2 Tab, 8 Phot

The oxyacetylene-welding method is the standard procedure for repairing wheel burns. Two welds of this type were prepared as controls. Eight engine-wheel burns were then welded by means of the electric-arc method. The first six welds were made on 115-lb RE rail and the last four welds were made on 132-lb RE rail. In this type of test 2,000,000 cycles without failure are considered a run-out. All of the welds were checked ultrasonically for defects. The oxyacetylene welds had the best results, in that one ran to 2,000,000 cycles without a failure and the other ran to 589,000 cycles, failing from a detected inclusion. The electric-arc welds failed prematurely at 49,000 to 159,000 cycles. The microscipic examination of fractures revealed that a sharp line of demarcation between the weld metal and rail metal existed as well as very fine porosity on the interface. This porosity in all of the electric-arc welds was the cause of the failure. The microsocpic porosity in the interface could not be detected ultrasonically whereas the indication of the inclusion was very definite.

040578
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 60, No. 5491959, pp 878-882, 2 Tab, 8 Phot

Twenty-five failed control-cooled rails were examined. Only two failures were transverse fissures from shatter cracks. Six failures were from hot torn steel. One failure was a transverse fissure from an inclusion. A vertical split head developed from a rolling defect in the bottom rail from an ingot. There were only one or two each of several other common types of rail failures.

040579
SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 60, No. 5491959, pp 941-948, 1 Tab, 23 Phot

Laboratory tests of chrome-vanadium rails give high cycles for failure but with considerable scatter in results. Rolling-load tests are reported on six extremely high-silicon rails with 1.63 percent silicon. These specimens did not give as good results as previous tests on rails with less than 1 percent silicon content. Rolling-load tests are reported on six induction-hardened rails. These hand rails resist flow or abrasion on the gauge corner but develop shelling cracks in the laboratory tests sooner than standard carbon-steel rails. Two detail fractures from shelling were produced in laboratory rolling-load tests of 136-lb chrome-vanadium rails with Brinell hardness of 368 and 373. These two rails ran 2,837,900 and 9,258,500 cycles.

040580
FINAL REPORT ON A THREE-DIMENSIONAL PHOTOELASTIC INVESTIGATION OF THE STRESS DISTRIBUTION IN THE HEAD OF A RAILROAD RAIL ALONG LINES PARALLEL TO THE AXIS OF THE RAIL

Frocht, MM, Illinois Institute of Technology

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 60, No. 5491959, pp 951-969, 13 Fig, 1 Tab, 2 Phot, 10 Ref, 4 App

The complete state of interior principal stresses along critical lines parallel to the axis of the rail have been determined photoelastically in the head of a model of a railroad rail. The curves of the stress distributions revealed several dangerous states of stress which may contribute to, or produce, the shelly failure. The normal stress components alternate between large compressions and relatively small tensions; there exist oblique planes, which are subjected to completely reversed large normal stresses; the range of the alternating shears is plus or minus 35,000 psi approximately, and the endurance limit for completely reversed shear is 37,000 psi; and the planes on which the maximum shears during each loading cycle act, are subjected to fluctuating shears and normal stresses. The range of the variable shear on these planes is at least from 0 to 54,000 psi, which comes dangerously close to the endurance limit of 59,000 psi.

040581
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 59, No. 542, Feb. 1958, pp 907-914, 2 Tab, 17 Phot

A summary is given of the analysis of 35 failed control-cooled rails submitted for evaluation during a one year period. Nine failures were transverse fissures from shatter cracks. Six were transverse fissures from hot torn steel. Eight shelled rails were submitted. Other type of defects included web failures, head splitting from segregation, wheel burn, defective welds, and electrode burn.

040582
SIXTEENTH PROGRESS REPORT ON THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 59, No. 542, Feb. 1958, pp 938-946, 2 Tab, 13 Phot

Seven tests using 115 RE bars with easements on the top bar surfaces to depths of approximately 0.220 and 0.110 in were completed. The shallow easements were effective in eliminating gouging of the bars by the rail ends. Six joints with shallow easements averaged 349,080 cycles. Twelve tests of joints using 132 RE bars with the same type of milled easement were completed. Two bars with deep easements failed. The shallow easements were effective in preventing gouging of the bars. Average cycles for failure for 6 joints with deep easements were 611,630 and average cycles for failrue for 6 joints with shallow easements were 583,530 cycles.

040583
REPORT ON PENNSYLVANIA RAILROAD M. OF W. TEST NO. 591, DETERMINATION OF PLASTIC FLOW IN RAIL HEAD

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 59, No. 542, Feb. 1958, pp 962-975, 4 Fig, 1 Tab, 16 Phot

On the high rail of curves there is a flow of metal at the top gauge corner of the rail toward the gauge side. This flow of metal extends to a depth of 1/4 in. to 3/8 in. below the rail surface. The flow of metal toward the gate side extends back to the edge of the center arc and beyond, probably to the center of the rail head. The magnitude of deformation is positive evidence of shear stresses well beyond the yield point of the steel. This condition was demonstrated on the high rail of a 4-deg curve under moderately heavy freight traffic after 75,000,000 gross tons. This was at a location of moderate shelling on previous rail. Only light flaking had developed in the test rail at the time of removal.

040584
SIXTEENTH PROGRESS REPORT ON SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 59, No. 542, Feb. 1958, pp 975-981, 2 Tab, 14 Phot

Three rolling-load tests are reported on chrome-vanadium rails. One specimen ran 4,874,000 cycles. One failed at 14,831,000 cycles, a record for this type of rail. A third specimen ran 2,857,000 cycles before it developed shelling. Seven rolling-load tests to produce shelling failures in high-silicon rails averaged 2,277,000 cycles. Past tests of standard carbon steel rails have averaged 1,000,000 cycles in the

same rolling-load test. Results are given of the examination of several detail fractures and one shelly rail from service.

040585
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 58, No. 535, Feb. 1957, pp 965-971, 1 Fig, 4 Tab, 8 Phot

Thirty-two failed control-cooled rails were examined. Causes of failure included: transverse fissures—two from shatter cracks, eight from hot torn steel and one from inclusion; 13 detail fractures from shelling; five fractures from wheel burns, weld defects or electride burns; and three other types of breaks.

040586
FIFTEENTH PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 58, No. 535, Feb. 1957, pp 1005-25, 6 Fig, 3 Tab, 22 Phot

Six tests of U.S.S. compromise joints, from 132 RE to 115 RE rail section averaged 288,800 cycles. All of the failures originated at the center of bar length at the change of section at the base of the bar. Six tests of Du-Wel compromise joints from 132 RE to 115 RE rail section avaraged 237,600 cycles. Five of the failures were from the base and one was from the top, and all six failures started at blowholes or porosity within the cast steel. Five tests of 115 RE, 36-in. headfree, bars with milled easements 1-1/2 in. long and approximately 0.200 in. in depth averaged 278,080 cycles. Two bars failed through the center of the milled easement and two companion bars revealed cracks in the easements. Fatigue tests on small specimens cut from joint bars tested under two ranges of stress indicated endurance limits from 26,000 to 72,000 psi. Both increasing the Brinell hardness and grinding the surface, in general, increased the endurance limit.

040587
FIFTEENTH PROGRESS REPORT ON SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 58, No. 535, Feb. 1957, pp 1041-47, 1 Fig, 2 Tab, 16 Phot

Mechanical tests and rolling-load tests produced shelling on 16 different rails: four standard carbon rails averaged 1,358,000 cycles; five silicon rails averaged 1,692,000 cycles; four higher silicon rails averaged 1,940,000 cycles; two silicon-vanadium rails averaged 2,038,000 cycles; and one chrome-vanadium rail ran 4,874,000 cycles; Laboratory examinations were made of six rails which developed detail fractures in service. Rolling-load tests produced detail fractures from shelling in 10 rails.

040588
INVESTIGATION OF FAILURES IN RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 605-617, 1 Fig, 5 Tab, 7 Phot

Twenty-three failed control-cooled rails were examined during the year. The failures included: eleven transverse fissures, three from shatter cracks and eight from hot torn steel; eight detail fractures, seven from shelling and one from head check; two web cracks; one base brake from welded electric bond, and one lap on rail tread.

040589
SERVICE TESTS OF VARIOUS TYPES OF JOINT BARS

Blair, TA

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 634-647, 10 Fig

The test sections for the new 115 RE rail were installed on the westbound main track of the Chicago and North Western Railways. Each test section includes 100 joints and is approximately 2000 ft. long. A comparison of the average maximum stresses and single maximum stresses obtained at the six test joints for the five different test locations is shown. The results obtained on tangent track indicate that the stresses developed in service in the new AREA headfree design and the Rail Joint Company designs of joint bars for 115 RE rail are well within the fatigue strength of the bars as determined by laboratory tests. It may be expected that the stresses will be higher on curved track, but the reserve appears sufficient to give assurance that these designs of joint bar will give satisfactory service from the standpoint of development of fatigue failures.

040590
NINTH PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 648-659, 1 Fig, 4 Tab, 9 Phot

Twelve tests of 131 K4 headfree 39-in. long-toe bars averaged 1,279,600 cycles. Two joints ran to 2,000,000 cycles without failure; one bar failed from the base at a rail end, and nine bars failed from cracks starting in spike slots. Twelve tests of 115 K22 bars reduced gouging but did not entirely eliminate it. Brinell and tensile tests on 42 of 242 failed bars from service indicated lower hardness on the cross section at the center of the head of the bars than near the bar surface. Data from these tests indicated that bars which met both specifications of 70,000 psi minimum yield and 100,000 psi, minimum tensile strength had Brinell hardnesses of at least 207.

040591
NINTH PROGRESS REPORT OF THE SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 664-679, 1 Tab, 31 Phot

Rolling-load and physical tests of heat-treated rails were continued on two specimens of 132-lb rails. Brinell hardness was increased from 269 to 360 by the heat treatment. Yield strength was increased 65 percent, tensile strength 31 percent, elongation 18 percent, reduction of area 100 percent, and endurance limit 40 percent. Cycles for failure of as-rolled rails averaged 1,257,000 while the heat-treated rails averaged 4,421,000 cycles before failure. Rolling-load tests were made on seven rails which were flame hardened different amounts on the rail treads. Four of these specimens failed by head and web separation cracks. The three specimens which failed by shelling averaged 1,448,000 cycles. Rolling-load and physical tests were made on two specimens of alloy rail steel. They ran eight million and five million cycles in the rolling-load tests.

040592
FATIGUE TESTS OF RAIL WEBS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 680-690, 5 Fig, 2 Tab, 2 Phot

This report covers corrosion fatigue tests using a corroding agent of tap water mixed with sufficient sulfuric acid. Specimens were stressed at a rate of 150 cycles per minute for the first 1,000,000 cycles or until a crack had been detected. After 1,000,000 cycles, the speed of testing was increased to 800 cycles per minute and maintained at that rate until the specimen cracked, or until 10,000,000 cycles had been reached. From these tests it may be concluded: that the stresses in the upper rail fillets on tangent track outside of the joint bar limits at the rail end and at the first bolt hole with the new 115 RE rail section and new AREA bolt spacing are well within limits that can be tolerated, provided no unusual corrosion conditions exist that substantially reduce the fatigue strength of the rail steel.

040593
MEASUREMENT OF STRESSES IN 115 RE RAIL ON TANGENT TRACK–NORTH WESTERN RAILWAY

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 690-704, 11 Fig

The test sections for the new 115 RE rail includes 100 joints and is approximately 2000 ft. long. The test section was installed for the purpose of testing various joint bar designs. The maximum tension and compression stress are shown during each test run obtained at one joint with the new spacing (3-1/2-6-6 in.) and another joint with the two hole spacing (4-1/2-9 in.) on the north rail. The chart shows the stresses for diesel and steam locomotives separately, and also those developed under cars. Values are plotted with respect to the speed of the train. The new 115 RE rail design on tangent track with either of the bolt hole spacings has sufficient fatigue strength to resist development of fatigue cracks, provided no unusual corrosion conditions exist.

040781
TESTS OF ELECTRIC FLASH BUTT-WELDED RAILS

Cramer, RE, Illinois University
Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 684-694, 2 Tab, 12 Phot

This paper describes rolling-load tests and physical tests of specimens of 131 and 130-lb electric flash butt-welded rails which were undertaken to determine if stress relief treatment would be necessary. The 131-lb. rail was set up for rolling-load tests of weld 73 in. in a 33-in. stroke rolling-load machine. The second rolling-load test was made on weld 52 in the 131-lb. rail, which was supplied with all the flash metal ground off except under the rail base. 1. The first two-rolling load tests that failed at a bolt hole and stress raiser on the rail webs emphasize the damaging effects of such conditions. 2. The rolling-load tests which ran over 2,000,000 cycles with 60,000-lb. wheel load without failure, are considered very satisfactory for welded rails. 3. The bend tests of 132-lb rails gave higher tests than unwelded 131-lb. rails, and as high as any previously tested rail welds. 4. Some of the physical tests indicate that the welds which were not stress relieved were slightly stronger than the stress relieved welds. However, the difference is negligible and no conclusions on this subject should be based on tests of only two welds.

040786
DETERMINATION OF THE SNAKING EFFORT IN TRACK LAID WITH LONG WELDED RAILS BY MEANS OF A NON-LINEAR CALCULATION

Bijl, F, N.V. Nederlandse Spoorwegen

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Aug. 1965, pp 580-588, 9 Fig, 3 Tab

Translated from De Ingenieur, No. 39, Sept. 1964.

The author describes a method to ascertain, with the assistance of an electronic computer, the axial effort due to snaking in a track laid with long welded rails. In these calculations, the influence of the lateral resistance and that of the angular rigidity can be introduced in their true nonlinear form, so accurately that the stress under which snaking occurs can be determined exactly. It is necessary to establish by measurements the lateral resistance and the angular rigidity. After this has been done, the admissible value of the preliminary deformation, free of stress, of a track with long welded rails can be calculated fairly rapidly. Provisionally we can affirm that the critical wave length will be considerably shorter than that obtained by the methods of calculation previously suggested.

040787
CROSSING FROG BOLT TENSION TESTS

Magee, GM, Association of American Railroads
Durham, HE, Association of American Railroads
Purnell, RE, Association of American Railroads

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 54, Bulletin 507, Feb. 1953, pp 1001-34, 16 Fig, 1 Tab, 3 Phot, 1 Ref

This report covers bolt tension service tests and the measurements of the dynamic variation of the tension in crossing frog bolts. The objective of this investigation is to determine the reactive characteristics required of spring washers for the proper maintenance of adequate tension in crossing and turnout frog bolts. The most important results obtained from the service tests were those concerning the use of harder materials on both sides of single-coil washers. It was determined that initial static bolt tension of 40,000 lb. was the most effective for maintaining the maximum cyclic net tightness of the assembly and minimizing the major shock loads in percentage of the static tension. A minimum tension of 20,000 lb. on the No. 1 bolts is required to avoid excessive looseness of the assembly and attendant wear on the areas in contact. Many of the major impacts in the No. 1 bolts when a pair of wheels struck the receiving arms of the crossing.

040788
GROOVED BENT STOCK RAILS FOR SWTICHES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 54, Bulletin 507, Feb. 1953, pp 1034-36, 1 Fig

This report provides a brief description of the design and results of Union Pacific tests of grooved bent stock rails for switches. The conclusion of the Union Pacific at this time is that grooved bent stock rails for 16-ft. 6-in. switches (No. 10 turnout) in locations of normal traffic on the turnout side are of undoubted advantage and will far outlast ungrooved stock rails. Further observation will be required before arriving at a definite conclusion on grooved bent stock rails for 24-ft. switches.

040789
DESIGN OF TIE PLATES

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 54, Bulletin 507, Feb. 1953, pp 1037-46, 3 Fig, 2 Tab, 1 Ref

This report consists of (1) a progress report on the service tests of seven designs of tie plates for the rail base width of 5-1/2 in. and (2) the results of a field test in which the magnitude and eccentricity of tie plate loads in tangent track under diesel and steam power were measured with calibrated dynamometer tie plates. In the service tests, it was found that the 13-in. length plates as compared with the 11-in. designs on the 4-deg. curve effected a greater reduction in plate cutting than would be expected from the inverse ratio of the plate lengths. Excluding the 3170 plate with the pressed circular rail seat, and bottom, the shape of the rail seat of the other 11-in. designs had no important influence as to the amount of plate cutting. So far, the 3170 designs of tie plate, which has approximately 10 percent more area than the 7-3/4 in. by 11 in plates, has shown no superiority for reducing plate cutting. The tie plate load tests showed that swinging ties resulted in an average increase in tie plate loads of 4000 lb. for the steam locomotives, as compared with approximately 5000 lb. for the diesel locomotives. The individual tie plate loads measured under the diesels were more uniform in magnitude than for the medium weight Mikado locomotives. The steam locomotives produced higher individual tie plate loads than those of the diesels.

040792
RESISTANCE TO WARPING OF CONTINUOUSLY WELDED OLD AND NEW RAILS

Rubin, H

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Mar. 1957, pp 199-203, 4 Fig, 2 Tab, 2 Ref

Translated from Eisenbahntechnische Rundschau, No. 9, Sept. 1955.

This paper uses computational methods for calculation of track stability to examine the feasibility of welding the rails of older types of permanent way. It also examines the problem of warping of new, continuously welded rail, and the problem of whether very heavy rails (S64, S55) can be subjected to continuous welding in view of the fact that they employ light fastenings. The general results of these investigations can be summed up as follows: 1. Because of their particularly great moment of inertia, heavy rails can be continuously welded even when laid with simple, non-rigid fastenings. 2. With medium-heavy and light type of rails, the type of sleepering and the ballast cross-section have an important bearing on the resistance to warping. In such cases, it is advisable to examine, before the welding takes place, the safety against warping in accordance with local conditions, and to determine the minimum temperature at which the rails may be laid. 3. Because of the rail wear, the safety against warping increases to some extent with the age of the continuously welded track. It is therefore possible to accept a certain amount of slackness in the rail fastenings and a consequent reduction in the frame rigidity of the track.

040793
TRACK ANALYSIS

Erismann, T, Amsler (Alfred J) and Company

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

6708-6709, pp 571-592, 8 Fig, 18 Ref

Translated from Glasers Annalen, Zeitschrift fur Eisenbahnwesen und Verkehrstecknik, Feb. 1967.

In the present paper an attempt has been made to create the physical based for an objective assessment of the quality of railway track. For this purpose, the damage occasioned by faults in the geometric position of the track has been reduced to the universally applicable notion of 'detrimental energy' which is, in its turn, based on the detrimental integral exclusively derived from the geometry of the track. The definition of these novel notions is made possible by classifying the faults as subcritical, critical or super-critical depending on the period length of the oscillations caused by them. This leads to a coherent evaluation system which is largely founded on physical facts, lends itself to automation by means of modern computers, and furnishes directly applicable data not only for short-term maintenance programmes (marking of danger spots) but also for long-term renewal programmes (quality assessment of entire sections of track). The necessary computing techniques are outlined in their logical setup.

040796
PROGRESS TOWARD SCIENTIFIC DESIGN AND ANALYSIS OF TRACK

Ward, EJ, Department of Transportation

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 70, 70-621-131969, pp 946-954, 3 Fig, 1 Tab, 2 Phot, 4 Ref

This paper surveys the DOT research and development program aimed at better track structures. This program includes the following: (1) improved ability to measure track geometry at speeds under load; (2) developing methods to analyze the measurements, and ways to make better use of the information; (3) looking at the possibility of designing track of greater stability; (4) experimental research on the dynamics of wheel-rail interaction.

040798
ROADBED STABILIZATION SOIL PROBLEMS IN RAILWAY TRANSPORTATION ENGINEERING

Ireland, HD, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 67, 6509-65101965, pp 7-19, 6 Fig, 3 Phot, 5 Ref

In this paper soil problems are examined in terms of the cut and fill of line changes, in the daylighting of tunnels and in the performance of track. Included are planning remedial construction to preclude landslides, geometry studies for daylighting tunnels, design of new cut slopes including those in the proximity of abandoned coal workings, fill design in new construction effects of water content of borrow materials on compaction, and planning and control of waste areas.

040801
INVESTIGATION OF FAILURES IN RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 543-550, 2 Tab, 16 Phot

Twenty-four failed control cooled rails were evaluated. The causes of failure are described. Preliminary tests were conducted to determine possible damage to rails by welding bond wires. A free held acetylene torch and the thermit welding methods were used to produce the bonds. The metallographic hardness tests and Charpy tests indicate that some martensite was produced in the rails which is hard and brittle. However, this did not seem to produce early failure in the rolling-load tests.

040802
EIGHTH PROGRESS REPORT OF THE ROLLING LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 585-593, 1 Fig, 4 Tab, 7 Phot

Twelve tests of 133 RE head contact 36-in. bars averaged 509,200 cycles. Twelve tests of 115 RE head free 36-in. bars averaged 1,462,450 cycles. Five of the joints ran to 2,000,000 cycles with no failure. Micrographs, taken on all failed bars, revealed decarburized bar surfaces to varying depths up to 0.024 in. No clearly defined correlation between cycles for failure and depth of decarburization was apparent. Brinell and tensile tests on 12 of 100 failed bars from service indicated higher hardness reading near the surface of the bars than at the center of the head. Ten of the 12 bars tested failed to meet the specifications of 100,000 psi, minimum tensile strength and 11 fell short of the 70,000 psi minimum yield point.

040803
RAIL FRACTURES RESULTING FROM ENGINE WHEEL BURNS, INCLUDING EFFECT OF REPAIRING SUCH BURNS BY OXYACETYLENE OR ELECTRIC WELDING

Akers, JB

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 594-595

Twenty-one specimens were artificially burned with the wheel rotating at a speed of 15 mph, the rails being applied to the moving surface of the wheel for 3-sec. intervals. The burns produced by this method were approximately 1-1/2 in. wide by 2-1/2 in. long and appeared to be quite uniform in nature. A tabulation of the rolling-load tests completed on these specimens up to the present time is shown. Up to the present time no explanation can be offered for the difference in fatigue life due to the location of the built-up metal on the engine burn. Tests have not progressed far enough to lead to any conclusions.

040804
EIGHTH PROGRESS REPORT OF THE SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 597-607, 1 Fig, 1 Tab, 26 Phot

Two rails were selected from the high side of a 4-deg curve. These rails had carried 63,385,600 tons of traffic at average speeds of 35 mph. One rail showed flaking along the gauge corner over its entire length and had also developed 6 or 7 small black shelly spots. The second rail contained 30 black shelly spots. During the past year, 23 specimens have been tested in the cradle type rolling load machine. The chemical analysis, physical properties and results of rolling-load tests of these specimens are shown. The laboratory rolling-load tests produce shelling failures similar to the deeper type of shelling which develops in service. It is also believed that the laboratory tests give a quick method of determining the relative length of service which can be expected in track as compared with standard carbon steel rails. Preliminary results of service tests of rails tested in the rolling-load machines last year give indications of this correlation but the service tests are not as yet completed.

040805
SUMMARY REPORT ON THE EXAMINATION OF RAILS WHICH CONTAIN DETAIL FRACTURES

Campbell, JE, Battelle Memorial Institute
McIntire, HO, Battelle Memorial Institute
Manning, GK, Battelle Memorial Institute

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 608-620, 5 Fig, 3 Tab, 6 Phot

This study examined detail fractures from shelling which had been found in rail by detector cars and determined if the chemistry, mechanical properties or structures of detail fracture rails varied from those of random rails. Examination of 54 detail fractures showed that such fractures may assume a wide range of size and shape. Of the fractures examined, 28 percent had bright, unoxidized surfaces; indicating no contact with the surface of the rail. About 70 percent of the rails containing detail fractures were taken from the high side of curves. The average chemical analyses and mechanical properties of 44 rails having detail fractures and 26 random rails were so nearly the same that no distinction between the two groups was possible. The mechanical tests included hardness, tensile properties, and impact properties.

040806
MEASUREMENTS OF STRESSES IN 132 RE RAIL ON TANGENT TRACK–SANTA FE RAILWAY

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 626-640, 11 Fig, 1 Tab

Three test sections are as follows: new AREA design, headfree 36 in. joint bar for 132 RE rail, with bolt spacing of a 3-1/2–6–6 in.; same joint bar design with bolt spacing of 4-1/2–9 in.; and same joint bar design with bolt spacing of 2-1/2–6-1/2–6-1/2 in. This installation offered an opportunity to obtain measurements of stresses developed under regular traffic in the new 132 RE section. On tangent track under conditions typical of main line operation, it may be concluded: that the stresses in the upper rail fillets on tangent track outside of the joint bar limits have been reduced with the new 132 RE section to well within the fatigue strength of rail, steel, and that the concentrated rail web stresses within joint bar limits at the rail end and at the first bolt hole with the new 132 RE rail section and the new AREA bolt spacing are well within limits that can be tolerated, provided no unusual corrosion conditions exist that substantially reduce the fatigue strength of the rail steel.

040807
FATIGUE TESTS OF RAIL WEBS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59

East Van Buren Street, Chicago, Illinois, 60605)

Vol. 51, No. 486, Feb. 1950, pp 640-647, 7 Fig, 1 Tab, 1 Phot

Two sets of tensile specimens were cut from the webs of the rails; one set parallel to direction of rolling, and the second set transverse to direction of rolling. Physical properties of the rail web steel as determined by these tensile tests are listed. Only slight differences in the physical properties of the two groups of specimens were disclosed. Previous studies of the fatigue of rail webs in the laboratory indicated a fatigue life several times greater than was actually obtained in service at some locations. Since corrosion of the rail web was quite heavy at the locations where early service failures occurred, it was thought that the discrepancy was due to corrosion. The S-N diagrams are shown for the tests completed to date with no corrosion on the specimens. The S-N diagram is shown for specimens under completely reversed stress, with tap water corrosion. Laboratory tests thus far, under tap corrosion, have not revealed as great a reduction in fatigue life of rail webs as service failures indicate.

040808
SERVICE TESTS OF MANGANESE CROSSINGS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 50, No. 479, Feb. 1949, pp 572-579, 3 Fig, 2 Phot

The report covers the comparative tests of designs of solid manganese steel crossing frogs at McCook, Illinois, the tests of manganese insert and solid manganese crossings on structural steel and longitudinal timber supports, and tests of crossing frog bolt tension. Some of the designs included in the tests are more resistant to the development of fatigue cracks than others, but in none were the developed stresses low enough relative to the fatigue strength of the manganese steel to give the service life under heavy traffic that should be expected. Four railroad crossings were installed in the double-track main lines of the Indiana Harbor Belt Railroad and the Chicago and Western Indiana Railroad. The structural steel T-beam support was placed under one each of the solid manganese and insert crossings and the other two crossings are carried on longitudinal bolted crossing timbers. The inspection made in 1947, after approximately one year's service, showed all castings in the four crossings to be in good condition with no-flangeway cracks. A plan of the flangeways of the four crossings showing the flangeway cracks as found on May 7, 1948 is presented. The extent of the cracks was about the same, regardless of kind of support, for the two types of crossings.

040809
FATIGUE TESTS OF MANGANESE STEEL

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 50, No. 479, Feb. 1949, pp 579-588, 4 Fig, 2 Tab, 2 Phot

All specimens were tested under a range of stress from a maximum compressive stress to a tensile stress 50 percent as great. Endurance limits at 10 million cycles were indicated as follows: As-cast surface 38,000 psi; ground surface 42,000 psi; shot peened surface 48,-000 psi. Corrosion fatigue tests using a 5-percent solution of sulfuric acid were made on unprotected specimens with as-cast, ground, and shot peened surfaces, and the S-N diagrams approached a vertical line at approximately one million cycles for all specimens. The protective paint coating applied to three groups of specimens proved to be beneficial, although not totally effective in increasing their fatigue life under 5-percent acid corrosion. A few hardness tests on unstressed specimens indicated little difference in hardness for as-cast and ground surfaces and a much greater hardness for shot peened specimens.

040810
EFFECT OF BOLT SPACING ON RAIL WEB STRESSES WITHIN THE RAIL JOINT

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 491947, pp 464-485, 17 Fig, 1 Tab

Tests were conducted to study the effect of bolt tension, applied wheel loads and bolt hole spacing, upon rail web stresses within the limits of the joint bar. Tests were made with bolt tensions of 10,000 lb., 20,000 lb. and 30,000 lb. Three bolt spacings from the rail end were used as follows: 2-1/2 in., 6-1/2 in.,6-1/2 in.; 3-1/2 in., 6 in., 6 in., and 4-1/2 in., 5-1/2 in., 5-1/2 in. The rail used was the new 115-lb RE section with 36-in. headfree joint bars and 1-in. diameter bolts. Similar stress measurements were also made on two 131-lb RE rail joints in tangent track during the passage of regular trains. Vertical tensile stresses in the rail web that would be expected to be in the range of 15,000 to 20,000 psi, with 30,000 lb. bolt tension were found to be as high as 50,000 to 70,000 psi at the bolt holes. Moving the first bolt hole farther away from the high stress area near the rail end not only lowered the tension stress at the bolt hole, but also reduced the stress in the upper and lower fillets and web area at the rail end. It is recommended that the present spacing of bolt holes at the rail ends of 2-1/2 in., 6-1/2 in., 6-1/2 in. be revised to 3-1/2 in., 6 in., 6 in. for six hole joint bars and from 2-1/2 in., 6-1/2 in., to 3-1/2 in., 6 in. for four-hole joint bars.

040811
FATIGUE TESTS OF RAIL WEBS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 491947, pp 485-490, 1 Fig, 1 Tab, 4 Phot

Corrosion fatigue tests were made on T-shaped specimens cut from the web of a 112 lb-RE rail under bending stresses ranging from a maximum compressive stress to a tensile stress 20 percent as great. A solution of 36 percent sulfuric acid was used as a corroding agent and was allowed to drip at the rate of 10 drops per min. on the specimens. in addition, corrosion fatigue tests were made on three groups of painted specimens in order to test the practicability of different types of paint as protective coatings for rails in tunnels, highway crossings, and other places where corrosion fatigue failures are likely to occur.

040813
INVESTIGATION OF FAILURES IN RAILRAOD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 53, No. 500, Feb. 1952, pp 843-849, 2 Tab, 9 Phot

During the year, 52 failed control-cooled rails were evaluated. The causes of failures follow: 17 failed due to transverse fissures, four from shatter cracks, seven from hot torn steel, one from inclusion, one from welded engine burn and four from hand gas butt welds; 16 failed due to detail fractures from shelling; seven from head and web separation cracks; three from crushed head and web; five fractured from base break at seam; 1 contained black shelly spots; and three had bolt hole cracks.

040814
TENTH PROGRESS REPORT ON THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59

East Van Buren Street, Chicago, Illinois, 60605)

Vol. 53, No. 500, Feb. 1952, pp 878-892, 1 Fig, 5 Tab, 10 Phot

Twelve tests of 115 K4 headfree, oil quenched 36-in. bars averaged 748,500 cycles. Four tests of 132 RE headfree 36-in. bars, not oil quenched, averaged 78,750 cycles. Four tests of 132 RE headfree 36-in. bars, not oil quenched, with the top fishing surface cold worked by rolling averaged 90,770. Four tests of 132 RE headfree 36-in. bars, not oil quenched, with easements ground 1/16 in. in depth over the central 2 in. of the top fishing surface, increased the number of cycles to 182,900. For the 2 joints in which the easements were carried completely over the top surfaces of the bars, the average cycles increased to 316,650. Tensile tests on 81 specimens selected from 347 failed bars from service revealed that 36 percent passed the yield point specification of 70,000 psi and 69 percent passed the tensile strength specification of 100,000 psi.

040815
RAIL FAILURES RESULTING FROM ENGINE WHEEL BURNS, INCLUDING EFFECT OF REPAIRING SUCH BURNS BY OXYACETYLENE OR ELECTRIC WELDING

Akers, JB

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 53, No. 500, Feb. 1952, pp 894-898, 3 Fig

Service failures of repaired burns have been negligible. One railroad reports that of 500,000 burns repaired in the last 8 years only 6 service or detected failures of welded engine burns have occurred. Benefits derived from welding repair are: elimination of undesirable microstructure and quench cracks; which serve as potential stress raisers or reduce the fatigue strength of the rail steel elimination of low spots on the rail surface; and building up of engine burns permits recovery of much rail for main line use which would otherwise be scrapped or consigned to secondary service.

040816
TENTH PROGRESS REPORT OF THE SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 53, No. 500, Feb. 1952, pp 902-915, 2 Tab, 42 Phot

Repeat cradle type rolling-load tests on two specimens of manganese chrome, vanadium alloy rails gave high cycles for failure 8,117,000 and 9,635,000 indicating that these alloy rails may be several times as good as standard carbon steel rails. A 115-lb. heat-treated standard carbon rail gave 9,625,000 cycles in the cradle rolling machine, which indicates that this type of rail is as good as the manganese, chrome, vanadium alloy rails. Rolling-load tests are reported on high silicon rails, nickel alloy bars and rails, and flame-hardened rails, but none of these particular specimens gave tests comparable with the maganese, chrome, vanadium alloy steel or the heat-treated standard carbon steel rails. Metallographic examination of 14 failed rails which had developed detail fractures in service located rather large inclusions in the steel near the fractures in half of these rails.

040817
SUMMARY OF PROGRESS OF INVESTIGATION OF STRESS RELAXATION IN RAIL STEEL

Jenkins, DR, Battelle Memorial Institute
Grover, HJ, Battelle Memorial Institute

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 53, No. 500, Feb. 1952, pp 916-920, 2 Fig, 3 Phot

Relaxation of stresses in small bar specimens is being studied as a function of time and temperature, and rolling-load fatigue tests are being run on small specimens. These specimens were cut from a 152-lb rail rolled in 1939. The rail had shelly spots throughout its length. Measurements are made before bending after bending and before heating and after heating and removal from the jig. A summary of test results is shown in a plot of percent stress relaxation versus time at temperature. For temperatures lower than 900 deg F., the amount of relation is quite small. After an initial period, the amount of relaxation at a given temperature increases only slightly as time at temperature increases.

040818
MEASUREMENTS OF STRESSES IN 115 RE AND 132 RE RAIL IN CURVED TRACK, OUTSIDE JOINT BAR LIMITS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 53, No. 500, Feb. 1952, pp 921-940, 12 Fig, 1 Tab

The magnitude of the measured fillet stresses for the frequency of occurrence that may be expected during the service life of the rail is less than one-half of the fatigue strength of uncorroded rail steel as determined by laboratory tests. For the curves laid with 115 RE and 132 RE rails, the diesel passenger locomotives operating at or above the balanced speed produced ranges of rail stresses that were quite moderate in value, and well within the endurance limit of uncorroded rail steel. On the curves laid with 115 RE rail, diesel passenger locomotives produced a range of stresses only slightly more than for freight car wheels, and on the curves laid with 132 RE rail the passenger diesels produced a range of stress no higher than under the freight car wheels.

040819
THE BEARING CAPACITY OF CLAYS

Peck, RB, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 531952, pp 1057-61, 4 Fig

The results of theoretical and experimental studies of the properties of clay soils lead to a very simple equation for computing the ultimate bearing capacity or maximum pressure to which the soil can be subjected without complete failure. This equation refers to a rectangular footing having a width B and length L. The expression is Q(sub d) equals 2.85 Q(sub u) (1 plus 0.3 B/L) in which Q(sub u) is the unconfined compressive strength of the clay beneath the loaded area, and Q(sub d) is the ultimate bearing capacity. The unconfined compressive strength of a clay soil can be determined readily by relatively rapid and inexpensive methods.

040820
STRESS MEASUREMENTS IN 115 RE AND 132 RE RAIL ON CURVED TRACK

Magee, GM, Association of American Railroads

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 531952, pp 1140-50, 10 Fig

Stress distribution in 112, 115, 131, and 132 RE rails on curved track is shown. Most measurements were made for steam locomotive wheel load; however, a diesel locomotive was used for one measurement with 115 RE rail. Fatigue test results are shown on a Goodman diagram.

040821
SUPERSONIC INSPECTION FOR DEFECTS IN RAIL ENDS

Code, CJ, Pennsylvania Railroad

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 531952, pp 1151-58, 10 Phot

Statistical data on rail defects found in 1951 by use of the Audigage flaw detector and the ultrasonic detector car are reported. Pennsylvania Railroad located 3400 defects in joints and 417 defective rails at highway crossings. Photographs of the detectors and some defective rails are shown.

040822
CROSSING FROG BOLT TENSION TESTS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 52, No. 493, Feb. 1951, pp 532-553, 11 Fig, 7 Tab

To determine the characteristics required of spring washers for use with turnout and crossing frogs, field observations have included measurements on a bolted heat-treated rail crossing in high-speed territory, and on this type of crossing together with a manganese insert, and a solid manganese type in slow-speed territory. For each service period, the bolts were initially set to a tension of approximately 40,000 lb. Loss in bolt tension was not due to the nuts backing off. Loss of tension is evidently due to wear. The rate of bolt tension loss was found to be considerably more on the bolted rail type of construction than on either the manganese insert or solid manganese types of crossing. The high reaction types of spring washers have shown better ability to maintain bolt tension over the test period than the low reaction types. The shock load or dynamic variation in the bolt tension under traffic was measured. Two series of tests were conducted; one with 40,000 lb initial tension, the other with 25,000 lb tension. The bolt tension tests are continuing.

040823
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 779-783, 2 Fig, 2 Tab

Since October 1, 1052 reports have been prepared on 41 failures in control-cooled rails. The majority of failure were due to shelly rail and transverse fissures from hot torn steel. Others occurred from shatter cracks, inclusions, engine burn, bolt hole cracks, head and web separations, and head checks.

040824
TWELFTH PROGRESS REPORT OF THE ROLLING-LOAD TESTS OF JOINT BARS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 814-828, 1 Fig, 5 Tab, 8 Phot

This report covers tests of joint bars conducted during the past year. The criterion for bar failure is taken to be the number of cycles of loading to propagate a fatigue crack to one-half of the bar height. 1. Twelve tests of 132K44 headfree, long-toe bars with pressed easements averaged 832,290 cycles in the rolling-load tests. Physical properties of these bars were well above AREA specifications. 2. Twelve tests of 132 RE headfree, 36-in. bars with pressed easements averaged 406,590 cycles, an average only about half as great as previous tests on this type of bar. 3. Tests on five 115 RE bars which failed in service indicated low hardness and low physical properties. 4. Tensile tests on 20 specimens from 50 failed bars from service for 100-lb rail indicated that 11 of the 20 passed the AREA specification of 100,000 psi tensile strength and 8 of the 20 passed the AREA specification of 70,000 psi yield point. 5. Micrographs on both laboratory tested bars and failed bars from service indicated depths of decarburization from less than 0.001 in. to 0.028 in.

040825
TWELFTH PROGRESS REPORT ON SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 832-840, 6 Tab, 19 Phot

This paper summarized the past year's progress on shelly rail studies at the University of Illinois: 1. Stress relieving of specimens during laboratory rolling-load tests at either 1000 or 800 deg F have not appreciably increased the life of the rails. 2. Rolling-load tests of commercially flame-hardened rails gave tests about 50 percent above the average for standard carbon steel rails. 3. Rolling-load tests of high silicon steel rails gave tests almost double the average for standard carbon steel rails. 4. An electric furnace 60-lb steel rail with European chemistry gave very low tests in the rolling-load machine—94,400 cycles. 5. Metallographic examination of 17 shelly rails from service found only 1 rail which contained extra large non-metallic inclusions, which could explain why it had developed shelling in service. 6. Using a special rolling-load machine, detail fractures from shelling were produced in five standard steel rails and one alloy rail. 6. The cause of shelling in service appears to be that present wheel loads are too heavy for the small area of contact between wheel and rail, so that as a result of the flow of the steel, internal stresses are produced that exceed the capacity of the steel to withstand such stresses. 7. Laboratory rolling-load tests indicate that stronger rail steel, such as high silicon steel rails, intermediate manganese chrome-vanadium alloy rails, or heat-treated rails should give longer life before shelling develops in service.

040826
FINAL REPORT ON THE STUDY OF SIMULATED RAILS UNDER REPEATED ROLLING LOAD

Hyler, WS, Battelle Memorial Institute
Grover, HJ, Battelle Memorial Institute

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 840-854, 5 Fig, 5 Tab, 3 Phot, 6 Ref

This investigation has studied some of the factors which might contribute to shelly failure formation. The investigation has been directed particularly toward a study of the effects of progressive plastic deformation resulting from repeated rolling-wheel loads. Some variables introduced were wheel load, wheel radius, and cycles of repeated rolling load. Experimental evidence suggests that plastic deformation occurs in a rail with early successive load repetition. Further, the tests show that, although deformation is inelastic, many of the effects of the variables studied would be qualitatively predictable by elastic equations such as the Herz equations and this work suggest that smaller wheel loads or larger diameter wheels would be quite helpful. It is also interesting to note that the Herz equations would suggest the use of higher strength rails for longer rail life. This is also in agreement with general observations from actual service and from laboratory tests of rail.

040827
FINAL REPORT ON A THREE-DIMENSIONAL PHOTOELASTIC INVESTIGATION OF THE PRINCIPAL STRESSES AND MAXIMUM SHEARS IN THE HEAD OF A MODEL OF A RAILROAD RAIL

Frocht, MM, Illinois Institute of Technology

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551954, pp 854-897, 22 Fig, 6 Phot, 5 Ref, 1 App

This report deals with a photoelastic study of the stresses in a model of the head of a railroad rail, utilizing for this purpose the most recent developments in three-dimensional photoelasticity. The study was undertaken in the expectation that the results would lead to a better understanding of the phenomenon of shelling in rails. It is concluded that: 1. Near the region of contact the principal stresses in the model are all compressive both for the vertical load and for the combined loads used. 2. Below the region of contact the longitudinal stresses become tensile for both types of loading. 3. The maximum shear lies in the transverse section of symmetry for both types of loading. 4. The effect of the horizontal thrust is primarily to increase the shear in the immediate vicinity of the area of contact by 30 percent. 5. On the side of the rail away from the load the stresses are predominantly tensile and are much smaller than on the loaded side for both types of loading.

040832
ROADBED STABILIZATION

Smith, R

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 501949, pp 882-890, 10 Fig

The purpose of this article was to describe conditions that make roadbed stabilization both desirable and necessary. Most slides of concern to railroads are of the slow and continual variety and attributable primarily to surface water. The characteristics of sand, silt, and clay soils are reviewed and slope failures by shear are analyzed.

040833
FATIGUE TESTS OF RAIL WEBS

Jensen, RS, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 471946, pp 464-466, 2 Fig

Two specially designed vibratory machines were used to determine the fatigue of less-than-full-size rails because rolling-load machines were unable to break the web of full-sized sections. In all tests a constant ratio of compressive to tensile stress was maintained, the bending stress on the top side ranging from a maximum compressive stress to a tensile stress 20 percent as great. The specimens were cut from two sections of 112-lb. RE rail. The fatigue curves show that reduced fatigue strength results from stamping. These data would indicate an endurance limit of approximately 59,000 psi, for unstamped specimens, and 51,000 psi for stamped specimens at 40 million cycles. At one million cycles, the reduction in fatigue strength for the stamped specimens is slightly over 20 percent. Although these tests were made on specimens instead of a complete rail section, the stresses were of the same order of magnitude as the web stresses which occur in the field, thus affording a measure of the reduction in fatigue strength of a full-sized web which may be ascribed to the presence of stamped numbers.

040873
COMPUTERIZATION OF HIGH AND WIDE CLEARANCES

Laden, HN

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 691968, pp 814-830, 1 Fig, 11 Phot

The clearance problem considered is limited to dimensional restrictions to movement. Weight distribution and axle-load restrictions are ignored. The operations of a typical railroad Clearance Bureau are outlined and the phases which would be simplified by the use of a computer are identified. Several photoelectric detector installations for measuring the clearance are photographed. The functions of the Mechanical and Engineering Departments regarding clearances are briefly described. The SCOPE car used to collect information for updating clearance records is shown and described. The flow chart of the digital computer program is illustrated.

033095
RAILWAY TRACK VIBRATION INDUCED BY TRAIN MOVEMENT

Sato, Y, Japanese National Railways
Toyoda, M, Japanese National Railways
Kobayashi, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Quart Rpt, Dec. 1960, pp28-31

The railway track under train movement suffers progressive deterioration, which is equivalent to multiplication of repeated train load and vibration induced. The paper presents the results of measurements on the aggravated track vibration and the comparative study of track vibration on the concrete ties and on the traditional ties. Ballast acceleration in two sections laid with concrete ties using tie-pads of 110 t/cm spring constant averaged 23 percent and 35 percent respectively, less than that of the section laid with common ties. The value in a section laid with concrete ties using tie-pads of 250 t/cm spring constant averaged 24 percent larger. There is a conspicuous difference in occurrence distribution of acceleration at the welded joint.

033133
FORMULAS FOR LENGTH OF TRANSITION SPIRALS

Ferguson, R, Association of American Railroads

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 34266

Feb. 1957, 2pp

Private Communication

A series of mathematical formulae relate the determination of a comfortable rate of lateral acceleration to the forces required to change the direction of a locomotive or cars from a straight to a curved path.

033206
PROBLEMS OF INTERACTION OF VEHICLES AND TRACK

Van Bommel, I, International Union of Railways

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Question C9, Annual Rpt, Jan. 1961, 14pp

A committee report considers that the railway vehicle is made up of units which are united by elastic elements. The movements of the various units are considered, and formulae to represent such phenomenon as single mass oscillation, nonlinear vibrations, self-sustained movement, are included. The problem of "hunting" is defined, factors discussed, and the part that the track plays in the phenomenon is discussed.

033207
BEHAVIOUR OF THE METAL OF RAILS UNDER THE REPEATED ACTION OF WHEELS. STUDY OF THE FIELD OF STRESSES IN THE ELASTO-PLASTIC ZONE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interm Rpt, Mar. 1964, 102pp

This report contains the results of the various calculations effected so far. These can be considered as preliminary calculations carried out before proceeding to the complete calculation of the stresses in a railhead. The report likewise contains several analytical studies, both for the purpose of gaining a better insight of the stresses (the methods and the formulae are, as a rule, well known, though, generally speaking, the numerical results are not published) and for rendering possible a comparison of the results obtained by means of the numerical method with those obtained by means of exact calculations.

033258
RELATION BETWEEN SUPERELEVATION AND CAR ROLLING

Nakamura, I, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 1, Quart Rpt, Mar. 1962, pp17-20

Springs and links between car body and axles can be thought as a mechanical filter to isolate the car body from axle motion (except axle revolution). Then the problem to know the relation between track irregularity and car vibration is the problem to know the characteristics of this filter. There are three methods to study the characteristics. The first method is to calculate the characteristics theoretically from the parts constants. The second method is to know the characteristics by measuring the output of filter for special input. The third method is to determine the characteristics by analyzing the input-output relations for normal operation. No special equipment except measuring instruments is needed. Second, the effect of random noise can be cancelled out by statistical treatment of data. An application of this method is described.

033284
SHOCK AND VIBRATION THEORY

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 19104)

The Railroad Environment: A Guide for Shippers and Railroad Personnel.

It defines terms used in a mathematical representation of shock and vibration which are part of railroad phenomenon and discusses mass, inertia, momentum, force as related to "railroad impact shock". In addition the relationship of railroad car spring, and effect of flat wheels or rail joints upon the suspension of the car are represented and discussed.

033285
TESTS OF PENNSYLVANIA RAILROAD ELECTRIC LOCOMOTIVES AT CLAYMONT, DELAWARE

Westing, F

Locomotives that Baldwin Built (Superior Publishing Company, 708 6th Avenue North, Box 1710, Seattle, Washington, 98111)

1966

In 1934 studies were made by the Pennsylvania of larger size electric motive power in anticipation of the heavier trains to come. A class R-1 locomotive was designed and built in 1934 with a 4-8-4 wheel arrangement. It was considerably heavier on the axles than the consulting firm which electrified the Pennsylvania deemed desirable, and they persuaded the Pennsylvania Railroad to borrow one of the new New Haven locomotives, which had a wheel arrangement of 4-6-6-4 and had a comparable axle load to the earlier class of Pennsylvania locomotives. The R-1 could not match the tracking flexibility of the GG-1, wheel arrangement of which was articulated. The GG-1 was safer and smoother riding at high speed with less destructive forces being exerted on the rail than the R-1.

033306
THE EFFECT OF THE RATIO OF WHEEL DIAMETER TO WHEEL LOAD ON EXTENT OF RAIL DAMAGE

Alleman, NJ, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 47, No. 453, June 1945, pp725-741

This is a report of progress on studies of pressure as affected by the area of contact between wheel and rail. One phase of this investigation involves the conduct of rolling load tests of rails subjected to wheels of various diameters and loads. To summarize, a depth hardness survey on a 112-lb rail removed from service after approximately 12,000,000 tons of traffic shows the maximum hardness to be at a depth of approximately 0.04 in. at a distance of 1-3/6 in. from the center of the head toward the gage side, the maximum hardness being Rockwell C 34.6. Tests on a full section 131-lb rail under a 75,000-lb load after 1,333,000 cycles (100,000,000 tons) of testing are as follows: For the 33 in. wheel—a hardness of Rc 15 on the tread and a maximum of Rc 32 at a depth of 0.15 in.; for the 50 in. wheel—a hardness on the tread of Rc 23 and a maximum hardness of Rc 27.4 at a depth of 0.10 in. Using "mutilated" head specimens and a 50-in. wheel it was found that a 58,000-lb load could be carried for 100,000,000 tons, but that a 63,000-lb load would break down the rail tread after 15-45 million tons.

033313
INVESTIGATION OF THE IMPACT EFFECT OF FLAT WHEELS PRELIMINARY REPORT

Magee, GM, Association of American Railroads
Cress, EE, Association of American Railroads

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 451944, pp9-23, 6 Ref

The test reported the effect of wheel flat upon rail, tie plates, ties. Test situation included a test track over which a loaded coal car with a 4 inch long flat spot, was run. Stress was measured by special M.I.T. testing gear and a high speed camera. The tests were run at speeds of 5 to 40 mph to determine effect of speed upon stresses created by out-of-round wheels.

033314
STUDIES OF THE PRESSURE AS AFFECTED BY THE AREA OF CONTACT BETWEEN WHEEL AND RAIL. EFFECT OF WHEEL SIZE

Alleman, NJ, Illinois University

American Railway Engineering Association Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 451944, pp3-8

The following is a progress report on one phase of this investigation, namely, rolling-load tests in which wheels of various diameters are rolled to and fro on a short length of rail for the purpose of determining the number of cycles of load application required to produce failure. The results of the rolling-load tests to fracture show considerable "scatter" and no very marked difference between the results of tests under a 50-in. wheel and those from tests under a 33-inch wheel. The vertical wear on rail 757C (33-in. wheel) was 0.046 in. at failure, whereas the wear on rail 757C1 (50-in. wheel) at 580,900 cycles was 0.041 in. At failure, 750,100 cycles, the wear on rail 757C1 was 0.0425 in. A second type of test being tried to ascertain the effect of wheel size on the rail is to measure the depth of work hardening in the rail head. The rail head appeared to have been work hardened down to a depth of about 0.45 in. by the 33-in. wheel with a maximum hardness of 296 at a depth of 0.15 in. A test on a section from the same rail rolled with the 50-in. wheel appears to have been work hardened down to a depth of 0.20 in. with a maximum hardness of 269 at a depth of 0.10 in.

033323
A THEORY OF THE DERAILMENT OF WHEELSET

Yokose, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 3, Sept. 1966, pp30-34, 1 Ref

In this study, in order to find out an allowable limit of derailment, the author made four assumptions and analyzed the simplest case where a wheelset derails. In order to prove the theory, the author made experiments by 1/10 and 1/5 scale model wheelset. The results of either case of 1/10 or 1/5 models coincide with theoretical values, and no difference was observed on the limit value of derailment by stationary side thrust having various kinds of radii of wheels.

033349
DYNAMIC EFFECT OF A FLAT WHEEL ON TRACK DEFORMATION

Satoh, Y, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 7, No. 1, No. 22, Mar. 1964, pp14-22

A series of riding tests was made to clarify dynamic effects of wheels (whose treads were set with flat spots) on the rolling stock as well as on the track at various speeds up to 200 km/h on the test run section of the New Tokaido Truck Line on December 7-11, 1963. In the present report, major test results concerning track deformation are outlined. Shock values resulting from rail bending stress and pressure between rail and sleeper grow rapidly with train speed, showing the peak at 20 to approximately 30 km/h, and thereafter up to 100 km/h, they gradually decrease.

033354
ON THE RELATION BETWEEN SUPERELEVATION AND CAR ROLLING

Nakamura, I, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 5, No. 1, No. 14, Mar. 1962, pp10-16, 5 Ref

Springs and links between the car body and axles can be thought as a mechanical filter to isolate the car body from axle motion (except axle revolution). To know the relation between track irregularity and car vibration is the problem to know the characteristics of this filter. Method is to know the characteristics by analysing the input-output relations for normal operation. Application of this method is introduced in the following section.

033390
THE EFFECT OF SUSPENSION DESIGN ON RAIL STRESSES. THE MATCHING OF SPRING STIFFNESS AND DAMPER CHARACTERISTICS AS AN AID TO IMPROVING RIDING AND REDUCING RAIL STRESSES

Koffman, JL, British Railways

Rail International (International Railway Congress Association,

17-21 rue de Louvrain, 1000 Brussels, Belgium)

Sept. 1960, pp756-766, 15 Ref

Article considers the relationship between spring stiffness, damper characteristics of rolling stock as a way to improve comfort and to reduce stress at the rail and also considers factors of vehicle mass, spring stiffness, damping factors of vehicles and track irregularity, sprang-unsprang weight mass, stiffness of track, and the softness of the ballast.

033422
CAR DYNAMICS STUDY

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 3, Quart Rpt, Sept. 1963, pp39

In the calculation of car vibration, for instance, especially that of hunting motions, the electronic computer is almost indispensable. Manual computation is quite inadequate for a problem such as this, involving a large number of degrees of freedom of motion. Calculations of the hunting characteristics of electric cars for the New Tokaido Line is now under construction by using a digital computer to find out the roots of the characteristic equation of such a high order as stated above. In this way, we have played since last year a leading part in developing measures to reduce hunting motion in the design of the bogie truck.

033435
EFFECT OF WHEEL FLAT ON THE CAR VIBRATION

Matsui, N, Japanese National Railways
Miyoshi, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 3, Quart Rpt, Sept. 1965, pp51

A series of running tests was performed with the prototype "B" train for the new Tokaido line. The object is to investigate the effect of the wheel flat on the car body and truck vibration. The data were expected to give a reference for design and maintenance of car, and to give a base for determining the allowable limit of the flat length in practical operation. The running speed was 200 km/h for the flat up to 90 mm, and 50 km/h for 110 mm. So far as the truck and car body vibration is concerned, flat caused more vibration at a low speed than at a high speed. So car vibration is not considered the most decisive factor limiting the allowable length of flat.

033440
THE RESISTANCE OF THE PERMANENT WAY TO THE TRANSVERSAL STRESSES EXERTED BY THE ROLLING STOCK

Prud'Homme, A, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Nov. 1967, pp731-766, 2 Ref

The improvement of the stability of running of the rolling stock is certainly important. Is desired to increase the speeds of both the passenger and the freight trains. In the case of the latter, in which the general public is interested, the problems raised by increasing the maximum speeds from 120 to 140 km/h and even 160 km/h have been solved satisfactorily, and it is now question of going a stage further by reaching speeds of 200 km/h in current service.

033442
AXLE LOAD AND WHEEL DIAMETER CONSIDERED FROM THE ASPECT OF THE STRESSES ACTING ON THE MATERIAL OF WHEEL AND RAIL

Kilb, E, German Federal Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1967, pp663-668, 5 Ref

This discussion is on the mechanical stresses of each wheel and each rail as part of the normal and tangential forces acting at the contact surface. Wheels wear and form "worn profiles" resulting in flatter curvature and lower stresses than in new profiles. As wheel diameters decrease, the load cycle or incidence of contact increases.

033445
STRESSES ACTING ON THE RAIL–RECENT FINDINGS

Eisenmann, J, German Federal Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

July 1967, pp537-550, 3 Ref

Increased axle pressures and reduced wheel radii give rise to higher stresses in the rail head. If the permissible shearing stress is exceeded, fatigue fractures will occur in the rail head. This can be counteracted by using a steel of greater strength and purity. Also of importance are the additional flexural tensile stresses at the lower edge of the rail head. This permits an indirect measurement of the guiding efforts.

033724
DYNAMICS OF HIGH-SPEED ROLLING STOCK

Matsui, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp45-97

Article discusses the results of running tests conducted with defective tracks, a rescue diesel locomotive and repeated speed up and operation tests at frequent intervals. In addition, the hunting of rolling stock, vibration of a vehicle with a defective track is detailed. Finally, the performance test of production vehicles is discussed on the whole line.

033725
RUNNING VIBRATION TEST OF TYPE ED61 ELECTRIC LOCOMOTIVE

Kunieda, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 1, Quart Rpt, Mar. 1960, pp77

It was detected by a running test that the for-and-aft vibration of newly manufactured ED61 electric locomotive was too large. Running vibration of each part of this locomotive was measured and analyzed. Results revealed that the vibration comes from pitching of the track and that application of oil damper between the end frame of the track and the car body is effective for prevention of these vibrations.

033727
THEORETICAL STUDY ON THE SIDE THRUST OF TRUCK WHEELS RUNNING ON CURVES

Kunieda, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 2, Quart Rpt, June 1970, pp105-108

The analysis in this paper purports to present the fundamental principles for the design of the truck with a good curving performance, that is, with a small side thrust against the curved rail. Measures to decrease the side thrust on curves are almost contrary to the measures to prevent the hunting of truck or wheelset. Effective measures to the side thrust have inevitably bad influences on the hunting. In order to improve the general performance of running stability, prevention of hunting must come first.

033732
TESTS ON THE TRACK ON THE RIDING STABILITY AND THE GUIDING QUALITY OF VEHICLES BY MEANS OF A SPECIAL VEHICLE-RESULTS OF THE FIRST TRACK TESTS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rp12 Question B52, Intrm Rpt, June 1963, 72pp

The report gives an account of the results of the tests made with the experimental bogie described in a previous report. The first part of the report supplies data relating to four series of tests during which the various parameters of the bogie (lateral play between axle-box and axle, axle load) and also the riding speed were successively varied. These tests have made it possible to establish conclusions relating to the wave-length of the hunting movement, the amplitude of the transverse movements of the bogie and the maximum transverse forces occurring between bogie and axles. The second part of the report supplies data relating to the tests during which the wheelbase of the test bogie was varied. The data obtained have permitted the establishment of some conclusions relating to the wave-length of the hunting movement, the transverse displacement of the bogie frame, the maximum angle of rotation of the bogie and the transverse forces. The third part of the report contains an account of the results obtained during the tests, the object of which was to study the same magnitudes as those prevailing during the previous tests, the wheel tyres of the test bogie having however been machined in accordance with the wear profile "Muller No. 2". All the tests were made on one and the same section, this being in an excellent state of repair and having a relatively constant gauge and chiefly consisting of straight track.

033734
VERTICAL FORCED VIBRATION OF VEHICLE BODY AND VERTICAL WHEEL LOAD DIMINUATION DUE TO TRACK IRREGULARITY

Matsui, N, Japanese National Railways
Arai, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp169-170

A high speed passenger railway vehicle is designed to offer an agreeable riding comfort as well as to assure the safety running. Possibility of a high speed of 500 km/h, from these viewpoints, is examined by calculating the vertical acceleration and the change of wheel load. The results suggest promising possibilities of realization.

033847
THE RIDING QUALITY OF A TRAIN PASSING A CURVE AS DETERMINED BY SUPERELEVATION AND CENTRIFUGAL FORCE

Koyama, M, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 6, No. 2, June 1963, pp19-25

The purpose of this report is to clarify the relationship between the riding quality and a lateral acceleration on a curved track. The author has polled the opinions of 50 persons who took part in the test by riding a test train and correlated the findings of such polling with different degrees of lateral acceleration. Thus, the limit of excessive acceleration on curved tracks was examined from the standpoint of riding quality.

033849
RUNNING OF TILTING RAILWAY VEHICLES OVER CURVED TRACK–GENERAL ASPECTS RECENT TESTS WITH THE S.N.C.F. TILTING COACH

Terrase, R, French National Railways
Joly, R, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31970, pp89-103

Article discusses the problems of passenger comfort as related to high speed trains on a canted curved track. The French experiments using a test vehicle to determine means to correct for this cant is detailed including the specifications of the vehicle, the ways in which solutions to the problem of cant were tested. Recommendations in the types of equipment to solve the problem are also discussed.

033850
RAILWAY TRACK STABILITY IN RELATION TO TRANSVERSE STRESSES EXERTED BY ROLLING STOCK. A THEORETICAL STUDY OF TRACK BEHAVIOUR. A PRACTICAL METHOD FOR DETERMINING THE RESISTANCE OF THE TRACK TO TRANSVERSE STRESSES EXERTED BY ROLLING STOCK

Amans, F, French National Railways
Sauvage, R, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Nov. 1969, pp685-716, 2 Ref

Part one studies the behaviour of railway track subjected to the stress of rolling stock and the experimental results on a test track with formulae for the pressures on the track through ballast or by rails through sleepers. Part two contains a computer solution to a fourth degree equation representing equilibrium equation of a track segment. Last, the interrelationship between rails, ballast, temperature and stress upon track behaviour are discussed.

033851
SOME PROBLEMS OF WHEEL/RAIL INTERACTION ASSOCIATED WITH HIGH-SPEED TRAINS

Evensen, DA, Department of Transportation
Kaplan, A, Department of Transportation

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Sept. 1969, pp513-542, 43 Ref

The objective of this study was to identify and evaluate potential problems involving wheel-rail interaction which could limit the speed of a high speed rail (HSR) system. The study is based upon a survey of existing knowledge in the areas pertinent to wheel-rail interaction; no extensive analytical work is presented, but several approximate calculations are given. The results and discussion are concentrated in four main areas, namely: Estimation of the dynamic loads; Wheel behavior and structural integrity; Rail dynamics and structural integrity; Adhesion, hunting, and relation problems.

033855
THE BEHAVIOUR OF THE SNCF STOCK AT HIGH SPEEDS

Mauzin, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21966, pp93-96

The behaviour of the rolling stock during the high speeds of 200 to 250 km/h, using three different types of equipment, all designed for 150 km/h, showed no abnormal findings as to transverse efforts exerted on the tracks by the equipment or transverse accelerations in the body of the last coach. The transverse acceleration in the last coach always remained under 0.08 g, which corresponded to the best obtainable in comfort with existing equipment.

033860
EXPERIMENTAL RESEARCH ON THE EFFECT OF VEHICLES ON RAILWAY TRACK AT HIGH RUNNING SPEEDS

Verigo, MF, Ministry of Communications, USSR

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Jan. 1968, pp39-70

The methods adopted by the Soviet railways for testing the effect of ultra-high-speed vehicles on the track are primarily designed for fixing safe speed limits for vehicles. These conditions are determined by different criteria and characteristics; the determination is based on the evaluation of extensive statistical data obtained by measurements on the track and on the vehicles.

037208
LATERAL FORCES ACTING TO WHEEL, WHEEL LOAD, COEFFICIENT OF DERAILMENT AND BENDING STRESS OF WHEEL-AXLE OF THE CAR ON THE NEW TOKAIDO TRUCK LINE

Nakamura, H Tanaka, S

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, June 1967, pp 103-106, 10 Fig

The lateral force acting to wheel, wheel load, coefficient of derailment lateral acceleration of carbody and bending stress of wheel-axle were measured for the purpose of track maintenance and for the running safety. Data are shown graphically.

037211
SOME ASPECTS OF THE HUNTING OF A RAILWAY AXLE

Brann, RP, London University College

Journal of Sound and Vibration (Academic Press Incorporated, Berkeley Square House, Berkeley Square, London SW1, England)

Vol. 4, No. 11966, pp 18-32, 6 Fig, 8 Ref, 2 App

Equations of motion are derived to describe the hunting mode of a railway axle running at constant velocity along straight track. It is assumed that the wheel and rail-head profiles take some arbitrary shape. This shape gives rise to non-linearities in the equations. The equations are first linearized, and approximate expressions derived for the frequency of the oscillation and conditions of stability. Asymptotic stability for all initial conditions of the non-linear system is then considered in the manner of Aiserman, and the equations are examined for stable limit-cycle by applying the first approximations of Kryloff and Bogoliuboff. It is shown that, when running at low velocities, the axle will execute limit-cycle oscillations even though the wheel's flanges do not contact the rails. Small increases in velocity, however, quickly result in flange contact.

037213
LATERAL DYNAMICS OF RAILWAY VEHICLES

Wickens, AH, British Railways Research Department

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Dec. 1965, pp 987-990, 4 Fig, 2 Phot, 14 Ref

The fundamentals of lateral dynamics theory of railway vehicles is reviewed. Numerous topics are presented, including: stable running theory, longitudinal creep, forward speeds, sinusoidal path, forces acting, hunting, conditons for stability, critical speeds, profiled wheels, suspension, coned and profiled wheels, wear of trends, vehicle design, and track geometry.

037216
TRACK LOADING FUNDAMENTALS–1 INTRODUCTION: TRACK AND WHEEL LOADING

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Jan. 1957, pp 45-48, 2 Fig, 6 Ref

This is the first article in a series describing how maximum axle loads can be determined for permanent way and conversely, how track can be designed and/or improved to carry maximum axle loads. This first article examines track and wheel loading, track stresses, and loading indices and track constants.

037222
TRACK LOADING FUNDAMENTALS–7 VARIOUS SPEED EFFECT FORMULA

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Apr. 1957, pp 479-481, 5 Fig, 2 Ref

This document discusses some formulae which are used to determine the permitted rail speed. Included are AAR, Indian Railways and Petersen formulae. The author suggests that rail speed is "a computed value, deduced by the elastic theory of the primary flexural stress at the base of the rail not exceeding the allowable stress value for the rail steel." The resultant value also includes an allowance for impact or speed effect.

037277
HIGHER SPEEDS THROUGH CURVES

Koffman, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, May 1970, p 367, 2 Fig, 3 Tab

Letter to the editor of the Railway Gazette.

Investigation of rail friction (mu (sub y)), made on both wet and sanded rock, at speeds between 6 and 72 km/h, showed values ranging between 0.4 mu (sub y) and 0.5 mu (sub y) with banding leading to higher values. Values of mu (sub y) for lateral slip versus wheel-load are given as are values of mu (sub y) for a range of R(m) from 300 to 890 at speeds from 80 to 110 km/h. It was noted that the use of bogie intercouplers reduce rail friction (mu (sub y)) and flange wear.

037430
METHOD OF DETERMINING THE RUNNING SMOOTHNESS FROM THE FREQUENCY CHARACTERISTICS OF ROLLING STOCK

Krettek, O

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 4, Apr. 1970, pp 151-155, 3 Fig, 1 Tab, 7 Ref

From various tests made to evaluate the smoothness of running of a railway vehicle, a smoothness coefficient, W (sub z), was derived. This article describes in detail mathematically how this coefficient, W (sub z) can be calculated in advance for any given vehicle from a knowledge of the track and vehicle characteristics. These calculations can only be accomplished by a digital computer. This process can be used to calculate coefficients during the engineering stages of new equipment.

037591
INTERACTION OF WHEEL AND RAIL WITH RESPECT TO TRACKING, WEAR, FREE ROLLING AND STRESS IN WHEEL SETS

Kurek, EG

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 15, No. 9, Sept. 1966, pp 338-346, 9 Fig, 2 Phot, 12 Ref

The author examines the interaction of wheel to rail with respect to tracking qualities, wear of wheel tread and rail, free rolling and stress in the power wheel sets under power or braking. A picture is shown comparing the stress lines in the rail under a wheel with the flange away from the rail with that where the wheel tread and flange both exert pressure on the rail. The verification of the theoretical considerations of these conditions by actual measurements has been made by modern techniques, which are closing the gap between theory and practice.

037593
TRACK STRESSES AND VEHICLE MOTION AT HIGH SPEEDS

Birmann, F

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 8, Aug. 1965, pp 335-351, 49 Fig, 2 Tab, 9 Phot, 15 Ref

The high speed test runs made with the locomotives E 10 299 and E 10 300 and 8 wheeled track recording cars and passenger cars are described. Extensive measurements were made of the stresses to which the track is subjected at train speeds of 140 to 200 km/h, and of the dynamic wheel loads and lateral pressures against the rail, as well as the effect of these forces on the roadbed. The results of these tests on curved and straight track are given and illustrated by charts. The present usual track structure will suffice for the high speed operation. The minimum radius of curvature should not be under 1890 meters. Continuous welded rail improves the riding qualities in high speed operation. A desirable riding comfort level is attained in the passenger cars at 200 km/h speeds.

037594
SERIAL MEASUREMENTS ON RAIL TO DETERMINE WHEEL LATERAL FORCES

Birmann, F Eisenmann, J

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 15, No. 5, May 1966, pp 155-164, 19 Fig, 1 Tab, 1 Phot, 10 Ref

The rail-head bending procedure is described for measuring the loading on the rail due to the lateral forces of the wheels of motive power and freight cars for various conditions of track curvature and speed ranges up to 200 km/h. Comparisons are given for the lateral and vertical loads imposed by the different wheel and axle arrangements of this equipment at various speeds and of the stress effects on the rail. Charts show these relations, and the relations of the lateral forces to the curve radii. The side wear or abrasion of the rails is also shown in mm(super 2) per million gross tons rolling over the rail in relation to the curve radii.

037595
ASSURING THE STABILITY OF THE BARTD LIGHTWEIGHT RAPID TRANSIT VEHICLE

Bugge, WA

Pearsons Brinkerhoff-Tudor-Bechtel, 814 Mission Street, San Francisco, California, 94103

Res Rpt, Apr. 1964, 14 pp, 12 Fig, 2 Phot, 9 Ref

The BARTD System will utilize lightweight cars about 800 lbs. per linear foot operating at higher average speeds than any other transit system in the world. These vehicles will be subjected occasionally, on 31 miles of aerial structures and 24 miles of at-grade construction, to high winds. Mathematical formulas were developed to determine the reliability of vehicle-track systems constructed to a range of gauges under various combinations of adverse conditions. As a result of these investigations, it is recommended that the BARTD System vehicle and track system be designed to a guage of 5'-6". Findings clearly indicate that this approach would assure the lateral stability and safety of the desired lightweight vehicle more effectively and economically than any other design approach.

037601
PROBLEMS OF RAILWAY MAINTENANCE OF WAY

Meier, H

Jahrbuch des Eisenbahnwesens (Hestra-Verlag, Darmstadt, West Germany)

1967, pp 7-35, 39 Fig

A historical discussion is presented on the achievements of heavier axle loads and higher speeds. The planning of new and larger cars for the Rheinische Braunkohlenrevier is included. These cars will have an axle load of 50 tons. This is followed by both a theoretical presentation and actual results of tests of the behavior of the track structure under the loading of locomotives and cars. One interesting point brought out is that there is practically no difference in the depth and frequency of the deflection of the track under an E-10 locomotive at 10 KM/H versus 200 KM/H. Studies show the effect on track deflections with closer spacing of narrower ties, and also on a concrete track bed plate. Problems encountered with long, continuous welded rail are presented, and the stresses in the rail are shown under the varying conditions of temperature. The importance of exact alignment of the track laid in curves is stressed. It is concluded that with stiffer section, harder rails of steel free of impurities, heavier axle loads may be safely carried without damage, especially when the track is laid on narrower ties spaced more closely together (50 cm) on a deeper rock ballast bed. Further research will be required to determine if a new concept of track bed will be required for speeds of 250 KM/H and 40 ton axle loads.

037692
LATERAL FORCES BETWEEN WHEELS AND RAILS, AN EXPERIMENTAL INVESTIGATION

Olson, PE, Swedish State Railways
Johnsson, S, Swedish State Railways

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

60-RR-6, Paper, Apr. 1960, 8 pp, 19 Fig, 1 Tab, 2 Ref

Presented at ASME-AIEE Railroad Conference Pittsburgh, Pa., April 20-21, 1960.

The paper deals with a new method of measuring continuously the lateral forces between the wheels and the rails over long distances. Fundamental knowledge concerning these forces has been obtained both from studies of the results from short test runs and from statistical assessments of the results from long sections of the Swedish railway network. Since the tests are concerned only with a single locomotive, the results should not be generalized. It is clear, however by means of the individual diagrams of curve forces as well as the statistical evaluation of about 40 curve runs, that the lateral forces between the rails and the wheels of the leading axle are on the whole substantially greater than the resulting force on the permanent way. This factor should be all the more noticed, since the utilized friction coefficient can assume such unexpectedly high values, as is shown from the measurements.

037695
THE EFFECT OF SUSPENSION DESIGN ON RAIL STRESSES

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Mar. 1959, pp 361, 6 Fig, 1 Tab, 15 Ref

The matching of spring stiffness and damper characteristics is discussed as an aid to improving riding and reducing rail stresses. Dynamic wheel load due to spring deflection as a function of deflection distribution and damping factors for a 100-ton truck locomotive is illustrated. The approximate dependence of the total wheel-load versus speed, which might be encountered in service, is plotted. The effect of spring stiffness, mass ratio and bolster damping factors on body displacement relative to the ground, on the deflection of bolster springs, on truck frame displacement relative to the ground, and on the deflection of axlebox springs, are shown. The theory that the stresses imposed on rails decrease inversely to wheel diameter is discredited.

037707
IMPROVING RIDING OF PASSENGER VEHICLES

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Nov. 1957, pp 585-586

The paper, "Vibrational Aspects of Bogie Design", by J.L. Koffman of British Railways, describes the five fundamental modes of vehicle body vibration of particular interest to bogie designers. These are: lateral oscillations; rolling and swaying oscillations; body nosing; fore and aft oscillations; and vertical oscillations. Each of these principles are briefly described and are related to production coach and locomotive bogies to illustrate how observance of these principles result in satisfactory performance.

037718
CAR ROLL AND WHEEL LIFT, PROBLEM CHARACTERISTICS

Scott, HL, Norfolk and Western Railway

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 30-32

The problem of car roll becomes more acute as the height of the center of gravity of the car body and lading is increased by greater car heights; and as car lengths are increased to the extent that the distance between truck centers approximates a standard rail length. While severe car roll is objectionable the most serious immediate consequences are wheel lift and resultant derailments. Commulative roll can develop very quickly to cause wheel lift. With rail joints 3/4-inch low, wheel lift can develop in four rail lengths at critical speed. Wheel lift can also be obtained on track with joints only 3/8-inch to 1/2-inch low if the joint stagger is midway and uniform, all joints are equally low, and the critical speed is maintained for about ten rail lengths. Fortunately, only a small percentage of wheel lifts result in derailments. When car roll is severe enough to cause wheel lift, there is a sizeable lateral force in the direction of the wheels staying on the rail, so that on tangent track, the wheels that are lifted simply come back down on the rail. In addition to the derailment hazard possibility there will be an increase in fatigue failures of journals, wheels and rail near joints as the result of the repeated high wheel loads being sustained due to severe rolling of heavier cars on track with less-than-perfect rail joint conditions.

037719
CAR ROLL AND WHEEL LIFT, PROBLEM SOLVING APPROACHES

Reed, G, ACF Industries, Incorporated

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 32-38

The author discusses the problem of derailment and larger hopper cars as a two step process, (1) problem definition and (2) the selection of possible solutions or alternatives. It is pointed out that not all 100-ton cars derail. Only a relative few derail and, those which do, derail at more or less predictable locations. In the rail-versus-car controversy, it is obviously not very reasonable to spend the money to overhaul every mile of railroad track, nor is it any more reasonable to condemn the 100-ton car since it is one of the major factors contributing to increased railroad business. One possible solution might be to correct the very bad areas of track where the rail joint conditions produce severe dip, and the track arrangement is such that roll is reinforced; then do enough to the car itself to make it tolerate the remaining track. A few solutions on which there has been some work during the last year or two include improvement of the track and roadbed, and control of operation of the train so that susceptible cars don't move over troublesome curves at the critical speed or under certain conditions of draft or buff. Most derailments occur with newer cars, and when substantial milage is accumulated so all contact surfaces are worked in and maximum freedom of movement is attained there is a distinctly lessened tendency toward derailment. However, work on hopper car derailments has not produced a generalized solution which is widely adopted.

037727
THEORETICAL STUDY OF A TRAIN PARTING

Fillion, SH, Waugh Equipment Company

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 63-69, 3 Fig

The author reviews the results of a mathematical analysis of a problem involving run-out of slack on a 100-car train headed by six diesel units. The cars were 100-ton gondolas. The solution of the problem indicated that the forces developed were high enough to overstress either undamaged knuckles or drawbars.

037732
CAR ROLL AND WHEEL LIFT TESTS ON SIMULATED SERVICE TRACK: TEST CONDITIONS AND RESULTS AT PRR ALTOONA TEST SITE

Bertram, LW, Pennsylvania Railroad

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 23-27

The class H-43, 100-ton hopper car began derailing at increasing rates beginning in the Spring of 1964 as more and more of these cars were placed in service. It was decided to set up a test track to simulate the rock-off phenomena and determine what modifications could be made to the car to reduce wheel lift and car roll. All cars were tested first on a tangent track with rails shimmed 3/4" to produce an 1-1/2" total change in cross level at each 39-ft. joint over a distance of ten rail lengths at speeds in the range of ten miles per hour to 22 miles per hour at approximately one mile per hour increments or until the critical speed was exceeded. The cars were then tested on a 3 degree curve having a 4-1/2" super-elevation with an 1-1/2" change in cross level superimposed at each joint over a distance of six rail lengths. Speeds on the 3 degree curve did not exceed 15 miles per hour. After testing, it was decided to adopt the following truck modifications:—1. Replace the 2-1/2" travel springs with 3-11/16" travel springs. 2. Add two friction snubbers to each spring group to absorb energy input into the spring group: 3. Move the side bearings in from 50" centers to 46" centers. 4. Machine the bolster gibs to permit more bolster lateral freedom. Even though a truck modification eliminate wheel lift on the test track, it was not certain just how close the wheel is to becoming unloaded.

037751
BENDING STRESSES IN A MOTORED AXLE ON ELECTRIC ROLLING STOCK–1

Broadbent, HR, London Transport Executive
Richards, J, London Transport Executive

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, June 1956, pp 511-514, 6 Fig, 1 Tab, 1 Phot, 4 Ref

This article gives results of strain gauge tests on a motored axle both empty and loaded. Deductions from the results lead to an emphasis on the transverse friction between wheel and rail. This factor, neglected in axle stress formulae, is shown to be of major importance in the bending moment on the wheel seat of an axle, amounting to about 40 percent of the total on a curve with equilibrium cant. Support for the deduced theory is given by the correspondence between calculated and measured stresses, and also by the results of direct comparative tests. Additional stresses from cant deficiency, track irregularities, and acceleration or braking are discussed. The apparatus used in the test and the procedure of testing are fully described.

037752
BENDING STRESSES IN A MOTORED AXLE ON ELECTRIC ROLLING STOCK–2

Broadbent, HR, London Transport Executive
Richards, J, London Transport Executive

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, June 1956, pp 543-547, 8 Fig

A further check of the theory that transverse friction is a major item in the stressing of axles was made by a series of comparative tests. While vertical differences in track level apparently affect the stress in the axle very little, it has been found that the test axle assembly is very sensitive to the condition of the running edge of the high rail on a curve. Contrary to expectation, passage over the toes of switches and the noses of crossings did not produce high stresses in the axle. Passage through the lead of turn-outs caused high values to appear, though no higher than those which occurred on some curves.

037780
SIMPLIFIED RIDE INDEX MEASUREMENT

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

Jan. 1971, p 35, 1 Phot

This portable instrument will provide a continuous meter indication of the ride index of the vehicle in which it is placed. The meter uses a variable inductance accelerometer as an acceleration element. The meter is placed on the floor of the vehicle and the plane of measurement selected, either vertical or horizontal. The ride quality is shown directly on the meter scale as a continuous reading.

037782
RUNNING THROUGH CURVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, June 1952, pp 682-684, 9 Fig, 12 Ref

Economic considerations demand high average, rather than occasional high maximum speeds. Rapid acceleration and retardation are essential and vehicles must also be able to negotiate curves at high speeds, which is of particular importance for lines with many curves. The forces acting on a vehicle running in a curve are shown and the limiting valves of speed and the effect of axle load on speed through curves are established mathematically. Transverse flexibility is important in reducing dynamic forces at curve irregularities. Time-speed and time-distance curves for a single car and for a car and trailer are plotted for electric hydraulic and mechanical transmissions.

037830
MATHEMATICS IN RAILWAY TECHNOLOGY

Coates, PJ, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Feb. 1967, pp 96-99, 3 Fig, 2 Tab, 1 Phot, 4 Ref

The article discusses the application of computers in railroad technology. Such applications as predicting design behavior before construction, stress concentration and distribution, as well as applications of linear programming, probability and statistics applied to predicability of component failure are included.

037884
LATERAL FORCES ON RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Dec. 1939, pp 702-03, 3 Fig, 3 Tab

A piezoelectric device was mounted between the axlebox and bearing brass of 4-6-2 and 4-4-2 type locomotives to measure the lateral forces between the wheel and rail. Trials were made on the Hericy section of the Paris-Laroche line, which has curves of radii down to 1,640 lb., speeds of 75, 81, and 87 mph. The lateral forces for both locomotives on straight track and curves are reported in tabular form. Tests were made, with apparatus consisting of an indicating potentiometer for measuring changes in length of a telescopic tube placed between the wheels, to measure deformation, of the crank axle by loads on a locomotive without balance weights. Using the 4-4-2 locomotive, the distance between wheels increased from 3/8 to 11/16 in. as the speed rose from 50 to 75 mph.

037986
THROWOVER CHART FOR ROLLING STOCK

Keith-Hitchens, JG

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Dec. 1960, p 767, 1 Fig

A throwover chart, which is a simple and straighforward method of obtaining the throwover of a vehicle at its several points up to 100 ft. over buffers and 4 ft. bogie wheelbase on any curve is described and illustrated.

039011
A CALCULATION OF THE LATERAL HUNTING MOTION OF A TRACKED VEHICLE

Iguchi, M

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76109-5, Nov. 1966, 27 pp

Contract C-85-65t

The lateral hunting motion of a vehicle running on tracks is not only prejudicial to riding comfort, but may also cause dangerous derailment. The initial step in the design of a safe high-speed train is a theoretical and experimental investigation of this lateral hunting motion and a practical method of preventing it. The usual railroad train may be idealized as a system consisting of a number of cars connected end to end like links of a chain. The transfer-matrix technique purports to be applicable to such a system, whereby once the transfer matrices of each component (car) are derived, it is only necessary to perform successive matrix multiplications to fit the entire system. It is demonstrated that the transfer matrix method may be applied successfully in a study of lateral hunting motion. The stability problem associated with this motion, and forced vibrations caused by irregularities and lateral distortions in the rails may also be investigated by the use of the transfer-matrix technique. (Author)

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039030
GENERAL VEHICLE DYNAMIC MODEL

Paul, IL Sankaran, H Jackson, JL

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76109-3, Nov. 1966, 189 pp

Contract C-85-65t

Two computer programs were developed to calculate the three-dimensional dynamics of a rigid high-speed ground-vehicle supported vertically and laterally by an arbitrary number of suspensions and excited by arbitrary inputs (acting on the suspensions or on the vehicle body). The first program models each suspension by a linear spring and damper in parallel connected to the unsprung mass and another linear spring and damper in parallel joining the unsprung mass and the vehicle. This model is applicable to a limited class of suspensions over their linear operating range. The second, much more comprehensive program permits non-linear and/or 'active' suspension elements. Each suspension can consist of masses connected (in series or parallel) by elements with force characteristics which can be any function of time or of the relative or absolute displacements, velocities or accelerations of any of the masses (including the vehicle mass). Both programs accept sinusoidal, step, ramp or arbitrary function inputs to the suspensions and print out any or all of the following vehicle response parameters as a function of time: vertical and lateral displacement, velocity and acceleration of the vehicle center of mass; vehicle roll, pitch and yaw (and their first and second derivatives); suspension forces on the vehicle and on the guideway. (Author)

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039068
STRESS AND STRAIN IN ROLLING BODIES IN CONTACT

Paul, IL Nayak, PR

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

Nov. 1966, 43 pp

Contract C-85-65t

The three-dimensional solution of the stresses and strains in the contact region of a rolling wheel which carries normal, lateral and tangential loads is sought. Because of the complexity of the general problem a preliminary step has been to seek the solution for two spheres of similar material rolling on each other. The approach has been to divide the 'locked' region into a grid of n cells formed by fixed circular grid lines and variable grid lines which have a shape similar to an assumed shape for the boundary between the 'locked' and 'slipped' regions. The equations and boundary conditions were formulated and a computer program solves 2n simultaneous equations to find the stress distributions. If all boundary conditions are not satisfied by the solution the computer program shifts the grid points according to an error criterion and reiterates the solution. The results were encouraging although the final solution is not yet available. The results for the two spheres can be extended to the case of a wheel rolling on a surface of dissimilar material. This solution is of considerable importance for high speed rail travel because forward and sidewise creep (which are vital parameters in stability calculations) and rolling stresses (fatigue, etc.) can be calculated from the complete picture of stresses and strains in the region. (Author)

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039100
A NEW THEORY OF ROLLING CONTACT

Nayak, PR Paul, IL

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

Apr. 1968, 156 pp

Contract C-85-65t

The report proposes an entirely new theory of rolling contact. Surfaces are modeled as rough (although rough in this context applies even to ball bearing smooth surfaces which are rough on the micro-scale) and are described statistically. When two rough surfaces are pressed together, their peaks (known as asperities) press against each other and form junctions. Friction in the interface is caused by the shearing of these junctions. An important result of this model is that the relationship between the dimensionless friction force and the dimensionless lateral slip velocity depends on the surface roughness of the wheel and track. This surface roughness is described by a roughness (or smoothness) parameter. The influence of the roughness on the friction is postulated and described. Finally, experimental results are presented which support the conclusions that surface roughness is a relevant parameter in rolling contact and that the force-slip relationship is strongly dependent on surface roughness. (Author)

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039140
SOME PROBLEMS OF WHEEL/RAIL INTERACTION ASSOCIATED WITH HIGH-SPEED TRAINS

TRW Systems Group, Washington Operations, Washington, D.C.

06818-W318-R0-00, Mar. 1969, 57 pp

Contract C-353-66

The objective of the study is to identify and evaluate potential problems involving wheel-rail interaction which could limit the speed of a high speed rail (HSR) system. The study is based upon a survey of existing knowledge in the areas pertinent to wheel-rail interaction; no extensive analytical work is presented, but several approximate calculations are given. An attempt has been made to investigate possible wheel-rail speed limitations and to set aside some of the 'non-problems' which may at first appear to constitute a serious constraint upon rolling HSR concepts. The results and discussion are concentrated in four main areas; estimation of the dynamic loads; wheel behavior and structural integrity; rail dynamics and structural integrity; adhesion, hunting, and related problems. (Author)

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PB-183846

039207
DYNAMIC RAILCAR SIMULATION PROGRAM

Melpar, Incorporated, Falls Church, Virginia

293 pp

Contract DOT-C-111-66

A generalized digital simulation has been programmed in the basic FORTRAN language for calculating the motions and forces during operation of a multi-membered railcar. The railcar is driven at selected speeds along a pair of rails represented by recorded numerical measurements. All massive components of the railcar are treated as general mechanical members with six degrees of freedom, coupled to each other by an arbitrary set of linear elements or a programmed set of nonlinear functions having given spring rates, damping constants, etc. The model includes simulation of truck hunting phenomena with cylindrical or taped wheel treads and simulation of the compliance properties of the rail roadbed. (FRA abstract)

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039210
FRICTION AND CREEP IN ROLLING CONTACT

Nayak, PR Hariharan, S Stern, R Abilock, R March, PA

Bolt, Beranek and Newman, Incorporated, Cambridge, Massachusetts

Nov. 1970, 273pp

Experimental and analytical studies of friction and creep in rolling contact are reported. Factors examined for their influence on friction (adhesion) and creep are surface roughness, surface vibration, surface contamination, dynamic loading due to irregular track, and rolling velocity. The following conclusions are reached: surface roughness does not influence the creep coefficients at operating loads. However, surface roughness influences the tractive capacity when the wheel and rail surfaces are either very clean or flooded with a contaminant, surface vibrations affect wheel-rail friction considerably, surface contamination decreases both friction and creep coefficients. The magnitude of the change in these coefficients depends on the oil viscosity temperature and pressure coefficients, the normal load on the wheel and the surface roughness, dynamic loads due to suspension resonances do not appear to influence the friction or creep coefficients significantly, observed decreases in the friction coefficient at increased rolling velocities are probably due to increased surface vibrations, decreased time for the formation of friction junctions, and elastohydrodynamic effects. (OHGTR abstract)

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039250
RAIL VEHICLE DYNAMIC STUDIES

Sewall, JL Parrish, RV Durling, BJ

National Aeronautics and Space Administration, Langley Research Center, Langley Station, Virginia

Oct. 1969, 21p

Presented at the Shock and Vibration Symposium (40th), Hampton, Virginia. 21-23 October 1969.

The paper deals with the application of simplified dynamic models to the problem of a ride comfort in tracked vehicles for high-speed passenger travel. The studies reported are aimed at the adequate simulation of significant degrees of freedom in a railroad car in order that optimum stiffness and damping characteristics of the car and its truck suspension may be found for improved ride quality. The mathematical model used for this purpose are a four-degree-of-freedom vertical model and a 10-degree-of-freedom lateral model. The vertical model is subject to vertical inputs applied simultaneously to both trucks, and the lateral model is subject to lateral and/or rocking (or cross-level) displacements from the rails. Responses to these inputs, which may be deterministic or random, are obtained in acceleration units for various parts of the system. More emphasis is given to the lateral than to the vertical model and also to responses in the car than in other parts of the system. Nonlinear spring characteristics are simulated in two parts of the lateral truck suspension system. Interaction of railbed flexibility is not included. Results of this study show that car bending flexibility and the stiffness and damping characteristics of vertical and lateral transformer mountings play significant roles in the search for optimum stiffness and damping properties of the model. Optimum damping coefficients for the car bolsters due to sinusoidal inputs were significantly changed for certain nonsinusoidal deterministic and random inputs. (Author)

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039251
UNDER RANDOM AND SINUOSOIDAL INPUTS

Mixson, JS Steiner, R

National Aeronatuics and Space Administration, Langley Research Center, Langley Station, Virginia

Nov. 1969, 40p

Presented at the ASME Annual Meeting - Symposium on Random Processes in Dynamical Problems, Los Angeles, Calif. 16-21 November 1969.

The investigation was concerned with techniques for determining values of damping and spring constants that would minimize the vibrations transmitted from irregular railroad track to passenger positions. Results developed for a three-degree-of-freedom model using a simplified representation of measured track roughness illustrate the influence on the minimizing values of the type of input used, the minimization criteria adopted, and the position at which vibrations were minimized. The results were sensitive to variations of the spectrum of the input, suggesting the importance of measuring actual track irregularities and of using the measured data in optimization studies. Different results were obtained when the rms acceleration was minimized than when peak value of spectral density was minimized, suggesting that the effects on passenger comfort of overall acceleration level be compared with the effect of vibrations that are concentrated near a single frequency. Results obtained by varying the suspension stiffness of a heavy electrical transformer suspended beneath the center of the particular type of railroad car suggest that such heavy components can be tuned to improve the vibration transmission characteristics of the system. (Author)

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039415
TRANSMISSION OF VIBRATIONS BY SUSPENSION ELEMENTS AND CONNECTION COMPONENTS WITH THE VEHICLE BODY

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

No. 28, ORE Pub-28, Jan. 1969, pp 29-30, 1 Fig

Question B96.

The problem is discussed of passenger car body vibrations, which are mainly caused by forces transmitted by tracks. These result mainly from track irregularities and flat or out-of-balance wheels. When out-of-balance exists, the horizontal connecting member between car body and the track has a harmful effect, plus differences in wheel diameters cause in and out of phase vibrations. Vibrations on the test bench may be different from that of the track which has not been explained.

039417
INVESTIGATION OF BOXCAR VIBRATIONS

Luebke, RW, Chesapeake and Ohio Railway

Federal Railroad Administration, 400 7th Street, SW, Washington, D.C., 20591

FRA-RT-70-26, Test Rpt, Aug. 1970, 175 pp, 140 Fig, 2 Tab, 19 Phot, 19 Ref

The vibration environment within a 50 foot-70 ton boxcar and its running gear was measured by accelerometers and recorded on magnetic tape. The program included evaluations of load, speed, track irregularities, flat wheels, friction damping, variable rate springs, spring travel, and truck design, on the vibration environment within the car body. It was concluded that an increase in load and spring travel reduced the vibration levels in the car body. All new truck designs tested produced reductions in the car body vibration levels. Friction damping levels presently used in freight car trucks were found to be nearly optimum. Flat wheels produced a tremendous increase in truck vibrations and a smaller increase in car body vibrations.

039419
VARIABLES IN TRAIN RESISTANCE

Keller, WM, Association of American Railroads

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

58-A-265, Paper, Oct. 1958, 17 pp, 13 Fig, 9 Tab, 3 Phot, 18 Ref

Prepared for presentation at the Annual Meeting, New York, New York, November 30-December 5, 1958, of the American Society of Mechanical Engineers.

A study has been made of train resistance and the variables necessary to determine the power to move railroad cars. Factors that influence train resistance are summarized as the journal-bearing friction, track resistance to rolling, wind resistance, curve and grade resistances, acceleration resistance, and starting resistance. Each is examined for its contribution to total train resistance. Explanations of the various resistances are given in the light of bearing performance considerations and of the developments that have occurred in roadbed, track, and motive power during the years.

039421
LONGITUDINAL-SHOCK PROBLEMS IN FREIGHT-TRAIN OPERATION

Scales, BT, Bethlehem Steel Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

64-WA/RR-4, Paper, Oct. 1964, 15 pp, 10 Fig, 3 Tab, 5 Ref

Prepared for presentation at the Winter Annual Meeting, New

York, New York, November 29-December 4, 1964, of the American Society of Mechanical Engineers.

Violent shock during train "run-in" and "run-out" is a familiar problem of freight train operation. Draft gear characteristics necessary for smooth train running are shown theoretically, the influence of car geometry being included. Instrumented run-in and run-out tests with a short train followed by running tests with 70 car trains confirmed the theory and showed that shock-free freight trains are possible. The application to current practice is discussed.

039443
STUDIES TO ELIMINATE HARMONIC ROLL OF HEAVY CARS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-440, Prog Rpt, Apr. 1965, 2 pp

The problem of heavily loaded hopper cars rocking and lifting wheels has been associated with the cross level conditions. With alternate rail joints, a forcing frequency is applied to trucks of cars which causes energy to build up in the body of the cars by rocking. To eliminate this conditions, studies indicate that lower spring rates, extending center of the spring nest and by applying swivel center plates and preloaded laminated side bearings, that the condition can be attenuated but not fully eliminated. Improvement has been obtained by permitting more lateral distance between the side frame and the bolster, in the bearing system, and by reducing the distance between the centers of the side bearings. Truck arrangements are being developed which will permit the truck to follow the irregularities of track and prevent the introduction of the forcing frequency into the body of the car at such a phasing as to cause harmonics in the car rolling. Snubbing and energy absorption are being studied from a theoretical standpoint and practical applications of snubbers have been made which help to reduce the incidence of wheel lift when the snubbers are applied in combination with other changes.

039452
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 541953, pp 1186-93, 6 Fig, 2 Tab

A summary is tabulated of the number and types of rail failure, while a detailed account of each type of failure is given. Sources, rail size, mill, date of manufacture as well as failure class are also included.

039474
MECHANICS OF WHEEL AND RAIL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, Mar. 1950, pp 247,253, 1 Fig

Tire-profiling tests undertaken in New South Wales to reduce oscillation resulted in an increase in the severity of the oscillations, which was directly traceable, not to the contact of the flange root with the edge of the rail, but of the steeply inclined portion of the tread adjoining the flange root. This is a well-known characteristic of all worn or hollow tire profiles. The objective of the tests was to defer the formation of the objectionable tread ramp near the flange in a worn tire. The design specifically allowed that there should always be a portion of the root radius still available to contact the edge radius of the rail. Diagrams representative of each of the tire contours and conditions of service are reproduced. In these diagrams, there will be noted a step developed after service at the junction of the flange root and the recess due to flange wear.

039481
THE MOVEMENTS OF RAILWAY VEHICLES ON THE TRACK AND THE FORCE ARISING THEREFROM

Liechty, MR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Nov. 1945, pp 564-565

A critical analysis is given of the interaction of flanges and rails, together with a resume of the scientific principles involved. The friction arising between wheel and rail is fundamental for all railway transport. The frictional force R is equal to or less than the product of the frictional factor f and the wheel load Q, which are the variable quantities. As the direction of force R coincides with the resulting sliding motor between wheel and rail, its action is opposed to the direction of motion. Force R determines not only rolling resistance, but also that due to curves, guiding pressure, security against derailment, maximum tractive and braking power, axle strain, wear of rail and flange, and—last but not least—freedom from hunting. Methods to determine the precise position and value of R are discussed.

039565
MEASUREMENT OF TRAIN RESISTANCE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Feb. 1954, p 173

The highlights of a paper dealing with train resistance are cited. Principally historical, the paper points out that the use of the mobile testing units and a statistical method of analysis adopted, has enabled the running resistance, including wind resistance of carriage and wagon stock, to be determined with a convenience and accuracy not hitherto possible.

039640
TRAINING OF DIESEL LOCOMOTIVE DRIVERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, May 1955, p 560

With a diesel locomotive, especially where electrical transmission is involved, fault diagnosis and prevention and cure of the smallest irregularity necessarily involve a more profound knowledge than that usually acquired by the average steam locomotive driver in the course of his career. Any satisfactory scheme for training drivers of diesel locomotives, whether diesel-mechanical or diesel-electric, should embrace training by instructors who themselves have received thorough training in mechanical engineering, including specific training in the various aspects of diesel traction. Training should take place on premises properly equipped with sectioned assemblies and diagrams.

039978
MEASUREMENT OF LOCAL STRESS ON OUTER RAIL HEAD

Sugiyama, T Yamazani, T Umeda, S

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 12, No. 1, Mar. 1971, pp 11-13, 5 Fig

This paper outlines the behaviour of the local stress on the outer rail head. This stress was measured in the laboratory and on the track. As a result, it was made clear that this stress produced by the lateral pressure of the wheel load is a tensile one. The value of this stress on the track is not so great.

039982
MEASUREMENT OF LATERAL STRENGTH OF RAILWAY TRACK BY "LATERAL STRENGTH TESTING CAR" (1ST REPORT) MECHANISM OF TESTING CAR

Tanahashi, H

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 2, June 1963, pp 46-48, 4 Fig

The "Lateral Strength Testing Car" represents a two-axle bogie car additionally attached with a one-axle testing truck which carries a mechanism, which applies a vertical and a lateral load to the center axle, a mechanism which lifts the said testing truck above the rails and an oscillograph for recording the vertical and lateral loads. The car answers the questions: How much lateral load can the track withstand? and under what conditions and in what process a derailment of a car takes place? Procedures for measuring these quantities are provided.

039989
RAILWAY CAR CURVE NEGOTIATION STANDARD METHOD OF CALCULATION

Standard Coupler Manufacturers

Circular No. 2163-A, Dec. 1963, 12 pp, 6 Fig, 3 Tab

This method may be used to determine the minimum horizontal or vertical curve and tangent any two coupled cars can negotiate. Tables are included giving dimensions pertinent to the standard coupler applications when draft gears are in normal position. The formulas presented are simplified empirical equations resulting from studies of exact methods and actual car service data.

039990
INVESTIGATION TO DETERMINE THE CAUSE OF "SUDDEN" WIDE GAGE ON THE DELAWARE AND HUDSON RAILROAD

Sckinke, R Akalin, MT

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 606

Test Rpt, Oct. 1966, 44 pp, 21 Fig, 9 Tab

The purpose of this investigation was to determine the cause of this "sudden" gage widening. It would appear that this gage widening would most probably be caused by a jackknifing condition. This investigation measured the jackknifing forces developed under heavy pushing. The first part of the investigation was made on a 3 deg curve. A special test train was used consisting of a number of diesel units in dynamic braking and 15 loaded hopper cars, including one 100 ton car, to provide the pushing resistance at one end, an 89 ft. TTX flat car and short hopper in the middle and the pushing diesel units under test at the other end. Four special ties and eight roller bearing tie plates were installed near the middle of the 3 deg curve to measure and record the lateral forces exerted by the equipment on both inner and outer rails. Strain gages were placed on the rail webs to measure the vertical wheel loads. The lateral displacement between the first and second diesel units and the total locomoitve drawbar force were also measured. The investigation did not result in finding any clear cut and specific answer as to the cause of the occurrences of "sudden" wide gage. However, it appears most likely that the occurrences were due to lateral forces exerted against the outer rail as a result of locomotive jackknifing under dynamic braking.

039991
LATERAL FORCES ON TRACK AND EQUIPMENT DUE TO DYNAMIC BRAKING ON THE SOUTHERN PACIFIC LINES

Schinke Aggarwal

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

ER-69, Oct. 1966, 30 pp, 9 Fig, 4 Tab, 3 Ref

This report embraces a description and analysis of data secured during the operation of regular scheduled freight trains on the Southern Pacific Company between Roseville, California and Sparks, Nevada. The purpose of the investigation was to determine the coupler forces and resulting lateral forces exerted on the rails by the passage of an 85 ft. car coupled to a short car in a train with the locomotive using dynamic braking while operating on steep grades and curves up to 10 deg. During the investigation, data were secured on coupler and car angles, lateral and vertical truck forces and longitudinal acceleration of the 85 ft. car with the train operating at various speeds. The analysis of data contained in this report may be summarized as follows: 1. The steady or longitudinal coupler forces for both pull and push conditions, as expected, are in proportion to the weight of that portion of the train behind the point of measurement. The compressive coupler forces were reduced considerably when the train air line pressure was reduced with the locomotive under dynamic braking on the descending grades. 2. The coupler angles are in direct proportion to the track curvature with the values obtained under the pulling condition slightly greater than those under the pushing condition. 3. The data indicate there is a linear relationship between the track curvature or coupler angle and the lateral truck forces acting on the rail. 4. The occurrence of slack action was rather infrequent due to the long and almost continuous grades for but some coupler forces as large as 90,000 lb were obtained by an application of the dynamic brakes which permitted the slack to run-in. 5. The sprung weight of the 85 ft. car was subjected to longitudinal accelerations as large as 2.2 g but there does not appear to be any direct relationship between the direction and magnitude of this acceleration with respect to the direction and magnitude of the slack action coupler force.

039997
REPORT ON THE CHARACTERISTICS OF STEELS AT LOW TEMPERATURES–COUPLER INVESTIGATION

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-M-190, Tech Rpt, Nov. 1945, 4 pp, 2 Fig

The report discusses problems in finding a basis for coupler failures between geographic areas. The parameter for comparison was the number of failures per freight car miles travelled. Conclusions are that more couplers fail during cold than hot months. The critical temperature for failure occurs a few degrees below freezing.

040040
CHICAGO, BURLINGTON AND QUINCY RAILROAD–RAIL STRESS

McGee, GM

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

T2252, Sept. 1951, 6 pp, 1 Fig, 1 Tab, 1 App

A test was conducted by Electro-Motive Division, G.M.C., to measure stresses in 60–and 72-lb. rerolled rails on branch track. AAR believes that the maximum computed rail stress including impact or speed effect should be limited to 35,000 psi, for speeds of 35 mph. and less. Over 35 mph, the stress should be limited to 30,000

psi. For 72-lb. rail, the EMD diesel, had a computed rail stress of 35,-000 psi, at 4 mph, so it would not seem advisable to operate this locomotive at more than 10 mph. For C, and N. W. diesel the maximum speed of 35 mph, is the limiting speed for the allowable stress of 35,000 psi. The 35 mph limit is also applicable to loaded coal car. The EMD diesel should not be operated on 60-lb rail. The C and N. W. diesel had a computed rail stress of 35,000 psi at 34 mph. The loaded coal car reached this stress at 19.5 mph, on 60-lb rail.

040042
THE RELATION BETWEEN THE SWAYING OF HOPPER CARS AND THE STAGGER OF RAIL JOINTS IN TRACK

Leffler, BR

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 27, Proceeding1926, pp 1243-51, 2 Fig

The sway of a loaded hopper car is studied mathematically to determine the proper stagger of rail joints to avoid cumulative swaying or increase of the amplitude of swaying. The following principle was derived: the stagger of rail joints must be such that a car must hit, simultaneously, a pair of joints, the joints being in opposite lines of rails. For the application of this principle in its entirety the following characteristics of track and cars must be present: the rail length must be twice the distance center to center of trucks; the joints must be staggered midway; the joints must be equally low; and the distance center to center of trucks must be the same for all cars.

040065
LATERAL FORCES ACTING ON THE TRACK DUE TO NOSING OF CARS

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryaskaya, Moscow 174, USSR)

No.8, 1964

6 pp, 1 Tab, 1 Ref

Depending on the type of motion, equations for determination of lateral forces produced by motion of cars on tangent track can be divided into two main groups: (a) without contact of flange and rail, (b) with contact of flange and rail. it is pointed out that Verigo's equation for calculating lateral forces accounts for such factors as angle of impact, condition of track and suspension component and equivalent mass and overall elasticity much more realistically than previously developed solutions.

040072
DYNAMIC CHARACTERISTICS OF RAIL FOUNDATION

No.7, 6 pp, 1 Fig, 3 Tab, 1 Phot 1, Ref

This unpublished material is based on a Russian article appearing in Railroad Transport Issue 7, 1964, page 16.

An experiment was conducted on track with P-65 rail, with 1840 ties per kilometer, with both wood and concrete ties, and stone ballast to evaluate the dynamic characteristics, particularily elasticity of the rail K1, coefficient of elastic friction of ballast L1, and equivalent mass of the track M1. It has been proposed that the tie reaction consists of an elastic component proportional to the rail displacement and a nonelastic component proportional to the velocity of vertical rail movement, inertia of the tie and adjacent layers of ballast and underlying soil. Linear differential equation were derived to permit theoretical analysis. The equations thus obtained are grouped to give proper number of simultaneous equations and solved as such. The results for various groups give different values of the coefficients and again their averages and maximums are given.

040078
DYNAMIC LOADING AT RAIL JOINTS–EFFECT OF RESILIENT WHEELS

Bjork, J, Svenska Aktiebolaget Bromsregulator

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, June 1970, pp 430-434, 9 Fig, 1 Tab, 7 Ref

This study of a simplified vehicle model passing over an idealised dipped rail joint using values applying to a BR Class 86 locomotive shows that resilient wheels give an equivalent reduction in unsprung axle mass of 2,500 kg. The following conclusions were made: The suggested model for a broadened analysis of the vertical response of vehicle and track at a dipped rail joint is workable and produces dynamic wheel load values which are in full agreement with observed data. Fitting a Class 86 locomotive with resilient wheels will have the effect of reducing the dynamic wheel load increment at severe dipped rail joints by some 40 percent. The effect of resilient wheels on a Class 86 locomotive–based on the dynamic loading at rail joints–is equivalent to a reduction of the unsprung mass from 4,200 kg to 1,700 kg on the leading axle. Thus the results of the analysis suggest that a power-unit comprising axle-hung motors and resilient wheels is a highly competitive alternative to conventional, mechanically complicated and expensive arrangements used to obtain fully-suspended traction motors.

040093
SIDE THRUST ON TRACK AT HIGH SPEEDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, July 1965, pp 529-530, 3 Fig

Measurement of lateral forces on wheels and track for high speed running on the Tokaido line were carried out in two different ways; by measuring and recording the stresses in the wheels of an inspection test car, and by measurements on the track. These measurements were made for speeds up to 150 mile/h.

040096
PROPULSION OF TRAINS ON SHARP CURVES

Pocklington, AR, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Nov. 1965, pp 909-912, 7 Fig, 1 Phot, 2 Ref

A model to simulate the forces resulting in overturning and flange-climbing with propelled trains on sharp curves led to a series of tests arranged on a sharp curve at Dover. An axlebox lateral-force gear was used to measure the elements of the flange force present at the axleboxes, and load measuring baseplates were fixed between the outer rail and the sleepers to measure the vertical loads imposed by the wheels as well as the lateral loads. The latter are equal to the flang forces, less the lateral tread friction at the outer rail. The results of these tests showed that the increased lateral force when propelling exceeded considerably the value attributable to the propulsive effort and the angle between the coaches.

040097
VEHICLE RIDING CONVENTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Nov. 1965, pp 913-916, 3 Fig, 1 Tab, 1 Phot

The convention on interaction between vehicle and track convened by the Railway Engineering Group of the Institution of Mechanical Engineers consisted of four sessions at which 10 papers were read: "An Appreciation of the Practical Problems—a Survey of the Problems and their Importance," "Some Observations on Linear Theory of Railway Vehicle Instability," "The Dynamics of Railway Vehicles on Straight Track: Fundamental Considerations on Lateral Stability," "Dynamics of Railway Vehicles on Curved Track," "Hunting Problem of High-Speed Railway Vehicles with Special Reference to Bogie Design for the new Tokaido Line," "Track Parameters Static and Dynamic," "The Influence of Track Twist on Vehicle Design," "The Static and Dynamic Parameters of Railway Coaches."

040098
EFFECTS OF LATERAL FORCES WHEN PROPELLING ROUND SHARP CURVES

Pocklington, AR, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Dec. 1965, pp 942-945, Fig 5, 3 Phot

Tests were undertaken to investigate the effects of lateral forces arising from the propulsive effort in a train. The train make-up was 12 coaches of multiple-unit stock (weight 450 tons) with the tractive force provided by two electro-diesel locomotives used as electric locomotives. The purpose was to determine whether the speed restrictions on certain turnouts would have to be reduced for propelled trains, bearing in mind that turnout curves are not normally fitted with check rails and that the curved track in single and double slips cannot be fitted with check rails. The coach adjacent to the locomotives was instrumented to record distance moved, speed, axlebox lateral forces, bolster lateral displacement, and tractive effort at the auto-coupler. Load measuring baseplates were placed under the outer rail of the curve at six adjacent sleepers to record lateral forces and vertical loads.

040099
HIGH LATERAL FORCES ON SHARP CURVES WITH PROPELLED TRAINS

Pocklington, AR, British Railways Board
Brown, TP, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Dec. 1965, pp 993-996, 4 Fig, 2 Phot

In an effort to explain why the outward forces on the trucks of propelled trains are greater than can be explained by the angle present between center lines of the vehicles, British Railways conducted a test on curved track to determine vertical loads and lateral forces. Six special baseplates were installed on adjacent sleepers on the test curve to record vertical loads and lateral forces between rail and sleeper. It was found that lateral forces towards the outer rail when propelled are considerably greater than when hauled. A more severe speed restriction on a particular curve is of little assistance because speed, and hence centrifugal force, is low anyway. The increase of lateral force towards the outer rail when the train is propelled is accompanied, at the leading outer wheel of a bogie, by increased vertical load so that the possibility of flange-climbing derailment is not altered appreciably. Propulsion on a sharp curve produces an overturning movement on the train. For severe locations its magnitude should be restricted by a limitation on tractive effort.

040105
TRACTIVE RESISTANCE OF ROLLING-STOCK

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Nov. 1964, pp 899-902, 5 Fig, 2 Phot, 13 Ref

An examination of the resistance of modern British Railways vehicles is made. This study is subdivided into resistances caused by track irregularities, bearing friction, wheel rolling resistance, total rolling resistance, rail joint resistance, parasitic motion resistance, sinusoidal motion, wheel contact, flange to rail clearance, suspension oscillation resistance, and damping characteristics. Dynamometer readings were taken from field tests.

040107
MEASUREMENT OF DYNAMIC FORCES ON TRACK

Brown, TP, British Railways Board
Loach, JB, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Nov. 1964, pp 938-940, 5 Fig, 1 Phot, 7 Ref

A baseplate for measuring vertical loads and lateral forces between rails and sleepers is described. The baseplates have been designed to withstand combined loads of 15 tons applied vertically and 10 tons applied laterally, loads which are in excess of values likely in practice. The general mechanical arrangement of the baseplate is shown. If the baseplates are installed on consecutive sleepers it is possible, by adding the signals from individual baseplates at specified instants in time, to determine the total vertical load and lateral force exerted by a wheel on a rail as the wheel passes over the baseplates. Because, the above forces are generally distributed over about three sleepers, a true picture is obtained as the wheel passes over the four center sleepers in the groups of six baseplates installed to date.

040108
TRACTIVE RESISTANCE OF MODERN B.R. ROLLING-STOCK

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Dec. 1964, pp 1028-10, 31

The effects of curved track, air resistance, transmission, torque distribution, car design, and welded track on tractive resistance are studied. The tractive resistance for diesel-electric and diesel-hydraulic locomotives is shown. From the data presented, it is concluded that designers must be concerned with the finer points of vehicle and track interaction in terms of static and dynamic track parameters, tire and rail design, flange to rail clearance and the matching of vehicle design features with the suspension and damping characteristics to reduce tractive resistance.

040116
RUNNING THROUGH CURVES

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Apr. 1967, pp 307-311, 7 Fig, 1 Tab, 27 Ref

Simple methods for the determination of forces and wear are discussed. Flange forces are determined by constructing a Heumann Minimum Diagram of the friction moment curve. A Vogel diagram is plotted to show the center line of the vehicle in a curve. The center of friction is located mathematically in the Vogel diagram. Axlebox clearance values are determined from the diagrams and corresponding force diagrams are plotted.

040117
PRACTICAL RESEARCH INTO VEHICLE DYNAMICS

Wickens, AH, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, June 1967, pp 467-469, 4 Phot, 15 Ref

Stability theory is evaluated by running an experimental car, HSFV-1, on a roller rig and on the track. The underframe and drawgear is standard, and the suspension is designed for an unladen weight of 10 tons and a laden weight of 35 tons. The wheel profiles conform to the RD6 profile. The first tests consisted of vertical and lateral damper tests; vertical and longitudinal spring stiffness tests; accurate turning and measurement of wheel and roller rig profiles; measurement of masses, moments of inertia and centres of mass; and, re-assembly of vehicle, checking and correction of dimensions. The next step was to measure the natural modes and frequencies of the vehicle, again with wheels fixed, in the frequency range 0 to 10 c/s. The longitudinal springs were modified for stability tests. The vehicle was completely stable up to a speed of about 100 mile/h, where wheelset instability occured. The purpose of initial track tests was to confirm that the lateral stability of the vehicle on the track was satisfactory and consistent with the roller rig tests, and to measure the response of the vehicle to track irregularities. The results and techniques established by the work on HSFV-1 are applicable to all railway vehicles.

040118
THE TORSIONALLY STIFF BOGIE WAGON

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Aug. 1967, pp 629-632, 4 Fig, 2 Phot, 6 Ref

Torsional stiffness is an important factor bearing on the ability of vehicles to run over twisted track. Results of British Railways tests of tank cars with tare of 26 to 28 tons and 41.75 ft. truck centers are described. Track twist varied from 1 in 400 to 1 in 150. The design limitations for wheel load is calculated. Suspension changes to eliminated derailment tendencies are discussed.

040121
THE ALLOWABLE LIMIT OF LATERAL PRESSURE ON RAILWAY TRACK

Satoh, Y Ohtsuki, T

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4 N3, Sept. 1963, pp 42-46, 4 Fig, 2 Tab

Three kinds of tests were made. The first test measured the strength of dog-spikes for sleepers sampled on the test sections, the second one measured the pressure on some dog-spikes under lateral pressure and wheel load upon rail exerted by a lateral pressure test car, and the third one measured the shift of dog-spikes on all sleepers of test sections after a loading run of the lateral pressure test car. The lateral pressure test car was a freight car with two axle bogie, which had a special axle below its center which can exert both lateral pressure and wheel load of variable amount by means of compressed air. Test results showed that considering the distribution of the lateral pressure caused by rolling stock and that of the strength of dog-spike, the limit of lateral force was established so that the pressure of 1% of dog-spikes may amount to their proportionality limit.

040123
THE DYNAMIC STABILITY OF RAILWAY VEHICLE WHEELSETS AND BOGIES HAVING PROFILED WHEELS

Wickens, AH, British Railways Board

International Journal of Solids and Structures (Pergamon Press Incorporated, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 11965, pp 319-341, 8 Fig, 25 Ref

The dynamic instability of railway vehicle bogies and wheelsets is caused by the combined action of the conicity of the wheels and the creep forces acting between the wheels and rails. The instability is investigated in the important case where the wheels are profiled rather than purely conical. Equations of motion are formulated and stability criteria obtained which indicate the effect of varying the various parameters of the system. The nature of the motion at the critical speed is investigated and the mode of energy conversion between the forward motion of the vehicle and the lateral motion of the bogie or wheelset is explained.

040124
THE DYNAMICS OF RAILWAY VEHICLES ON STRAIGHT TRACK: FUNDAMENTAL CONSIDERATIONS OF LATERAL STABILITY

Wickens, AH, British Railways Board

Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England

Vol. 180, Proceeding, pp 29-44, 10 Fig, 3 Tab, 4 Phot, 27 Ref

Proceedings from the Institution of Mechanical Engineers

Existing and recently developed theories of the lateral motion of railway vehicles are discussed in relation to experimental work on both models and full-scale vehicles. It is shown that a realistic theory taking into account flexibility between the wheelsets and the frame in the longitudinal, lateral, and vertical directions, and the influence of wheel and rail profiles, yield values for the critical speeds which are consistent with experimental results. The influence of various parameters on stability is discussed and it is explained how railway vehicles can be designed for stable running at high speeds. Examples of suitable choices of suspension and other parameters are given and experiments carried out in order to verify these concepts are described.

040152
STUDIES TO ELIMINATE HARMONIC ROLL OF HEAVY CARS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-440, Prog Rpt, Apr. 1965, 23 pp, 6 Fig

The problem of heavily loaded high center of gravity cars rocking and lifting wheels has been associated with the cross level conditions which may exist in track. With alternate rail joints, a forcing frequency is applied to trucks of cars which causes energy to build up in the body of the cars by rocking. Means have been studied to eliminate this condition and these studies indicate that lower spring rates, extending center of the spring nest and by applying swivel center plates and preloaded laminated side bearings, that the condition can be attenuated but not fully eliminated. Some improvement has been obtained by permitting more lateral between the side frame and the bolster, in the bearing system, and by reducing the distance between the centers of the side bearings.

040171
PERMISSIBLE SPEED OF FREIGHT CARS ON CURVES

American Railway Engineering Association, 59 East Van Buren

Street, Chicago, Illinois, 60605

Vol. 701969, pp 1019-10, 29

In Part I, the dynamic effects due to lateral roll motion of a freight car are analyzed and the position of the resultant dynamic force with respect to center line of track for cars having 71, 85 and 99 inches combined center of gravity heights is calculated. These calculations use data on the amplitudes of the lateral roll motion of a fully loaded 70-ton 55-ft gondola which were measures during an extensive series of running tests on the Lackawanna Railroad in 1955. In Part II, calculations, based on extensive tests with freight cars having center-of-gravity heights of 71, 85 and 99 in with 3 11/16 in travel springs and conventional snubbing, were used to establish the elevation for curves and maximum permissible speeds for the operation of freight trains.

040191
ANALYSIS FO DD-35 LOCOMOTIVE & TRUCK IN OPERATION ON NEW YORK CENTRAL R.R. TRIBES HILL 2 DEGREE 58' CURVE

Koci, LF

General Motors Corporation, Electro-Motive Division, Chicago, Illinois

118, July 1964, 111 pp, 32 Fig, 1 Tab, 11 Phot, 43 Ref, 4 App

This report is a study of the conditions associated with operating the DD-35 locomotive over the 2 degree, 58 minute curve involved in the derailment at Tribes Hill on February 21, 1964. The expected lateral loading considered likely to occur on the Tribes Hill curve under the most extreme conditions would give net lateral wheel load of 15.900 pounds with instantaneous peaks to approximately 25,000 pounds. This extreme value of 15.900 pounds represents only 37 per cent of the associated vertical wheel load. Analysis and test results accumulated from numerous tests, including curve negotiation of many different locomotive models and measurements of wheel stresses, axle stresses, and lateral loads, indicate: the instantaneous peak values acting over and above the base loads are not significant in rail turnover, and, lateral loadings representing 90–100 per cent of vertical load can be applied to the rail at a single wheel location without any indication of rail turnover or wheel climbing.

040196
VEHICLE DYNAMICS AND WHEEL-RAIL INTERFACE PROBLEMS

Wickens, AH, British Railways Board

This paper reviews problems of wheel-rail contact in terms of present knowledge of the conventional steel-on-steel system and on possibilities for research and innovation arising out of extensions to this present knowledge. Specific directions for research suggested are: experimental work on wheel-rail contact forces, followed by refinements of theory to include effects such as surface chemistry, surface roughness and unsteady motion; studies of new structural forms for wheels and rails which might yield a superior overall system design; investigation of the wear-vehicle dynamics feedback process for steel wheels on steel rails, particularly where there are radical changes in vehicle suspension design; and studies of various wheel-track kinematic and guidance systems to provide basic information for overall system design.

040198
THE RIDING OF RAILWAY VEHICLES

Wickens, AH, British Railways Board

Society of Environmental Engineers, 68a Wigmore Street, London W1, England

Proceeding1963, pp 39-44, 13 Fig, 5 Ref

Some of the basic facts are outlined for the definition and control of vibration and shock in railway vehicles and their loads. The action of conic wheelsets and the kinematic motion of wheelsets are clearly illustrated and describe the hunting principle. A laterally restrained wheelset connected to a high inertia vehicle body by perfectly elastic lateral springs is described and the stability criterion is shown. These theories are then applied to the analysis of railway vehicle stability and response.

040217
WHEEL, AXLE, AND RAIL STRESS PROBLEMS RELATED TO HIGHER CAPACITY CARS–PART IV-EFFECT ON RAIL

Stampfle, RB

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Paper, Nov. 1963, 13 pp, 1 Tab

Those items that have been found advantageous in reducing shelling caused by higher capacity (85 to 100-ton) cars are wheel loads should be limited in proportion to wheel diameter. Higher strength material in the rail will greatly reduce shelling but not entirely eliminate it (under the wheel loading conditions existing with 70-ton capacity cars before the allowable load was increased 5%). Modified rail head contours in today's modern rail sections which approach the average worn wheel condition, have been helpful in reducing shelling. Rail lubrication on curves extends the rail life but results in the removal of more rails for shelling rather than abrasive wear.

040312
DIGITAL COMPUTER SIMULATION OF RAILROAD FREIGHT CAR ROCKING

Liepins, AA, Dynatech Corporation

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 701-707, 12 Fig, 1 App

A mathematical model for the simulation of railroad freight car rocking is presented. The equations of the model are developed into a digital computer program. The model response is validated by two series of test results, and the model is considered reliable for engineering predictions. The test car is a 100-ton loaded hopper on two American Steel Foundries Ride Control trucks. Experimental results for this car were obtained in a series of tests near Hollidaysburg, Pennsylvania. The experimental data include continuous traces of car body rock angle and vertical and lateral dynamic rail profiles for the test section of the track. Wheel lift was computed at car speeds of 15.0 and 16.5 mph. Rail profile measurements indicate wheel lift at 16.5 and 18.5 mph. For additional verification of the model, rocking of the test car equipped with a stabilizing device under development by American Steel Foundries was calculated. For this series of simulations the available rail profiles were incomplete.

040344
ROLL ACTION OF HOPPER CARS INDUCED BY STAGGERED RAIL JOINTS

Magee, GM

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

Test Rpt, Jan. 1968, 20 pp, 19 Phot

Loaded hopper cars were tested on a test track at elevations of 3 and 6 inches and low joints from .25 to .75 inches. The suspension system was varied to determine the effect on car rocking. Some tentative conclusions drawn from the tests are as follows: if joints are not more than 1/2 in. low in the loaded condition, wheel lift and derailment are not likely to occur; derailment is less likely to occur with 3 inches elevation than with 6 inches elevation; the use of 3 11/16 in. travel springs, widened gibs and supplemental snubbers, substantially reduces the likelihood of wheel derailment from roll action; and the hydraulic snubbers between the underside of the car body and the spring seat on the truck frame were effective in eliminating car roll and flange climbing; and provision of 2000 lb. friction resistance between the underside of the car body and the spring seat on the truck frame was effective in reducing the roll amplitude but did not prevent derailment.

040345
MEASUREMENTS OF VERTICAL AND LATERAL FORCES ON BOTH RAILS OF A SIX-DEGREE REVERSE CURVE UNDER DIFFERENT TYPES OF SIX-AXLE AND FOUR-AXLE DIESEL LOCOMOTIVES

Magee, GM

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

Mar. 1967, 27 pp, 24 Fig

An investigation was conducted on a 6 deg. reversed curve with 150 ft. spirals and practically no tangent between them. The track was instrumented at two locations, one on each of the spirals near the juncture with the 6 deg. curve. Vertical and lateral wheel loads were measured for each passing wheel of the locomotives on both rails. Four classes of locomotive were included in the tests having six wheel trucks as well as locomotives having four wheel trucks. The lateral force exerted against the high rail increases with speed; is relatively low for the freight diesel locomotives with four axles and the passenger diesel locomotives with six axles; and is appreciably higher for the two types of freight locomotives with the trimount trucks.

040352
STUDIES TO ELIMINATE HARMONIC ROLL OF HEAVY CARS

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

AAR-MR-440, Prog Rpt, Apr. 1965, 23 pp, 6 Fig, 3 Tab

The purpose of this study was to observe controlled tests and fine solutions for harmonic roll in 100-ton hopper cars during low speed operation on staggered joint track which initiated wheel lift and subsequent derailment. These studies indicated that lower spring rates, extended center of the spring nests, applied swivel center plates, and preloaded laminated side bearings can be attenuated but not fully eliminated. Also, some improvement has veen obtained by permitting more lateral between the side frame and the bolster, in the bearing system, and by reducing the distance between the centers of the side bearings. Experimental truck arrangements are being developed which will permit the truck to follow the irregularities of track and which will prevent the introduction of the forcing frequency into the body of the car at such a phasing as to cause harmonics in the car rolling. Also, snubbing and energy absorption are being studied from a theoretical standpoint and practical applications of snubbers have been made which help to reduce the incidence of wheel lift when the snubbers are applied in combination with other changes.

040353
ANALOG-COMPUTER SIMULATIONS OF END IMPACT OF RAILWAY CARS

Roggeveen, RC, National Research Council of Canada

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

65-RR-3, Apr. 1965, 16 pp, 21 Fig, 3 Tab, 16 Ref, 1 App

Description is given of attempts to simulate, on an analog computer, the impact of two railway cars. It is found that considering each car as a single lumped mass gives results nowhere near those measured from physical tests. Considering each car to consist of two lamps, structure and lading—allows reasonably accurate results to be obtained, as shown by various comparisons of simulated and physical results. The complication involved in making better representations of railway cars is discussed in relation to the problems of simulating the overall motions of trains.

040375
A COMPUTER STUDY OF DYNAMIC LOADS CAUSED BY VEHICLE-TRACK INTERACTION

Meacham, HC, Battelle Memorial Institute
Ahlbeck, DR, Battelle Memorial Institute

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Aug. 1969, pp 808-816, 12 Fig, 3 Tab, 3 Phot, 11 Ref

Computer analyses of vehicle and track are producing enlightening results regarding actual dynamic loads and the manner in which various parameters of vehicle and track structure affect these loads. Using this information, it is possible to decide more intelligently how to alleviate the high wheel-rail stresses caused by today's unique traffic and track conditions. Possible solutions range from better track maintenance to different wheel rail geometries to changes in stiffness and damping of trucks and the track structure itself.

040378
DYNAMIC MEASUREMENT OF RAIL PROFILE AND RELATED LOCOMOTIVE TRUCK MOTIONS

Spangler, EB, General Motors Corporation
Marta, HA, General Motors Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-RR-1, Paper, May 1966, 9 pp, 12 Fig, 3 Phot, 18 Ref, 1 App

Contributed by the Railroad Division of the ASME for presentation at the 9th Joint ASME-IEEE Railroad Conference, San Francisco, California, May 4-6, 1966.

The profile of the railroad track on which a railway vehicle operates represents an input into the vehicle. This input is due to vertical and lateral rail irregularities and can cause dynamic loads that result in excessive damage or wear and tear on vehicle components and on the track itself. In order to study the dynamic operation of rail vehicles, it is necessary to know the profile of the track on which they operate. Since the unloaded profile of the rail can vary significantly from the loaded condition, it is the loaded-rail profile that must be known. This paper presents a method developed by the authors' company for the rapid measurement of the loaded-rail profile and includes some typical rail profiles and related truck motions resulting from these profiles. The instrumentation resulting from this work appears to have immediate application in day-to-day railroad operation and in high-speed rail transportation studies.

040381
THE RELATION BETWEEN THE SWAYING OF HOPPER CARS AND THE STAGGER OF RAIL JOINTS IN TRACK

Leffler, BR

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 271926, pp 1243-51, 2 Fig, 1 App

Freight cars with high-center-of-gravity loads sway considerably, especially on tracks with low joints. To produce synchronism, the time of swaying must have a definite relation to the speed of the train. A principle that maybe used to destroy cumulative swaying is that the stagger of rail joints must be such that a car must hit, simultaneously, a pair of joints, the joints being in opposite lines of rails. A second principle is that the stagger should be unequal in such a way that enough joints occur at suitable phases of swaying to neutralize the effects of the other joints. Frictional resistance helps in this principle. The amplitude of swaying may be increased by a series of low joints, provided that the swaying of cars synchronizes with the impulses given by the joints.

040382
LATERAL OSCILLATIONS OF RAIL VEHICLES

Langer, BF, Westinghouse Research Laboratories
Shamberger, JP, Westinghouse Electric Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

RR-57-A, Dec. 1935, pp 481-493, 16 Fig, 3 Tab, 1 Phot, 10 Ref, 4 App

The authors point out in this paper that lateral oscillations, which either do not occur or are negligible at slow train speeds, are of vital importance at the high train speeds now demanded by the railroads. Aside from collisions and broken rails, practically all railroad accidents result from lateral derailments. Lateral derailments are caused by lateral pressure of wheel flanges against the rail. Therefore, the prevention of lateral derailments requires a knowledge of both the conditions which cause high lateral forces and of the conditions which must prevail in order to keep the lateral forces below some indicated safe value. The essential difference between the previous studies and the present one is that the previous ones discussed forced oscillations the life of which depended upon the application of some periodic force, such as that from cylinder action or rail joints, whereas the present discussion describes and explains a type of oscillation which, after an initial disturbance, even though a minor one, may build up to dangerous proportions and sustain itself indefinitely on absolutely perfect track. This type of oscillation is frequently encountered and is commonly known as "nosing." It is only one phase of the whole problem, but it represents the most serious menace to the safe operation of rail vehicles at high speed.

040387
GENERAL ASPECTS OF THE LATERAL DYNAMICS OF RAILWAY VEHICLES

Wickens, AH, British Railways

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Aug. 1969, pp 869-878, 12 Fig, 4 Phot, 34 Ref

Contributed by the Railroad Division of the ASME at the Winter Annual Meeting, New York, New York, December 1-5, 1968.

Recent developments in research into the lateral dynamics of railway vehicles are reviewed with particular reference to dynamic stability, dynamic response and curving. Two engineering aspects of this work are stressed—namely, the advantages of applying linear theory to a comprehensive study of vehicle dynamics, and the choice of basic assumptions required to make such studies realistic for design purposes.

040389
DIGITAL COMPUTER SIMULATION OF RAILROAD FREIGHT CAR ROCKING

Liepins, AA, Dynatech Corporation

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 701-707, 12 Fig, 6 Ref

Contributed by the Railroad Division of the ASME for presentation at the ASME-IEEE Railroad Conference, Chicago, Illinois, March 27-28, 1968.

A mathematical model for the simulation of railroad freight car rocking is presented. The equations of the model are developed into a digital computer program. The model response is validated by two series of test results, and the model is considered reliable for engineering predictions.

040418
PROBLEMS OF INTERACTION OF VEHICLES AND TRACK–WORN PROFILES OF RAIL HEADS AND WHEEL TYRES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 6, Oct. 1962, 2 pp

Question C9

As a result of a large number of tests it has been proved that service wear on wheel tires and rail heads leads to definite profiles. These worn profiles are to a large degree independent of the initial profiles of tires and rail heads. In the worn condition the profiles maintain their form and are not subject to any further change. The worn profiles are characterized by good mutual conformity and thus by little increase in wear. The worn profile of tires results in a shortening of the wave length of the periodical wheel set motions (hunting) in the track clearance. It was concluded that to wear new profiles of rail heads and tires should be adapted as much as possible to the worn profile. The use of special wheel tire profiles promise no lasting influence on the riding quality of vehicles. Therefore other design measures on the vehicles should be preferred to control the hunting motion.

040419
PROBLEMS OF INTERACTION OF VEHICLES AND TRACK–MEASUREMENTS MADE WITH RAIL VEHICLES DURING 1961 TO ASSESS THE CLEARANCE GAUGE ALLOWING FOR ROLLING MOVEMENTS OF THE VEHICLES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 5, Oct. 1962, 10 pp

Question C9

The purpose of these measurements was to shed light onto the behavior of the bogies, their position on the track, and to assess the lateral and rolling motions of the moving vehicles, caused by the forward traveling speed, the curve radii, and superelevation in curved track. The values so determined were to be taken as a basis for the setting up of a kinematic vehicle gauge. One of the most important results of the experiments is the linear dependence which was confirmed, for all vehicle types, between the angles of rolling, or between the transverse displacement of the sprung masses and the excess transverse accelerations respectively. This seems to indicate that the magnitude of the quasi-static angles of rolling can be precalculated, provided that the mathematical layout of the problem is sufficiently accurate. This would, however, entail complex conditions, because it would be necessary for all force effects of the connecting members between the individual masses to be incorporated in the process, with reasonable accuracy.

040436
CONTACT ZONE–ENQUIRY INTO THE PROBLEM OF SMALL DIAMETER WHEELS APPENDIX 3

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 3, Oct. 1966, 11 pp, 5 Fig

Partial Copy--Appendix Only-Summary of Report Abstracted Separately, Question C53.

The observations made at the Mairy mine concerning the wheel-rail dynamics are discussed. The width of the rolling band is wider than on the SNCF and can be explained by wear of the wheel and rail. It could also be due to transverse elastic deformation of the wheel. The calculations and measurements are summarized which were carried out in the laboratory of the SNCF to investigate the influence of the load, the curvature of the rail and the tire, and more particularly of wheel diameter on the stresses to which these components are subjected.

040525
SHELLY RAIL STUDIES AT THE UNIVERSITY OF ILLINOIS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 64, No. 577, Feb. 1963, pp 534-541, 6 Tab, 4 Phot, 1 Ref

Rolling-load tests are reported for the following types of rail: (1) German abrasion-resistant rails; (2) basic-oxygen standard carbon-steel rails; (3) basic-oxygen high-silicon steel rails; (4) 115-lb. standard carbon-steel rails; and (5) flame-hardened rails. Mechanical tests are presented for Japanese induction-hardened 119-lb. rails.

040548
A FEW PERMANENT WAY MATTERS OF INTEREST TO ROLLING STOCK ENGINEERS

Loach, JC

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 301, Part 5, 64-65, pp 465-490, 9 Fig, 7 Phot, 7 Ref

Present track design techniques and rail maintenance problems of the British Railways are discussed. The effect of wheel design and load on track clearances and rail wear is shown. Conditions producing flat wheels, axle stresses and corresponding rail damage are described. Curve designs are shown.

033071
HIGH-SPEED ROLLING STOCK. I. SOME PROBLEMS ON HIGH-SPEED ROLLING STOCK

Hara, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp41-44, 1 Ref

High Speed Rolling Stock article discusses problems of high speed rolling stock including: tests on pressure variation caused by trains, comparison of a steel and rubber life guard. Part Two discusses strength and other design problems of high speed cars, and Part Three considers the unique problems of traction motors in high speed cars.

033076
STATIC DISTRIBUTION OF WHEEL LOAD OF TWO-AXLE BOGIE CAR

Koyanagi, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 3, Quart Rpt, Sept. 1966, pp37-40

Since off-loading of wheel is one of the important factors of the derailment phenomenon, it is significant to analyze relations between off-loading of wheel and various parameters of a car. Analysis of this sort has been done before for a two-axle car, this report concerns a two-axle bogie car.

033077
COMBINED EFFECT OF FRICTIONAL AND ELASTIC MOMENTS AGAINST TRUCK TURNING UPON HUNTING OF TRUCK

Matsudaira, T, Japanese National Railways
Arai, S, Japanese National Railways
Yokose, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 3, Quart Rpt, Sept. 1966, pp40-45

The hunting of a truck subjected to frictional moment and elastic one, combined in series connection, against truck turning was analyzed and a solution as well as an analogue computation was presented. Effect on friction and rigidity against truck turning upon the hunting speed was investigated and was checked by analogue computation. The spring action against truck turning plays the leading role to increase the hunting speed and the frictional resistance pays an important supporting role to make the spring action effective to the range of a large amplitude though the friction itself has no action to prevent truck hunting. To determine appropriate magnitudes of these factors, the supporting stiffness of the axle with respect to the truck frame should be taken into consideration.

033082
STUDY OF RIM STRESSES RESULTING FROM STATIC LOADS ON DIFFERENT 36-INCH RAILROAD WHEEL DESIGNS

Lovelace, WS, Southern Railway

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

71-RR-4, Jan. 1971, pp1-11, 8 Ref

A comparative study of wheel design to determine the factors which lead to the fatigue cracking of the wheel tread. Also, the influences of rim design, service wear and the position of applied load are considered. Conclusions include the variation in rim stresses which are a result of the two wheel designs tested.

033085
ELECTRICAL WEIGHING PLANT FOR FREIGHT-CAR INSPECTION CONCERNING AXLE-LOAD AND WHEEL-LOAD UNBALANCE

Ono, S, Japanese National Railways
Nishimura, B, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 1, Quart Rpt, Mar. 1960, pp31-37

Plant is an electrical weighing device to detect the axle-load and the differences between left and right wheel of an axle, concerning the freight train in motion. Derailment of car and the fracture of running parts have been one of the most difficult problems in railways. The risks to which the freight cars under heavy load and high speed shall be subjected to diverse, ignorance concerning the quality and quantity of the interaction between the running part and the rails is most important of all.

033086
TRACK INSPECTION CAR "SUYA-34" BODY RIGIDITY TEST

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 1, Quart Rpt, Mar. 1960, p23

Measurements were carried out on the rigidity of car-body proper of the track inspection car under construction. The measured amounts of the bending, torsional and lateral-bending rigidities were large enough to estimate that the vibrational deflection of the body during operation would be within the requirements of specifications.

033099
ROLLING STOCK FOR HIGH-SPEED OPERATION

Miki, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Apr. 1960, pp7-12

Discussion of factors to be considered in the design of rolling stock for high speed operation. Factors in the design to rolling stock includes: gauge, outside forms as related to streamlining, carriage structure, locomotion systems, braking systems.

033100
SAFETY AND RIDE-COMFORT OF HIGH-SPEED RAILWAY CARS

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I.,Quart Rpt, Apr. 1960, pp13-19

Running safety is the essential requirement for the high-speed operation of rolling-stock. However, riding comfort is another important factor which should never be overlooked. Discussion is limited to the car-dynamical problems such as the over-turn or derailment of cars. The riding problem is concentrated to the vibrational riding quality.

033101
HIGH SPEED ROLLING STOCK

Miki, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I.,Quart Rpt, Apr. 1960, pp47-56

Design of rolling stock for high speed operation including a discussion of the problem of air resistance and the need to streamline parts of the units. Consideration of the construction of the rolling stock, testing of bearings trucks and driving gear with recommendations of materials to be used in the body structure, traction motors and transmission equipment.

033104
ON THE TYRE PROFILE OF FREIGHTCAR WHEELS

Matsui, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 2, Quart Rpt, June 1970, pp61-65, 7 Ref

Adoption of the N-profile tyre wheels for double-link suspension freight cars has been decided upon. Fundamental considerations in determination of wheel tyre and flange profile are as follows: (1) high stability to hunting, (2) little wear due to running, (3) great safety against derailment. The N-profile tyre proposed to meet this demand has been confirmed to be effective both theoretically and experimentally; it is going to be adopted in all two-axle freight cars of double-link suspension. It is expected to make drastic cutdown of derailment cases of two-axle freight cars.

033105
CALCULATION ON HUNTING OF HIGH SPEED RAILWAY TRUCK–PROBLEMS OF TRUCK DESIGN FOR SANYO SHIN KANSEN

Yokose, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 2, Quart Rpt, June 1970, pp108-112, 5 Ref

This report treats of an outline with the fundamental characteristic of the hunting of car, and of the theoretical foundation on the basic design of the test truck for the SYNYO SHIN KANSEN with an example of numerical calculation. Discusses the various factors which affect to the hunting speed of the truck, for instance, the supporting stiffness of the wheelset, the spring constant between the side frame and the truck one, and the frictional moment and the elastic one against to the truck turning etc. As a result the basic data for the car design are proposed.

033129
HIGH SPEED ROLLING STOCK

Miki, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Nov. 1961, pp15-19

Discusses additional aspects of high speed rolling stock to include the air resistance of the car body, train draft, air pressure in tunnels, load test of proto-type bodies, loads on wheel set, bearings and lubricants and power transmission equipment.

033130
DYNAMICS OF HIGH SPEED ROLLING STOCK

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Nov. 1961, pp20-26

Article deals with the relationship of passenger comfort to braking of the train, research on running safety with measurements of side thrust and vertical forces in the axle wheel. Additionally, results of testing related to minimizing truck hunting are discussed.

033132
TECHNICAL PROCEEDINGS OF THE ENGINEERING EXCHANGE FORUM

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Dedew, New York)

Sept. 1966, 53pp

Papers from a railroad forum which discuss car design trends, high speed track design, roll and wheel lift tests, coupling requirements. Also included with the papers are comments and questions concerning the papers presented at the forum.

033135
ON THE EFFECTIVENESS OF CAR BODY STRUCTURAL MEMBERS (PART 2)

Ito, H, Japanese National Railways
Kawamura, T, Japanese National Railways
Kezuka, E, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 1, Quart Rpt, Mar. 1969, pp31-33

The experimental results and some considerations on a large car body structural model in bending which were carried out utilizing repeated strain method are presented. Detailed stress distributions on the structure are obtained conveniently by this method, and the accuracy of measurements is satisfactory enough in view of practice. Some data on the effectiveness of members are derived from these experiments.

033155
STATIC LOAD TEST OF THE 1/4-MODEL OF A PROPOSED CAR BODY

Kawamura, T, Japanese National Railways
Ito, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, Quart Rpt, June 1967, pp84-85

The so-called "body-mount" type car structure is now proposed as the new model of the electric train for the new Sanyo trunk line under construction and for the present new Sanyo trunk line under construction and for the present new Tokaido line as well. Rigidity and strength were examined with a 1/4-structural model.

033156
EXPERIMENTAL STUDY ON THE RUNNING RESISTANCE OF JNR FREIGHT CARS, GENERAL EQUATION OF RESISTANCE AND ITS VARIANCE

Harada, M, Japanese National Railways

Railway Technical Research Institute (Japanese National

Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, Quart Rpt, June 1967, pp92-95

The writer has recently made a study for the hump track layout design for the Koriyama shunting yard. In this study new measuring and analytical methods were adopted to establish a general equation of the running resistance which may be applied to all types of freight car of JNR. This equation expresses the functional relation of the type and the loading condition of cars, and the meterological elements. This paper may possibly give a convenient and useful information for practical design, operation and control of freight cars.

033158
TOLERANCE CRITERIA OF RIDING COMFORT FOR LATERAL VIBRATION (REPORT 1)

Miyoshi, K, Japanese National Railways
Sakamoto, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, Quart Rpt, June 1967

This report refers to preliminary experiments studying the effect of low-frequency lateral vibrations on the psychological quantities of human subject on a vibration table.

033163
CALCULATION METHOD FOR THE STRENGTH OF CAR BODY SIDE FRAME (PART 3)–POSITION OF CENTER PLATE, ARRANGEMENT OF MEMBERS, RIGIDITY OF CONNECTING PART OF MEMBERS, ENERGY THEOREM IN CALCULATION, ETC.

Arai, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 3, Sept. 1967, p183

In the Part 1, the theorem of calculation method was explained, and in the Part 2 thoroughly automatic program of strength calculation based on the theorem was described. In this paper, several properties of side frame clarified by the calculations are reported. This method is applicable to the design of the light alloy car body with high rigidity and strength.

033171
STABILITY REGION OF THE NONLINEAR HUNTING VIBRATION OF RAILWAY VEHICLE TRUCK

Mano, K, Japanese National Railways
Arai, S, Japanese National Railways
Yokose, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968, pp109-110

Applying the describing function method to the estimation of the nonlinear hunting vibration of a railway truck, the stability region of that truck can be estimated easily by the computer. The result obtained by this method coincides well with the one obtained by an analytical method.

033174
MEASUREMENT OF MOMENT INERTIA OF FREIGHT CARS

Nihonyanagi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968, pp124-125

The physical properties of freight cars of various kinds were measured. This paper provides the way to find the position of the center of gravity and the moment of inertia of car body. The experimental formulas are offered for the convenience of freight car design. The measured freight cars were the two-axle cars of tank cars and coal cars, and an open wagon bogie car.

033177
CALCULATION ON DYNAMIC PERFORMANCE OF HYDRAULIC CUSHION UNDERFRAME (REPORT 1)

Matsui, S, Japanese National Railways
Suzuki, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 1, Quart Rpt, Mar. 1968, pp25-32

The car structure with a movable through-member which connects the draft gears at the car ends-the cushion underframe–is considered for the case when a hydraulic shock absorber acts against the relative motion between the through-member and the car body. The impact motion between a conventional car and the car with a cushion underframe is solved in order to give a practical method to determine suitable dimensions of elements and also to predict the motion under any initial conditions. For the calculation, use of electronic computer is considered. Numerical examples show the favourable performance of the system, giving the coupler forces within the limit of car-end strength even for a very high impact speed, say 20 kn/h, of the cars. The method described in this article has been successfully applied for the designing marine-container cars. The test results are quite favourable.

033186
CALCULATION ON DYNAMIC PERFORMANCE OF HYDRAULIC CUSHION UNDERFRAME (REPORT 2)

Matsui, S, Japanese National Railways
Suzuki, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt, Dec. 1968, pp216-219, 1 Ref

Car end-to-end impact of the hydraulic cushion underframe car was analyzed numerically, not only for one-to-one but also for one-to-two car impact. The result shows a good agreement with the data of the actual car test. Besides, effects of masses of coupler and sliding sill, coupler rigidity and draft gear damping were clarified.

033187
COMBINED EFFECT OF FRICTIONAL AND ELASTIC MOMENT AGAINST TRUCK TURNING ON RUNNING STABILITY OF ELASTICALLY SUSPENDED AXLES

Yokose, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt, Dec. 1968, pp220-223, 1 Ref

In this paper, the author analysed the hunting of truck where spring and friction are connected in a series against truck turning. A describing function method is applied to the analysis of the truck hunting having a non-linear characteristics, and the Frank-Koenig's method is used to search for the criterion of stability for polynomials with complex numbers. And it is made clear that the turning stiffness of truck, the friction of side bearer, the supporting stiffness of axle, the slope of wheel tread and the creep coefficient between wheel and

rail have effect on the truck hunting, which will be helpful for basic car design.

033188
ON THE WELDABILITY OF HIGH STRENGTH CAST STEEL COUPLER

Ando, S, Japanese National Railways
Takimoto, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt, Dec. 1968, pp234-238

Weldabilities of three 60 kg/mm square-class high strength steels newly developed as materials for fabrication of couplers (C 0.13 to approximately 0.29 percent, and small amounts of Ni, Cr, Mo, W, V, Cu, as well as Mn, Si) were investigated using the synthetic apparatus for weld thermal cycle. The relations between the results of investigation, the properties of buildup weld on couplers, and the crack-sensitivity of test steels were studied. Among the three steels, one with less carbon content (0.47 percent carbon equivalent) was better weldable and one with more carbon content (0.56 percent carbon equivalent) developed cracks in weld; the other was found unfit for buildup weld at atmospheric temperature. The results of experiments contributed to formulation of SCC 60 specification and provided a guide to the tolerable number of buildups.

033190
TEST RESULTS BY FULL SIZE WHEEL-AXLE FATIGUE TESTING MACHINE

Mori, B, Japanese National Railways
Yaguchi, S, Japanese National Railways
Nakamura, H, Japanese National Railways
Tanaka, S, Japanese National Railways
Hatsuno, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Mar. 1968, pp133-135

For the perfect solution of the problem of preventing train accidents due to axle failure, it is necessary to get an accurate grasp of mechanism of fatigue crack initiation and its propagation in wheel axle. From this standpoint, it was decided in 1964 to develop a full size wheel axle testing machine and the developed machine was set in RTRI and now, several kinds of fatigue tests have been carried out using this machine. This report describes the general performance of the machine and a few fatigue test results about old axles or new axles. The forms of wheel-seat are four kinds and the heat treatments of axles are two kinds.

033201
TESTS ON THE TRACK ON THE RIDING STABILITY AND THE GUIDING QUALITY OF VEHICLES BY MEANS OF A SPECIAL VEHICLE. CHARACTERISTICS OF THE EXPERIMENTAL VEHICLE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 1, Question B52, Intrm Rpt, June 1963, 50pp

In order to study experimentally the riding stability and the hunting movements of vehicles, it was decided to consider a vehicle of the simplest possible design i.e. a two-axled isolated bogie. Each of the factors entering into the dynamic phenomena connected with its running can be separately varied. This experimental bogie is placed under the middle section of the body of an ordinary bogie coach. The bogie and the experimental coach are described in detail and also the methods adopted for measuring the interesting magnitudes.

033203
STUDY OF THE OPTIMUM DAMPING REQUIRED BY THE SUSPENSION SYSTEMS OF WAGONS SO AS TO ENABLE THEIR RUNNING, UNDER ANY LOADING CONDITIONS, AT A SPEED OF 80 KM/H ON TRACKS IN AN AVERAGE STATE OF REPAIR

Moron, International Union of Railways

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Question B56, July 1962, 71pp

The running of trains in ordinary service at a speed of 80 km/h as of 1970 entails problems especially as regards certain series of existing wagons, which will not have been redeemed in the forthcoming years and which may give rise to difficulties when being run at higher speeds. In the present report of enquiry the measures to be taken in order to improve the riding stability of these latter vehicles are examined. These arrangements concern both the constructional modifications to be made and the adaptation of the damping systems. They should, however, be economic in order that they can rapidly be redeemed. The study shows as regards the two-axled wagons the importance of the ratio between wheelbase and length of the wagon body and, more exactly, between the wheelbase and the radius of gyration to the vertical axis of the centre of gravity. The increase of the wheelbase has shown to be one of the most efficacious measures in order to improve the stability of the wagons having insufficient riding qualities. In the case of bogie wagons, the study gives an account of the damping systems based on friction aiming at an improvement in the behaviour of the vehicles fitted with helical spring suspension systems. Such systems also enable bogies to be visualised capable of being used at speeds up to 120 km/h. The report finally supplies some general indications on the choice of the lines where the tests on vehicles could be undertaken within the frame of studies of a Specialists Committee. These tests should make it possible to guarantee the safety of the running of the modified wagons on all the lines where a speed of 80 km/h is authorized.

033204
MAINTENANCE OF THE WHEELSETS OF TRAILER STOCK. TESTS ON PASSENGER COACHES TO ASCERTAIN THE PERMISSIBLE OUT-OF-ROUNDNESS AND OUT-OF-BALANCE OF THE WHEELS OF THESE FOR SPEEDS OF BETWEEN 0 AND 250 KM/H

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 9, Question B79, Oct. 1970, 39pp

Previous reports contain the results of the tests carried out with a view to determining the permissible out-of-roundness and out-of-balance values for the wheel-set of trailer-stock, for running speeds comprised between 0 and 150 km/h. New tests have been carried out for speeds comprised between 0 and 250 km/h. These have consisted of bench-tests, carried out on the SNCF dynamic test-rig for vehicle suspensions at Vitry-sur-Seine, and have concerned 3 coaches (SNCF, DB and FS). In addition, line tests have been carried out with the SNCF coach; in a first series of tests a speed of 250 km/h was reached, while, in a second series of tests the running-speed was only 160 km/h. The results obtained have permitted the following limit values of plus minus 0.15 mm for the out-of-roundness and 0.125 kg.m for the out-of-balance per wheel (static balancing would seem to suffice in most cases) to be fixed, such that the comfort obtained with the three coaches is still acceptable. This is valid up to the speed of 250 km/h in the case of the DB and SNCF coaches and up to 220 km/h for the FS coach. It has also been found: a) that the test-bench used constituted a perfect reference basis and that it seem desirable to devise a better correlation between the excitation obtained on the track and that produced on the rig; b) that, for the purpose of determining the comfort, the whole of the floor of the coach should be covered by the examination, since, for speeds beyond 150 km/h, the body can present a complex vibratory system with several nodes; c)

that, if it is whished to use a coach for high running speeds, it must be checked to see that, beyond a certain speed, there is no very sharp increase in all the recorded accelerations.

033205
CATALOGUE OF DEFECTS ON THE WHEELS OF RAILWAY TRAILER STOCK

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

B79/RP10, Oct. 1970, 29pp

This report forms a contribution towards the standardization of the terms used for designating the most frequent defects encountered on the wheels of trailer stock wheelsets. The defects have been grouped according to their location i.e. running tread and surface of the flange, wheel rim with tyre (solid wheel) or tyre and rim (tyre wheel), wheel disc, hub. For each type of defect, its designation, characteristics and apperance accompanied whenever possible by one or more characteristic photographs, have been indicated. In addition, information has been given concerning the means for detecting the defect, recommendations (of a general nature) concerning the procedure to be adopted following its detection, and its probable origin.

033208
ASSESSMENT CRITERIA FOR THE PERMISSIBLE WEAR PROFILES OF WHEEL FLANGES AND SWITCH COMPONENTS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Apr. 1969, 33pp

Studies include the investigation of the wear forms of a great number of worn wheel flanges used on various types of vehicles (passenger coaches, wagons, railcars, electric and diesel bogie locomotives) and of worn rails in areas containing points and crossings so as to obtain an adequate basis, adapted to practical demands, for arriving at a judgment. Starting from a characteristic wear profile of a flange a track gauge was developed, permitting the verification of the compatibility of the wear profiles of the ironwork of switches with such a flange. The measurements conducted using this gauge enable the development of wear forms of rails endangering the traffic to be detected (particularly in sections containing switches and stock rails) and they indicate, at the same time, how this risk can be eliminated and how their use can be prolonged by reprofiling operations. The results of the studies is that it will be possible to deduce, from an analysis of the geometry of the contact between flange wear shapes and track, the compatibility criteria adapted to practical conditions and only requiring simple measures to be taken on the wheel and the switch work items (checking by means of the gauge). This procedure will lead to a decisive improvement of the riding safety of vehicles.

033222
LATERAL OSCILLATION OF BOGIE BOLSTER

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Feb. 1960, pp245-249

States that the occurrence of resonance conditions at operationally important speeds can be prevented for all mileages between major overhauls. Gives theory and design features of swing hanger trucks and describes the features of railroad cars that cause the swaying of the car. Theory and sample calculation for the design of swinghangers for railway cars to control inherent instability of cars as related to sway.

033223
CARRIAGE AND RAILCAR BOGIES, THEIR DESIGN AND DEVELOPMENT–IV

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Aug. 1961, pp216-218

Article discusses torsional stresses in bogie frames, and how it is controlled in Belgian locomotives. Discusses the requirements for brake designs and components as part of high speed operation. Axles, adhesion, and stresses between wheel and rail contact are also considered.

033224
CARRIAGE AND RAILCAR BOGIES: THEIR DESIGN AND DEVELOPMENT–V

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Sept. 1961, pp303-366

This part describes experience gained in ride evaluation and road trials.

Article discusses ride evaluation and road trials in bogie design. The means of determining ride quality and the use of instrumentation as a more scientific device is also discussed. Vehicle body oscillations, lateral acceleration and displacement are among those measured.

033225
CARRIAGE AND RAILCAR BOGIES: THEIR DESIGN AND DEVELOPMENT–VI

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Oct. 1961, pp446-449

Conclusion of a six-part article deals with the effects of track and sound intensity.

Article discusses the interrelationship between design of a bogie and the coach under which it will be installed. Differences in coach length, width, centers of gravity, wheel diameters and rail condition are considered. The factors of sound intensity, bouncing and pitching of the coach are related to ride and comfort index.

033229
HIGH SPEED ROLLING STOCK. I. AERODYNAMIC PROBLEMS

Hara, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Aug. 1964, pp9-19

Articles discusses unique problems of high speed trains. Aerodynamic problems such as testing of sealed-nonsealed train units, means to measure aerodynamic drag are discussed. Structural analyses of side frames, load tests, strength of bodies and components are also included. Testing of power transmission, effects of wheel flat, bearings and life guard are further investigated.

033231
FLAME HARDENING OF TYRE FLANGE

Koinumaru, T, Japanese National Railways
Saito, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 1, Quart Rpt, Mar. 1964, pp30-31

Flange wear is critical as a thin flange leads to excessive removal of tread metal in restoring the profile and hence to a relatively short wheel life. The reduction of flange wear is of great economic importance. The principal methods of reducing flange wear are to harden the flange surface by flame hardening and to reduce the friction between wheel and rail by oil lubrication.

033233
DISCUSSION ON THE STRENGTH OF WHEEL-AXLE FOR HIGH SPEED TRAIN AND SOME FUTURE PROBLEMS

Nakamura, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp171-173

When the train speed increases to more than 200 km/h, the variance and increase of wheel-load will be more remarkable than in present cars. The train speed must be increased carefully, the bogie construction, the track construction and its maintenance method must be fully investigated. In future, problems of the thermal crack, tire flat and residual stress are very important for wheel-tire and the fatigue strength under complex stress amplitude and the study of increasing press-fit parts strength are very important for axles. According to all data, the critical speed of wheel-tire will be 300 km/h.

033234
BEARINGS FOR HIGH SPEED GUIDED VEHICLES

Akaoka, J

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp173-175

Limiting speed for promising super high speed vehicles is presumed from the viewpoint of bearing systems, and the base of presumption is described. The bearing systems discussed are as follows: the traditional system (limiting speed will be 350 km/h), the system with independent wheel (350 km/h), the system in which wheels are not concerned in transmission of power but only carry load of wheels (800 km/h), and the system without wheels (1,000 km/h).

033237
A NEW TRANSIT PROPULSION UNIT SUSPENSION—PROVED ON NORTHEAST CORRIDOR HIGH SPEED TEST CARS

Nelson, JA, General Electric Company
Hapeman, MJ, General Electric Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

69-RR-3, 12pp

Conference Paper.

The old generation propulsion units for lightweight, inboard journal trucks had the motor and gear unit bolted solidly together, driving the axle through, and supported on, rubber around the axle. By correcting deficiencies in this design, yet retaining the principle of floating the motor in rubber to isolate it from rail shocks, this new propulsion unit arrangement for lightweight, inboard journal trucks has successfully permitted the car operating speeds to double, from 75 to 150 mph in one jump. Paper has been written to emphasize the growing importance of dynamic vibration analysis in the design of rail vehicle trucks and truck and axle-mounted propulsion equipment. Detailed analytical studies of the wheel and axle, truck, and propulsion equipment suspension dynamics has generally been deferred in the past. The car body dynamics have been studied closely to ensure that the passengers receive a smooth ride, but the ride of the trucks and their equipment has been of little concern to most. We will point out why the suspension dynamics of the truck must be studied, how they can be analyzed, and the consequences of failure to do so.

033239
REPORT NO. MR-439 ECONOMIC SURVEY OF AXLES WITH OVERHEATED JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 34266

MR-439, Report, Apr. 1964, 12pp

In order to determine the economics involved in this subject, a survey was made in the main wheel shop on five large railroads in the United States, covering the following items: (Item 1) How many axles are scrapped due to all causes except those handled for overheated journals? (Item 2) How many new axles are now being used as replacements for axles which are scrapped due to condemning limits for wear on wheel seats, journals or uncorrectable defects such as cracks? (Item 3) How many axles are now being used to replace axles which were overheated and badly scored and gouged? (Item 4) How many axles are considered useable, machined and then tested and found to be defective and subsequently scrapped under present Interchange Rules? (Item 5) What is the approximate expense of reclaiming by turning, magnetic particle testing for cracks, and placing axles in condition for use under current Interchange Rules? The data thus obtained was analyzed and these conclusion were reached: The adoption of a ruling to arbitrarily scrap all axles which had an overheated journal will not eliminate broken journals from other causes, or affect the number of hot boxes; The principal cause of the greater number of all broken journals is burn-offs as a result of being continued in operation without being detected while overheating; Further reduction in the number of hot boxes will most effectively reduce these incidents; The net annual material and labor costs of arbitrarily scrapping axles having overheated journals which are presently reconditioned for further service under current Interchange Rules, based upon the secondhand value of the replacement axles, is estimated to be $403,752.13.

033243
NEW PRINCIPLES IN BOGIE-BODY CONNECTIONS. TWO PROTOTYPE BOGIES DESIGNED BY THE S.N.C.F.

Mauzin, M, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 100 Brussels, Belgium)

Nov. 1965, pp751-767

Until recently the problem of the comfort of railway coaches was settled empirically. It was not till 1952 that a start was made with experimental research into the conditions determining comfort in a railway vehicle. There was a problem in connection with the link between bogie and body as far as railway vehicle comfort was concerned. It appeared that the choice of the solutions made by trial and error was not the best. The problem of comfort has two aspects: transversal comfort; and vertical comfort. Two bogies have been designed on the same theoretical bases: Suspension rods of the body in relation to the bogie 0.500 m long, inclined 1/10 towards the interior. Transversal play of the body in relation to the bogie plus or minus 65 mm. Complete freedom of rotation of the bogie in relation to the body.

033244
FREIGHT CAR TRUCK PROGRESS

Cottrell, RB, American Steel Foundries

American Steel Foundries, 1005 Prudential Plaza, Chicago, Illinois, 60601

The modern High Speed Freight Car Truck of the present-day 50-ton freight car has a weight complete of about 14,000 lbs. in Grade "B" steel, and is capable of transporting 110,000 lbs. of material safely and without damage at speeds up to 100 mph. The trucks also support the car body, which in some cases weighs 40,000 to 45,000 lbs., making 150,000 to 155,000 lbs. in all. This is 11 lbs of load carried per pound of weight. The cast steel truck bolster supports about 90 lbs. per pound of its own weight, and the cast steel side frame about 65 lbs. per pound of weight. The cast steel bolster is capable of carrying 65 lbs. and the cast steel side frame 46 lbs. of revenue freight per pound of their own weight. Analysis shows that the forged steel axles carry 34 lbs. of revenue freight per pound of weight and the one-wear steel wheels 24-1/2 lbs., indicating the excellent efficiency and weight economy of the cast steel side frame and bolster.

033249
DRAFT GEAR RESEARCH IMPACT TESTS OF AAR APPROVED STANDARD POCKET DRAFT GEARS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 34266

MR-348, May 1961, 25pp

This report describes an investigation conducted by the utilization of impacts made on eleven AAR approved (24-5/8 in.) standard pocket draft gears. During the study two gears of the same manufacturer were installed in two identical 50-ton box cars and impacted under test conditions of: (a) empty cars (no load), (b) half or medium load, and (c) full load. The draft gears investigated included six friction, three rubber, and two friction-rubber types. This investigation resulted in the development of a large volume of data related to such variables as force input, gear closure, stress distribution in the car underframe and car body, and load accelerations. Only a part of the data has been reduced and analyzed for this report. No attempt has been made to present any conclusions.

033255
HIGH-SPEED ROLL ING STOCK. I. AERODYNAMICAL PROBLEMS

Hara, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Oct. 1963, pp7-20

Considering the various problems of high speed train operation, pressure variations of trains in tunnels and the relationship to internal pressure changes is discussed. Structural problems of rolling stock including deformation, stress and window design, wheel axle and axle box are also considered. Finally, traction motor design and power transmissions are considered.

033262
HIGH-SPEED ROLLING STOCK

Miki, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Nov. 1962, pp5-12

Article discussing the topic of high speed rolling stock and the unique design problems of high speed operation. Aerodynamics of design and such factors as wind pressure of passing trains, on pantographs. Tentative car designs, factors of wheels such as axle strength, flat wheel and bearings are considered. Finally the design of the main driving motor and temperature rise, rectification and driving gear are discussed.

033266
ALUMINUM IN ROLLING STOCK IMPACT TESTS AT COLLISION SPEEDS

Campbell, RA, Aluminum Company of Canada, Limited
Sutherland, JG, Aluminum Company of Canada, Limited
Whiting, JF, Aluminum Company of Canada, Limited

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

58-RR-1, Paper, Apr. 1958

The paper records the results of 75 impact tests, 47 of which occurred between the speeds of 5 to 15.4 mph on an all-aluminum 70 ton capacity covered hopper car. Coupler forces ranged between 500,000 and 947,000 lbs. The hopper car was equipped with aluminum centersill and bolsters. Summary values of strain gauge reading are presented. Considerable space is devoted to describing the damage to various parts of the "hammer" and "anvil" cars as a result of the highest speed collision. One of the unique results of the test explained in the paper is a schedule showing coupler force distribution from the centersill to the carbody, along the length of the car from the collision point. The discussion on location of strain gauge is very adequate, but little specific information is given on stress levels recorded. There is a graph showing average longitudinal compressive stresses recorded in the aluminum centersill along with a design specification for the centersill.

033269
STUDY OF THE VERTICAL SUSPENSION OF A RAILWAY VEHICLE

Mauzin, A, French National Railways
Joly, RE, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1968, pp948-1006, 1 Ref

In the following pages, we propose to study the vertical suspension of a railway vehicle considered as a rigid body resting on elastic supports. This study will make it possible to determine the numerical values of the suspension components to obtain the best possible comfort in the body, i.e., (1) the rigidity of the springs making up the 2 stages of the suspension; (2) the positioning and rate of amortization. In addition, a study of the transitory regime will make it possible to describe the behaviour of the suspension when the vehicle passes over an isolated defect in the track (low joint, faulty frog, etc.) and to see whether the stipulated rate of amortization is sufficient to damp out the oscillations rapidly.

033274
TRAIN RESISTANCE, POWER AND ENERGY REQUIREMENT OF M-U CARS

de Koranyi, L, General Electric Company

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

34CP 66-201, Conf Paper, Mar. 1966, 13pp, 14 Ref

Equations to be used in determination of multiple-unit train resistance, power and energy requirement are developed. Curves are presented for air resistance in tunnels. For open air the effect of wind speed and direction is also analyzed. Methods are presented for energy requirement optimization. Considerable energy savings can be realized by using these methods as guide lines for operational criteria. This study extends the work of W.J. Davis, Jr., for all kinds of M-U cars. The Davis equations were prepared and still are successfully used for conventional rapid transit train speeds and shapes, but not for high speeds and streamlining.

033286
TANK CARS IN THE NEWS

Traffic World (Traffic Service Corporation, Washington Building, Washington, D.C., 20005)

Report on a speech concerning effective rail car utilization and applications to the 4 wheel, 125 ton car. Lists the objectives to the same car which are; light rail, rail wear, and bridges and trestles. Proposes several alternatives to the problem of meeting the railroad costs by increasing the payload of each car.

033329
THE 1/5 SCALE MODEL WHEEL-AXLE FATIGUE TESTING MACHINE AND SOME EXPERIMENTS

Nakamura, H, Japanese National Railways
Hatsuno, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 3, Quart Rpt, Sept. 1965, pp47-50

Article discusses the design of a machine to test for fatigue and failure of wheel-axle assembly. Machine is used to test 1/5 scale of wheel axles for fatigue calculated from bending stress and S-N curves of axles, and measurement of amplitudes of shock waves generated when wheel axles ran over rail joints or have flat on wheel tread.

033338
STRENGTH CALCULATION FOR CAR BODY

Yoshimine, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 2, Quart Rpt, June 1963, pp29-32

Since about 1925, use of steel in car bodies of rolling stock for passenger transportation has become popular in Japan. To check the increase of weight resulting from it to the possible minimum, the strength calculation of the side frame of the car body became necessary, and in 1927, Mr. Suzuki proposed a method. Since then the study of strength calculation of the side frame of a car body has become accelerated, because of increased need for lightweight cars and introduction of test methods resulting from appearance of the wire strain gauge. A car body is subjected to such external forces as (1) bending due to self-weight and load (shearing too, at the same time), (2) torsion and (3) tension and compression in the longitudinal direction. Therefore, the strength calculation of a car body has to be made with regard to these loads.

033365
IMPROVING THE RUNNING QUALITIES OF THE COACHES TO BE INCLUDED IN HIGH SPEED LUXURY TRAINS–MODERN BOGIES–POSSIBLE TECHNICAL EVOLUTION

Robert, J, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21968, pp97-122

Discusses the needs of bogie design when rolling stock speeds reach 200 km/h. Suggested areas include relationship of connections between axles, bogie frames and coach bodies; tire profile for stability of 250 km/h speeds; vertical suspension systems for light weight coaches, reduction of unsprung weight, use of rubber in suspension systems. Finally, the problems of running coaches on lines with superelevated curves where problems exist in retaining a level coach interior.

033368
AN ECONOMIC SOLUTION TO THE PROBLEM WHEELS FOR TRAILING VEHICLES ON THE S.N.C.F.

Revillon, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 41969, pp201-209

Discussion of problems in wheel design and structural weaknesses of particular steels used in the construction. The means used to resolve the deterioration of wheels at minimal expense is discussed. A single solution to be used for freight and passenger service is discussed with 4 grades of steel finally determined for passenger and freight usage.

033370
PROGRAMME FOR TECHNICAL RESEARCH INTO VERY HIGH SPEEDS

Tessier, M, French National Railways
Mignot, C, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 1, 1970, pp1-13, 2 Ref

A study of the areas which need to be researched for very high speed (up to 300 km/h) operation. The S.N.C.F. program of research for such operation is listed, stability, aerodynamics and train resistance, braking, adhesion, running gear, safety equipment, infra-structure, traction systems and collection are each discussed in detail. The problems, and possible solutions are also considered individually.

033375
BASIC PRINCIPLES FOR THE DESIGN OF BOGIES FOR PASSENGER ROLLING STOCK

Moron, P, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 41970, pp117-139, 5 Ref

Discusses the parameters to be used in the design of the bogie unit. The principles which are established concern good lateral control of car body, critical speed of bogie and tread profile. New devices and materials may be necessary for the design of units for speeds in excess of 200 km/h. Good matching between the characteristics of bogie and attached body. Design of each unit alone is not satisfactory but matching of the components is necessary.

033382
TRIAL RUNS AT SPEEDS EXCEEDING 200 KM/H OF NEW ROLLING STOCK DESIGNED FOR THE ITALIAN STATE RAILWAYS

Manzo, M, Italian State Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

May 1965, pp323-345

Report on the performance and capabilities of an Italian high speed rail car. Designed for speeds of 160 km/h, though tests included speeds of 200 km/h. Discussion of pantograph used for current collection is included. A detailed report on the bogie design and structural considerations is also included. The test results of the components of the pantograph and bogie assembly suggest that the units are capable of exceeding maximum speed of 225 km/h.

033389
SELECTED BY THE S.N.C.F.: MONOBLOCK WHEELS OF NON-ALLOY STEEL, SURFACE TREATED

Ravenet, P, French National Railways
Gauthier, P, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1963, pp696-714

Discusses the types of stresses to which wheels are subject. Also, the damage caused by stress and the ways in which they may be controlled. Thermic flows, exfoliations, fissures of wheel rims are wheel problems which are treated in detail, and a practical solution to these problems is discussed.

033392
HYDRODYNAMICS OF PHENOMENA DUE TO PASSING-BY OF TWO TRAINS

Kawaguchi, M, Japanese National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1965, pp404-409

The investigation on such a flow became necessary in connection with the construction of the new Tokaido trunk line where trains will run at the speed of 200 km/h. The calculated results (three-dimensional) agree with the actual data from the passing-by test of trains not only qualitatively but also quantitatively.

033400
A CONTRIBUTION TO THE STUDY OF TRANSVERSAL COMFORT OF CARRIAGES

Mauzin, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 11966, pp24-38

To improve test techniques and to provide for advances, investigations have been implemented by the use of a motorized rail car, on which factors relating to bogie/body suspension could be varied as desired. Significance of studies is that much of the consideration of the vehicle dynamics design problems does not have to be left to trial and error methods on line, thus avoiding the possible setting up of hazardous resonance phenomena.

033407
RESULTS OF TRIALS WITH A NEW TYPE OF BOGIE DESIGNED BY THE SNCF

Mauzin, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31966, pp145-148

These tests dealt with the truck Y 207 and considered particularly the transverse stability of this truck at speeds of from 140 to 245 km/h, with wheel tires in tread worn condition, corresponding to 350,000 km of operation, and with tires worn to profiles to generate "shaking". After the wheels on this truck had actually made 350,000 km (217,000 mi.) without requiring turning for sharp flanges or instability on the track, and having an average depth of tread wear of 2 mm, this vehicle was tested at 140 km/h. These tests were the first ever run at speeds over 200 km/h with wheel treads in such worn conditions, and have significant results.

033408
RESEARCH ON PNEUMATIC SUSPENSION SYSTEMS

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31966, pp149-153

The efforts made to improve the service and to raise the speed of traffic impose technical advance on the S.N.C.F. concerning, notably, riding stability and the dynamic comfort offered by vehicles in general, and more particularly passenger coaches. Systematic theoretical and experimental research work is being effected on this subject, and diverse solutions differing with the bogie design or the characteristics of the suspension components are being tried out. One of these consists in fitting, to the secondary suspension, pneumatic springs, identical with those employed successfully by the Japanese Railways.

033412
NEW TYPE RUNNING PERFORMANCE TESTING CAR

Miyoshi, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 2, Quart Rpt1970, pp28-30

New type testing car, SUYA 11, has been built incorporating the latest developments in both measuring and rolling stock building techniques. Items measured by the testing car are as follows: forces acting between wheel and rail; relative movements of wheels against rails; rolling stock vibration; stresses exerted on running gear parts; temperature rise in running gear parts.

033423
CAR BODY STRUCTURE STUDY

Ito, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 4, No. 3, Sept. 1963

Theoretical methods of structural analysis have made a marked progress, side by side with the development of new methods of experiment in post-war years, such as use of the electrical resistance wire strain gage for measurement of strains on a car body. A method known as the "Yoshimine's Method"—a very rigorous method—is adopted in the calculation of sideframe strength. With the introduction of the Bendix G-20, the author composed the program (by its SNAP-EASY System) for finding the influence coefficients as well as the load terms which had required much calculating labor.

033432
DETERMINATION OF WEAR METALS IN LUBRICATING OIL IN AXLE BOXES OF ROLLING STOCK FOR NEW TOKAIDO LINE

Kuno, M, Japanese National Railways
Abe, H, Japanese National Railways
Matsumura, M, Japanese National Railways

Railway Technical Research Institute (Japanese National

Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 1, Quart Rpt, Mar. 1965, pp20

As lubricant in axle boxes of rolling stock for the new Tokaido line, lubricating oil has been employed instead of lubricating grease in consideration of their highest-speed. If wear metals and dusts mixed in lubricating oil are determined periodically, wear of roller bearings can be inspected without the trouble of overhauling. Spectrochemical analysis is considered to be applicable for this purpose. First, analytical methods were studied, and then wear metals in lubricating oil used in all axle boxes of rolling stock of trial manufacture were determined.

033444
SEPARATE AND JOINT COMPONENTS FOR THE VERTICAL AND TRANSVERSE DAMPING BETWEEN BOGIE AND VEHICLE BODY

Lipsius, JM

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Aug. 1967, pp597-613, 15 Ref

A general discussion of the influences of separate and joint suspension components on lightweight construction and smooth riding of bogie vehicles is followed by a discussion of the technical requirements which the vehicle body suspension must meet. Subsequently, the various types of separate and joint suspension components already in use are examined in order to ascertain to what extent they meet the various requirements. Finally, a number of possible arrangements of joint suspension components is mentioned.

033447
NEW PRINCIPLES IN BOGIE-BODY CONNECTIONS. TWO PROTOTYPE BOGIES DESIGNED BY THE S.N.C.F.

Mauzin, M, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Nov. 1965, pp751-767

Discusses the development and design of prototype bogies for high speed passenger operations. The factors related to comfort are transversal and vertical comfort. Two bogies were designed and built, tested at speeds up to 140 km/h. The results of the test over the same track between the 2 prototypes and the type bogie presently in use is documented and compared.

033453
A REVIEW OF THE FIRST THREE YEARS OPERATION OF THE NEW TOKAIDO LINE

Hoather, SJ

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, No. 61970, pp664-677

Discusses the aspects of the operation of the New Tokaido Line in Japan. The history of the line, reasons for the construction are included. The aspects of multiple train units and technical description, the design of catenary and collection system, aerodynamic considerations are also included. Finally, the maintenance of the train and all of its systems is discussed. The maintenance schedule of the units is detailed as well as the revenue and expenditures of the operation.

033726
DYNAMICS OF HIGH SPEED ROLLING STOCK

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Apr. 1960, pp57-65

The main object of this research group is to solve the problems concerning the safety of rolling stock and the passenger ride comfort. The researches for the determination of allowable limit with respect to safety and the researches for the prevention of derailment as well as destruction of track, the running stability of truck, and the elimination of rolling stock vibration and shock are dealt with here.

033731
DYNAMICS OF HIGH SPEED ROLLING STOCK

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I.,Quart Rpt, Sept. 1964, pp21-25

Basic researches on running safety and riding quality were required for the design of vehicles for the new Tokaido line, and high speed tests of the prototype vehicles on the test track section have been almost finished in the fiscal year 1962. In the fiscal year 1963 researches on some remaining problems for the final design of production type vehicles, especially, minute researches on the hunting prevention and on the lateral load-deflection characteristics of air springs, have been made continuously. In March 1964 the running performance test of the first built six production type vehicles was performed. The main results of these researches and test are described.

033736
FIRST PROGRESS REPORT LATERAL ACTION OF COMMON DESIGNS OF FREIGHT CAR TRUCKS HAVING AXLES WITH AND WITHOUT END COLLARS

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

F4000, Dec. 1950, 51pp

Progress Report.

The objective of certain instrumentation in the tests was to obtain fundamental information on the lateral action of different common designs of freight car trucks having standard and modified parts in the journal box assemblies, and having axles with and without end collars. It was desired to determine the motions of truck parts, and relation between these motions and lateral car body accelerations, and the origins of lateral disturbances to the car body, relative importance of these origins, and manner of transmission of these disturbances from the rail through the truck to the car body. A mechanical recorder was attached to one truck to obtain records of the relative lateral movements of truck parts (axle, bearing, wedge, frame) at both ends of one axle, and records of the vertical and lateral displacements of both side frames relative to the bolster. The conclusions are as follows: The most important origin of lateral disturbance to the car body is the nosing of the wheel-axle assemblies and truck, due to coning of the wheel treads. The effects of axle end collars on truck action are to increase the activity of truck parts but to limit the forces transmitted through the truck. Increase of lateral clearance, which does not reduce the beneficial effects of axle end collars, should improve the lateral riding quality of conventional trucks with snubbers. Curved track produces a quieting influence on truck action and improves lateral riding quality. Definite improvement in lateral riding quality should result from the use of a device which would cause the car body to seek a centered position between lateral clearances.

033737
DYNAMICS OF HIGH SPEED ROLLING STOCK

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Oct. 1963, pp21-27

Test on passenger ride comfort on curved track and also under braking were carried out in March 1962 to supplement the data obtained by the previous tests. Tests were planned minutely with the theory of sensory inspection and experimental design, and the analysis of the subjects' evaluation of ride comfort was made with a statistical technique. Main difference of these tests from the previous ones lies in the method of evaluation of ride comfort. The evaluation was marked separately for degree of sensation against acceleration, for degree of mood or comfortableness, and for judging whether the ride is permissible or not in terms of sensation or mood.

033738
DYNAMICS OF HIGH SPEED ROLLING STOCK

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Nov. 1962, pp13-22

Article devoted to dynamics of high speed rolling stock. Areas of discussion include test of allowable acceleration in a curved track, limit of wheel side thrust, effect of load upon wheel side thrust, track hunting and reports of bogie assemblies especially designed for high speed operation in conjunction with air springs and rubber draft gear.

033856
INCREASE OF TRAIN SPEED ON CURVES

Sakai, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

For a train to reach the destination in shorter time is to increase speed on curves and gradients. It would involve enormous investment to eliminate curves and gradients through re-routing the track in a mountainous country like Japan. Thus, the alternative would be to achieve an effect of speed by selectively investing in certain high-speed trains. Introduced a bogie truck TR96 which is an experimental one built for the purpose of exploring the possibilities of increase speed on curves. The data collected using this truck will offer the basis upon which a new high-speed train will be developed for actual service in a few years.

033857
HOW HIGH CAN TRAIN SPEED BE INCREASED?–A REVIEW OF PRESENT AND FUTURE

Matsudaira, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 2, June 1966, pp4-7

Discusses the factors which are the practical limits of trains speeds. These include obstacle by wave formation, adhesion limits, vibrational disturbance, problems of curved track, and the speed limits of existing trains. The summary discusses probable limits of present and future trains with differences in power-adhesion systems.

033863
WORK SESSION

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1968, pp1018-98

Discussion of rolling stock for high speed operation. Includes discussion of bogie-suspension systems, comparison of 4 2h33l vs. bogie systems, locomotive design and relationship to track for determining speed limits. Part II which concerns fixed installations, discusses the theoretical and experimental solutions to the problems of track design for high speed operation. Note as these are records of working sessions, the papers are abstracted, and there are questions and discussion of many points raised in the meetings.

033864
DESIGN AND MAINTENANCE ASPECTS OF FREIGHT ROLLING STOCK RELATIVE TO THE EFFECTS ON THE TRACK

Love, A Sugden, EA

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 41971, pp467-482

A modern Railway has grown up in this country with new and more powerful forms of traction and improved signaling and track, but the majority of wagons in use still consist of small four-wheelers, the basic design of which has not changed for over 50 years. These wagons incorporate a 'Box-on-Wheels' design which was robust and cheap, suitable for the low axle weight, low speeds, and low utilization of their day. They are, however, incapable of meeting today's conditions of high utilization and speeds without an unacceptable degree of maintenance and inspection. Until recently very little was known of the behaviour and design parameters necessary for high-speed wagons, and because of this, in 1963 when it became obvious that improved wagon suspension was required B.R. adopted the U.I.C. Double Link Suspension. This was a proven design which was, and still is, in wide use on the Continent, but here again problems arose when operating at higher speeds and axle loads permitted in this country. These problems concerned the rapid wear of the links and saddles due to the friction necessary for lateral damping and spring failures caused by the torsion induced in the spring superimposed on the normal vertical loading.

033865
TOWARDS HIGHER SPEEDS

Miller, TCB

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, No. 61970, pp628-661, 12 Ref

It is essential that track design and locomotive design should be considered together as a single joint problem. Present bogie damper designs for both locomotives and coaches must be developed to the stage where they give satisfactory performance for 150,000 miles. Existing carriage brake gear is inadequate for braking from any higher speed than 100 miles/h and has shown itself not to be able to withstand the buffeting which it gets without costly maintenance. Passenger standards for comfort require future stock to be noise-proof and probably, air-conditioned. Studies of sustained higher speed led to several design changes to such things as carriage brakes, the vehicle suspension of both locomotives and carriages, of the overhead contact catenary on electrified lines and so on. They also focused attention upon the importance of the weight, both sprung and unsprung, on the axles of locomotives and the effect their characteristics have on the permanent way and upon its maintenance.

037209
HUNTING PROBLEM OF HIGH-SPEED RAILWAY VEHICLES WITH SPECIAL REFERENCE TO BOGIE DESIGN FOR THE NEW TOKAIDO LINE

Matsudaira, T, Japanese National Railways

Institution of Mechanical Engineers, Proceedings (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 180, Pt 3F, 1965, pp 58-66, 6 Fig, 1 Tab, 3 Phot

This paper describes the preliminary experiment on hunting by means of a model vehicle; the hunting tests of an experimental bogie and the prototype bogie at the rolling stock testing plant; a considerable amount of various hunting calculations carried out in the design stage; running test, with casual hunting observed, of the prototype bogies on the test track section of the new Tokaido line; and the construction of a bogie finally designed—and gives a number of major results with some discussion on the points to be considered. Elaborate running tests of six prototype cars were carried out on the test track section of the new Tokaido line. In designing this bogie, special attention was paid to the following two points to prevent hunting: (1) Mode of axle-box support and its stiffness: (2) Combination of frictional and elastic restoring force against bogie rotation. According to the running test at 246 km/h this bogie exhibited a very high running stability.

037223
VERTICAL OSCILLATIONS OF BOGIE VEHICLES

Koffman, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, July 1960, pp 73-80, 6 Fig, 1 Tab, 5 Phot, 18 Ref

Considers the oscillations of bogie vehicles and the factors which must be known in order to calculate the frequency of these. As a result of the calculations, the preference for "good" riding qualities results in the selection of helical springs for primary and secondary springs. For locomotive springing, leaf springs are preferred. After discussion of amplitude limits, pitching and the relationships of tractive forces to static deflections, the application of rubber and air springs is discussed. The undesirable effects of 3 types of quill drives are discussed. Factors of drive position, and deflection caused by pitching are discussed last.

037224
THE RIDING PROPERTIES OF BOGIE VEHICLES–1

Koffman, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Nov. 1959, pp 483-487, 8 Fig, 10 Ref

This article discusses the problems of values assigned to ride quality as an indicator of the effectiveness of a suspension system of a rail vehicle. In order to find an index of such performance, a mechanical device such as the Askania Universal Vibrograph is recommended. The charts which are produced by the Vibrograph are evaluated and the application of the results to vehicle design is discussed. The instrument may be used to measure vehicle body oscillations. Vertical acceleration and resonance is included in the measurements. The article concludes with the reminder that the factors recorded by the vibrograph should not be used alone as parameters of vehicle design but should be used with the factors of noise and vibration also.

037225
THE RIDING PROPERTIES OF BOGIE VEHICLES–2

Dilg, WC

Engineering Interchange for Railroad Advancement (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Dec. 1959, pp 538-540, 6 Fig, 3 Tab, 7 Ref

The author explores various theoretical aspects of railway vehicle riding performance as an aid to the rationalization of bogie design. It was shown that low ride index values can be retained by minimizing the natural frequency and/or the amplitude of the oscillation. The importance of damping with respect to amplitude ratio is shown and it is pointed out that dampers are actually undesirable at speeds in excess of 1.41 of the resonance speed. It is also pointed out that damping is of relatively little importance with short swing links. In order to determine the ride index of a rail vehicle, the magnitude of excitation amplitudes, the natural frequency and the damping factor of the system must be known.

037231
STANDARD BOGIE FOR WAGONS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE No. 26, Comm Rpt, Jan. 1968, pp 9-12, 2 Fig

The assignment of the B 12 Committee was to define a bogie able to run at 120 km/h, both on standard-gauge (1.435 m) and on broad-gauge (1.524 m) track, which will permit the automatic traction and shock coupler to be used on wagons and which with the aid of some simple intermediate parts could replace the bogie of the present standard flat wagon. The two solutions were proposed: (1) a bogie with super-critical running gear and a suspension system, (2) a bogie with sub-critical running gear, helical springs and vertical and horizontal friction-damping. Testing consisted of: static strength tests, dynamic strength tests, running tests, and removing and mounting tests with the automatic traction and shock coupler. The results obtained with both types of bogie are good. Comparisons of construction and probable maintenance costs of the bogies have not revealed substantial differences. The bogie with leaf springs is 140 kg lighter than with helical springs. Both are lighter than the present standard bogie. In view of the small differences in the quality of each type of bogie, either could be selected as standard.

037245
MEASURING STRESSES IN CARDAN SHAFTS

Hartle, R, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Oct. 1965, pp 818-820, 3 Fig

A radio telemetry system was developed by British Railways to collect stress data from rotating railcar cardan shafts under service conditions. Torque and bending data were simultaneously handled by amplitude modulation of two sub-carriers. The advantages of this system over conventional slip rings are the lack of difficulties associated with making, fitting and protecting sliprings from atmospheric pollution.

037256
TESTING OF INTEGRAL COACH STRUCTURE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, May 1965, pp 409-412, 1 Fig, 1 Tab, 2 Phot

Following the successful design and construction of Inter-City diesel multiple-unit trains in 1957, the Swidon Works designed an integral coach to comply with the B.R. specification for coaches operating on main lines. The combined coach body and underframe structure was required to be capable of carrying all vertical loads and resist an end crushing load of 200 tons without permanent deformation. Testing of the prototype was in general accordance with conditions adopted by the U.I.C. Office of Research and Experiments, Committee B.7. The tests covered static vertical load and compression at end coupled attachments. Results showed satisfactory performance of the shell under vertical load. Window pillars adequately carried their share of the resistance. Compression load tests showed an upward longitudinal deflection of 7 mm and a shortening of the coach body of 10 mm. The tests confirmed that the general design of body shell met the requirements of British Railways Specification for main line coaches and also normally resists the conditions laid down by Committee B.7 in so far as they apply to coaches with control couplers.

037264
SUB-CRITICAL AND SUPER-CRITICAL BOGIES

Sheppard, FE, Rolls-Royce Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Feb. 1963, p 220, 1 Fig

Subcritical and supercritical design aspects of bogies are discussed, and a diagram reveals pitching frequency versus speed and relative severity for various bogie designs. It was considered improbable that a bogie could be designed more subcritical than the Commonwealth, so that the problem was one of the feasibility of designing a supercritical bogie. Such a bogie must exhibit a natural frequency of 11.6 cycles/sec. for a maximum speed of 90 mph or 12.4 cycles/sec. for 100 mph. It was concluded that such a bogie would pose no design problems even with a pivot load of 9 ton and a maximum speed of 100 mph.

037270
SYNTHETIC RUBBER SPRINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 117, Aug. 1964, pp 167-168, 1 Phot

Neoprene disc springs, developed in Austria, are replacing both the steel and natural rubber springs formerly used, because of their better all-round performance. In service operating tests, neoprene springs have been used on railcar bogies with excellent results. They have all the qualities of steel springs as regards suspension, also self-dampening properties which do away with the need for hydraulic shock absorbers. They have good resistance to oil, heat, weather, ozone, and abrasion.

037272
RUBBER-SPRUNG BOGIE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 1161962, p 289, 1 Fig

The Gloucester rubber-sprung freight-bogie is a springless unit of three-piece form, but without sliding bolster-guides. Design features of this bogie are described in detail.

037275
THE DESIGN OF RAILWAY BOGIES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Nov. 1961, pp 588-589

In connection with bogie design research and development has led to the establishment of ten particular design features which cover primary and secondary spring deflection; primary damping; secondary spring disposition and damping; swing-link design and suspension; bolster anchorage by traction bars; bogie frame stiffness; rotational damping; secondary spring anchorage, and check stop clearances. It has been clearly established by investigation and testing that the inclusion of the recommendations on these ten points into a new bogie design will give a consistently good ride, which is relatively insensitive to tyre wear and to normal track irregularities.

037285
DIESEL RAILCAR HIGH-SPEED INSPECTION RUN ON THE CENTRAL ARGENTINE RAILWAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, Feb. 1945, pp 185-186, 4 Phot

The riding qualities of a C.A.R. twin-articulated diesel railcar, and a B.A.P.R. single-unit diesel railcar on earth-ballast tracks were tested. A standard twin-articulated Ganz diesel railcar and a single-unit Ganz car fitted with the Kimberley patent suspension and Voith-Sinclair hydraulic transmission made an experimental run of 1,157 km. (723 miles). Officials were favourably impressed with the results of the trial, especially as to the comfort and riding qualities of the C.A.R. railcar and the comparative absence of dust up to speeds of 100 km p.h. (62 m.p.h.), but over this speed the riding tended to deteriorate, except on the best stretches of track. The B.A.P.R. railcar rode very well, and, on account of the design of the suspension, it appeared to run more smoothly with complete absence of any pronounced hunting. As its maximum speed did not exceed 100 km p.h. (62 m.p.h.), it was not possible to make direct comparisons over the higher-speed ranges.

037286
BOGIE DESIGN FOR HIGH SPEED

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, Apr. 1945, p 337

Opinion holds that the line of demarkation between low speed and high speed operation, from the coach design point of view, is in the region of 80 to 85 mph. Bogies that have been tested in freight wagons have exhibited good riding qualities at 80 mph, or lower, but have shown themselves entirely unsuited to speeds above 85 mph, in some of the tests the shocks recorded were doubled in intensity as speed increased from 80 to 90 mph. Up to 80 mph the amplitudes of body swing were within reasonable limits, but at 90 mph the body of the box wagon under test was becoming unstable. Experiments proved that, given equal conditions of springing and of maintenance, a six-wheel bogie gives slightly better riding in both vertical and horizontal planes than a four-wheel bogie, and has better braking qualities also; but the gain is not considered to be worth the increase in weight, first cost, and cost of maintenance. In the design of passenger-car bogies, coil bolster springs perform the same duty as the swing hangers in the elliptic spring bogie. Another important requirement is that in wheels for high speed equipment the treads shall be concentric within 0-10 in. Experiment showed that one of the principal factors in causing bogies to "hunt" at speed, is a short and sharp taper close to the throat of the main flange of the wheels, even if the extent of the taper be no more than 1/10 in. No bogie design tried by the Milwaukee has given good riding at high speed if the wheels have been in this condition, and the only way to restore such wheels to good riding qualities is by re-turning or griding them.

037293
NEW ALUMINIUM TRIPLE-HOPPER WAGON

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Aug. 1946, pp 123-124, 2 Fig, 2 Phot

In 1945 the American Car and Foundry Company completed the development of a triple-outlet hopper wagon having a nominal capacity of 70 tons and 2,840 cu. ft. with a light weight of 55,500 lb. The new type has a load limit of 154,500 lb. and the overall width is based on the A.A.R. unrestricted clearance of 10 ft. 2-1/2 in. The body is divided into three vented compartments which can be unloaded separately or simultaneously. The new car is 39.25 in. longer than the A.A.R. standard 70-ton steel hopper wagons, but can increase the payload by about 6.5 tons. The yield strength of the aluminium used is 38,000 lb. per sq. in. which gives a high factor of safety. The thick sheets and plates allows a long life when possible wear in handling abrasive materials is taken into account.

037309
THE RIDING PROPERTIES OF BOGIE VEHICLES–3

Koffman, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, No. 20, Dec. 1959, pp 398-601, 4 Fig, 2 Phot, 18 Ref

Recent vehicle development has led to the introduction of railcars and locomotives with unsymmetrical body-weight distribution, resulting in the use of bogies of differing design at each end. The author explores theoretical predictions of railcar and locomotive riding performance as an aid to the rationalization of bogie design.

037413
A METHOD FOR THE MEASUREMENT AND ANALYSIS OF RIDE VIBRATIONS OF TRANSPORTATION SYSTEMS

Catherines, JJ Clevenson, SA Scholl, HF

National Aeronautics and Space Administration, Hampton, Virginia, 23365

NASA TN D-6785, Tech Note, May 1972, 30 pp, 18 Fig, 10 Ref

One important consideration in the design of any public transportation system is passenger comfort, or the ride quality required to assure passenger acceptance. Extended periods of low-altitude flight with STOL aircraft or lengthy trips on high-speed trains over unimproved track have revealed that ride-quality considerations are of major importance for such systems. However, very little quantitative or descriptive information exists on ride quality. Part of the difficulty in developing ride criteria stems from the problem of measuring, recording, and analyzing the dynamic environment associated with public transportation vehicles. The purpose of this report is to present the method or technique employed for measuring, analyzing, and interpreting vibratory accelerations associated with passenger vehicles. Sample measurements and results obtained on a number of vehicles are presented in the form of peak accelerations, power spectral densities, standard-deviation values, and histograms.

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037416
ON HUNTING OF HIGH SPEED RAILWAY VEHICLES

Yokose, K, Railway Technical Research Institute

Japan Society of Mechanical Engineers, Bulletin (Japan Society of Mechanical Engineers, 1-24 Akasaka, 4-chome, Minato-ku, Tokyo 107, Japan)

Vol. 14, No. 73, July 1971, p 713

To make clear the hunting phenomenon of high speed railway vehicles general equations of motion were derived of bogie car on the new Tokaido Line, and the roots of characteristic equation were obtained by digital computer. The supporting stiffness of the axle with respect to the truck frame is capable of eliminating the body hunting whenever a proper supporting stiffness is chosen, and the body acts as a stabilizer of the truck hunting. When the creep coefficient decreases, a remarkable body hunting of yawing mode occurs. The analytical result closely agreed qualitatively with the experimental ones obtained using a one-fifth model car at critical speed of truck hunting.

037417
"LRC" PROTOTYPE DEMONSTRATED–POWERED BANKING ON CURVES IS KEY FEATURE ON NEW CANADIAN FAST-TRAIN CAR

Shedd, T

Modern Railroads (Watson Publications, 5 South Wabash Avenue, Chicago, Illinois, 60603)

Dec. 1971, p 60, 3 Phot

The prototype coach of Canada's high-speed "LRC" train has successfully undergone running tests at speeds in excess of 90 mph. When completed, the "Lightweight Rapid Comfortable" train would operate in pushpull service, with a locomotive at each end and up to 12 coaches, at speeds up to 120 mph on existing North American Tracks. LRC's most significant engineering feature is its "powered banking" system, built into the car suspension. The two-axle trucks, are basically of conventional design, but they have an additional bolster that can tilt the car body to compensate for up to 10 deg of unbalanced superelevation. Each truck has a sensor, which responds to centrifugal force and seeks a bank angle that will reduce this force on the passengers to near-equilibrium. The sensor activates a servo mechanism that causes the banking bolster to be rotated hydraulically until the car body meets the desired bank angle.

037425
TILTING COACHES TO RAISE SPEEDS ON CURVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Sept. 1970, pp 655-659, 4 Fig, 1 Tab, 7 Phot

Of all the ways in which overall passenger train speeds can be raised, tilting the coach body inwards on curves is probably one of the easiest and cheapest. As a result, there are now three countries with tilting coaches in service, and a further six with experimental or prototype stock at an advanced stage of development. The design of these trains and their limitations are discussed.

037427
THE QUESTION OF SIZE FACTORS IN CALCULATING THE STRENGTH OF RAILWAY WHEEL-SET AXLES

Brinkmann, P

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 5, May 1970, pp 185-193, 13 Fig, 3 Tab, 10 Ref

Numerous indications are given in technical literature about the decrease in the bending strength of axles in relation to an increase in size, but the views are widely divergent. This article considers the size factors or coefficients to be used in calculating the strength of shafts or axles subject to bending reversal stresses, and attempts to correlate the various findings to clarify these theoretical considerations. The influence of other factors such as the geometry of the axle, and also the technology of heat treatment of the steels, is included. The effects of the pressing on of wheels on to the wheel seat of the axle, and the notch effects in the geometry must also be considered in determining the strength of axles.

037429
ON THE USE OF INDIVIDUALLY SUPPORTED FREE ROLLING WHEELS ON RAILWAY VEHICLES

Becker, P

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 11, Nov. 1970, pp 457-463, 8 Fig, 3 Phot, 12 Ref

The kinematics of wheel-sets on railway vehicles is discussed in theory. The tests are reviewed which were made of individually supported, free rolling wheels in frames under vehicles without a rigid connecting axle from wheel to wheel. The conclusions of this study point out the following: free rolling wheels have no guidance capabilities along the rail; wear on the curves is not avoided by free wheels. Safety factor against derailments is less than with conventional wheel sets, since the free wheel cannot develop sine waves in its running, it runs free of such lateral vibrations and is therefore quieter.

037434
TRAILS WITH GLUED WHEELSETS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Jan. 1969, p 61, 1 Phot

One of the most recent developments in the metal adhesives field is their use in the assembly of wheelsets. One reason for this is the increasing demand for lighness of unsprung parts. The normal method of assembly of wheelsets by interference press fit has reached the limits which the materials can withstand. A careful choice of the adhesive to be used is most important in all cases, but especially so for such highly stressed parts as wheels, axles and tyres. With these factors in mind, the German Federal Railway decided on an experimental application of the process. Four axles were assembled using adhesive methods in the repair works at Stuttgart-Bad Cannstatt. For the joints between the wheel hubs and axles a very strong adhesive of low viscosity was chosen, but it was decided to press on the axle in the usual manner. A first test on a wheelset testing machine at the Minden Research Institute took the form of running 10,000 km with a constant axleload of 17 tons. This produced no displacement of the glued components, and it was noted that the wheelset ran remarkably quietly.

037435
DB EXPERIMENTS WITH POWERED TILTING OF COACH BODIES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Jan. 1969, pp 57-58, 2 Fig, 2 Phot

A three-car diesel train with air suspension has undergone field testing to develop an electro-pneumatic servo which tilts the body inward on curves. The three-car diesel train has been run experimentally at 130 km/h over a route that is largely limited to 105 km/h. If the train itself was capable of higher speeds it is claimed that 135 km/h could have been attained safely. Air springing provides the tilting mechanism, the servo system being arranged so that the air bellows on the outside of the curve are inflated and those on the inside deflated, thus tilting the body relative to the bogie towards the inside of the curve. The centrifugal force that can be tolerated without discomfort is taken as 0.067 g, which is equivalent to a cant deficiency of 100 mm.

037437
RUBBER IN WAGON SUSPENSIONS

Hirst, AJ, Dunlop Company, Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Oct. 1969, pp 776-779, 5 Fig, 1 Phot

The article is a discussion of the ways in which rubber suspension can provide stable running of railroad vehicles at high speed. The need for controlled flexibility in all directions for vehicles can be provided by chevron springs which have been tested in locomotive and passenger car suspension systems. Illustrations and discussions of the various forces at work in these chevron types of suspension systems are included.

037439
KONI DAMPERS ON BRITISH RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Oct. 1969, pp 771-773, 4 Fig, 2 Phot, 2 Ref

The article is concerned with the use of Koni dampers on British Railway vehicles. The construction, operation, adjustment and lines characteristic of these dampers are discussed. The use of special Koni dampers in air suspended vehicles is mentioned as well as the fitting of the units to the vehicles. Finally, results of testing these dampers as well as the operational life is discussed. At present, the units have completed at least 125,000 miles while some have exceeded 200,000 miles. As yet no failures have been reported and operational characteristics remain within acceptable limits.

037440
RECENT DEVELOPMENTS IN RUBBER SPRINGS

Hirst, AJ, Dunlop Company Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Mar. 1969, pp 231-234, 3 Fig, 2 Phot

The unique advantages of using rubber based springs are discussed. The factors which must be considered in the composition of the rubber used in such springs are included as well as the effects of temperatures upon the performance of these systems. Secondary and primary suspensions in which the Metalastik springs have been used, are described and discussed. Several needs in the field of rubber compounding are specified.

037446
WHEELSET DEVELOPMENT REVIEWED BY ENGINEERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, July 1969, pp 550-553, 1 Fig, 2 Phot

Design and wearing qualities to accommodate increased speeds and axleloads predominate in the papers delivered at the Third Wheelset Conference. Spalling of wheels experienced on North American rapid transit systems had been brought about by wheel slip and it was recommended that a total adhesion system should be considered at the design stage of coaches. In introducing synthetic brake blocks where wheel tyre cracking existed and it was considered that tyre steels which should be used were those which did not have a hardening tendency and soft steels of low carbon content which were immune from heat cracking. Resilient wheels for use under rail vehicles for suburban and main line railways, cast steel wheels, hollow-tread profiles, wrought-steel wheels, and non-alloy wheels are also briefly discussed as well as cast steel wheels.

037448
WHEELSETS UNDER CURRENT CONDITIONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Aug. 1969, pp 591-592

The importance of heat-treatment techniques and their effect on wheels carrying increasing loads at faster speeds were discussed at the three-day Third International Wheelset Conference. Most speakers accepted the martensite theory without advancing reasoned criticism of the "plastic-strain cycle" theory or attempting to discuss a cardinal point that thermal cracking could occur at hot-spot temperatures below the transition temperature, so that no martensite was produced. Development of resilient wheels was considered somewhat slanted in favour of the screwless, single-ring type. Performance of single-ring wheels in which the rubber was both in shear and compression was based on the assessment of the desired load-deflection characteristics in the radial, tangential and axial directions.

037464
STEERING CHARACTERISTICS OF BOGIES

Newland, DE, Sheffield University

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Oct. 1968, pp 745-750, 12 Fig, 3 Ref

This article, which is a description and analysis of the fundamental steering properties of four-wheel bogies, considers the limitations of bogie vehicles for high speed operation and compares their performance with estimates for the APT, the 250 Km/h advanced passenger train. Because bogies act to attenuate the effect of road bed irregularities, there are strong reasons to favor bogie vehicles whenever passenger comfort is a major consideration. A possible disadvantage is that bodies designed to be dynamically stable at high speeds may need a primary suspension which is too stiff for good steering properties. It is concluded from mathematical studies that a dynamically optimized bogie still provides satisfactory guidance, comparable with a four wheel vehicle with a very soft suspension, and bogies should not, therefore, be regarded as unsuitable for high speeds.

037465
THE ADVANCED PASSENGER TRAIN

Smith, SF, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, June 1968, pp 109-416, 4 Fig

A high performance lightweight train has been studied and a comprehensive series of computer evaluations has been carried out, indicating that this advanced passenger train (APT) will be capable of operating with safety and comfort at speeds 50 percent in excess of present line restrictions. For the APT a power to weight ratio of some 15 hp per ton is required compared with 5 to 6 hp/ton for the present inter-city diesel-hauled trains. A light-weight stressed-skin aluminium structure has been adopted. The portable power unit and transmission are described. Train resistance, tractive effort and adhesion required for an eight-unit APT with two power cars is plotted. Tapered body profile to be used for the advanced passenger train will allow it to tilt relative to the track. The braking system will probably be hydrodynamic.

037466
PRIMARY SUSPENSIONS FOR COACH BOGIES

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Feb. 1968, pp 108-111, 3 Fig, 1 Tab, 2 Phot, 7 Ref

British Railways adopted the Schlieren type of cylindrical axleguides with their B4 and B5 bogies, now used in large numbers under coaches running extensively at 100 mile/h. The use of friction dampers is described to reduce bogie pitching oscillations at speeds above 75 mph. The design of the integral friction damper for the primary suspension of high speed, Russian coaches is illustrated and described. The clouth roll spring used on Hamburg Underground and the German Railway interurban coaches is also described. Test results for clouth springs on a British Railways experimental bogie are reported.

037472
SYNTHETIC MATERIALS AND GLUED CONNECTIONS FOR RAILWAY ROLLING STOCK

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE No. 26, Comm Rpt, Jan. 1968, pp 23-24, 1 Fig, 2 Phot

Question B68.

Fiberglass reinforced resin composites are desirable over metal structural components because of light weight, high elasticity, corrosion resistance, and high acoustic, electric and thermal insulation capacities. Principal applications of synthetic materials for large components are discussed and include: end walls, framework and roof parts for locomotives; sliding doors and roofing for freight cars; vehicle bodies for refrigerator vans; and tanks for tank cars.

037587
INVESTIGATION OF WHEEL SETS

Egelkraut, K, Bericht aus der Abteilung fuer Mechanik
Lange, H, Bericht aus der Abteilung fuer Mechanik
Mussnig, V, Bericht aus der Abteilung fuer Mechanik

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 15, No. 9, Sept. 1966, pp 346-360, 10 Fig, 2 Tab, 20 Phot, 3 Ref

With the increasing axle loads and train speeds, the stress limits are being approached for the steels used in the wheels, tires and axles. Described are the various aspects of the work being done to cope with the ever-increasing problems of axle, wheel tread and tire defects and failures. Magnetic particle testing and ultrasonic testing techniques are described, as also the balancing of the wheel sets and the testing of the form stability and strength of the axles. The results of these tests are tabulated.

037604
TOWARD A WEARLESS TRUCK

Gaertner, W

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 9, Sept. 1965, pp 406-413, 16 Fig

Apart from the wear at the wheel treads bogie or truck wear is confined to the journal boxes and guides, the truck and bolster suspension and connections, and the truck pivots or center plates. The use of modern rubber suspensions can now make the "wearless" truck a practical reality, as well as providing the desirable qualities of dampening the oscillatory motions vertically, longitudinally and laterally. The author describes these developments and presents with illustrations locomotive and car trucks built with the various types of rubber suspensions.

037621
RUBBER IN RAILWAY ENGINEERING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Jan. 1957, pp 71-72, 3 Fig

Design of bogies employing rubber to avoid wear on metal surfaces, thus increasing service lift of rolling stock, is discussed. The Silentbloc suspension system is illustrated. The rubber suspension system designs attempt to eliminate bogie hunting by eliminating all wearing parts, providing spring action in three degrees of freedom, and giving a suspension system with constant periodicity.

037624
ADVANTAGES OF HYDRAULIC BUFFERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Feb. 1957, pp 180-181

The hydraulic buffer automatically produces a steady retarding force of such a value that, whatever the speed of impact, the wagon is brought to rest as the buffer-stroke is completed. These buffers also produce a very low recoil. Hydraulic buffers make it possible for the safe speed of impact, to be raised from something over 4 mph to nearly 10 mph. Present-day marshalling yards already work with impact speeds of 10-12 mph and a survey carried out at one hump yard showed that 4 percent of impacts were at speeds of more than 10 mph. Hydraulic buffers also have a part to play in the reduction of shock in trains fitted with continuous brakes.

037626
BRITISH TIMKEN RAILWAY WAGON BEARING UNIT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Mar. 1957, pp 251-252, 1 Fig, 4 Phot

A new railway wagon bearing unit is in use on railway freight vehicles. The new design constitutes a two-part assembly which completely replaces the conventional roller-bearing axlebox. Production of the new assembly is much simpler, and therefore much more economical, than that of a conventional axlebox. Normal service wear is confined to the axle guard grooves of the horsehoe adapter. These are linered, and the liners can be renewed without interfering with the wagon bearing unit.

037630
EXPERIMENTAL COACH WITH PENDULUM SUSPENSION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, May 1957, p 506, 1 Phot

The prototype coach of the French National Railway, which uses a pendulum suspension to improve stability, is shown and described. The relationships between speed, superelevation of the track and centrifugal force are explained. In trail tests run at about 100 mph, g-forces were reduced from 0.24 to 0.06 by the use of the pendulum suspension, which greatly added to passenger comfort and reduced track stress.

037633
PROTOTYPE AUTOMATIC COUPLER FOR BRITISH RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, May 1957, pp 625-628, 1 Fig, 3 Phot

The prototype A.S.F./v automatic coupler was designed for use on high-speed freight trains. The unit is one of the first to be equipped with either an automatic vacuum or air connector. The present prototype of the coupler is designed to take a drawbar pull of 40,000 lb. but it will be tested with a load of 140 tons giving a safety factor of approximately eight to one. This second prototype has, a greater range of buffer height and incorporates the hydraulic draft gear as an alternative to the rubber gear fitted to the first unit.

037635
CONVERSION FROM PLAIN TO TAPERED ROLLER BEARINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, June 1957, p 711, 1 Fig, 1 Phot

All coaches of the Morning Talisman were fitted with the Timken Tapered roller bearings. Special design problems were involved for each type of coach, because the bogie designs varied. A diagram shows a Timken dual race bearing with a 4.5-in. bore and an outside diameter of 7.94 in.

037637
LIGHTWEIGHT PASSENGER STOCK DEVELOPMENT IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Aug. 1957, pp 135-136, 3 Phot

A prototype stainless-steel passenger car, the Pioneer III, which meets all the strength and safety requirements of the Association of American Railroads, with a net weight of 595 lb. per passenger, has been designed by the Budd Company, Philadelphia. A feature is the lightweight four-wheel bogie with single air spring on each side, with tubular axles, and outside-mounted disc brakes. The basic design is suitable for both suburban and main line stock. The principal parts of the bogie are the side frames, bolster, and two air springs; there are no equalizer beams, springs, swing hangers, spring plank, or transom. Interior partitions are of micarta-faced plywood which is resistant to wear. Use is also made of laminated plastics for doors, vestibule ceiling panels, exterior door inner panels, air ducts, enclosure aroung the air conditioning, and seating.

037640
AUTOMATIC ARC WELDING OF RAILWAY WHEEL TYRES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 74, Apr. 1941, pp 424-425, 1 Fig, 2 Phot

Worn wheel flanges are being repaired by the automatic arc welding process, which allows the wheels to undergo three times the number of machinings before reaching the scrapping stage. It is estimated that the net savings over previous methods used is 50 percent. The process is that of the Fusarc Welding Co., Ltd. of Letchworth, and is carried out with a standard Fusarc stationary type automatic arc welding head mounted on a specially designed jug to hold one pair of wheels. The details of the machine and process are illustrated.

037653
DEVELOPMENTS IN SPHERICAL ROLLER BEARING AXLEBOXES–1

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Dec. 1957, pp 655-656, 2 Fig, 4 Phot

The design of the spherical roller bearing has been improved to give an increased fatigue life of some 200 per cent compared with that used in railway axleboxes for over 35 years. The principal feature of the spherical roller bearing, its self-aligning property, has not been affected by using only one spherical roller bearing per axlebox, but even in rigid boxes where two bearings are used side by side, the self-aligning property of this kind of bearing is still valuable. Test equipment for accelerated life tests is shown.

037654
DEVELOPMENTS IN SPHERICAL ROLLER BEARING AXLEBOXES–2

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Dec. 1957, pp 707-710, 5 Fig, 4 Phot

The carrying capacity of a roller bearing is increased to a greater extent by using larger diameter rollers rather than by increasing the number of rollers. Except for the difference in the end faces of the rollers, the rollers in the new SKF Type C spherical roller bearings are symmetrical. The close conformity and the uniform distribution of the load over the roller length–give an increased carrying capacity of approximately 15 percent. This means approximately three times longer fatigue life, a factor of no little importance. The bearings are pictured in several railway applications.

037658
JOURNAL STOPS FOR WAGON-TYPE PLAIN BEARINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Oct. 1958, pp 425-426, 2 Fig, 3 Phot

In a new A.A.R. journal bearing assembly, with all dimensions nominal and journals central laterally, the maximum displacement from impact is 7/16 in. Bronze stops, cap screwed to the side wall of the journal box to prevent displacement of the journal out of its bearing were considered the most practicable means to achieve the desired stabilization. The increased bearing life obtained with the journal stops is principally because of reduced end wear and the elimination of spread linings.

037667
A WHEEL PROFILE: FOR BETTER RIDING AND LONGER WHEEL LIFE

List, HA

Modern Railroads (Watson Publications, 5 South Wabash Avenue, Chicago, Illinois, 60603)

May 1970, pp 61-62, 4 Fig, 1 Phot

Riding qualities can be improved and wheel life can be extended by making rather modest modifications to conventional profiles. The present AAR profile has one major shortcoming in common with the conventional British profile, and one additional problem that is unique to railroading in North America. The common problem is that there are two points of contact between the wheel and the rail when flange guiding is required. The uniquely American problem is associated with the inward cant at a 1:40 angle whereas the angle of the tread face is 1:20. Because of the angle between the rail and the tread face, there is rapid tread wear immediately after wheels are turned and an attendant loss in lateral riding qualities. The proposed profile uses a basic taper of 1:40. A flange throat contour which at all points has a slightly larger radius than the head of the rail, and a short section of flange face at a 70-degree angle. The region of the tread face which gets the least use is relieved at a 1:10 tamper. Using a modified flange throat contour will improve the steering action of a wheel set lateral movement of the wheel will be opposed by a smoothly increasing lateral restraining force and on a curve the rolling radius of the outside wheel can increase much more than is possible with a conventional wheel set.

037668
LABORATORY INVESTIGATION OF TWO FAILED JOURNALS SUBMITTED BY NORTHERN PACIFIC RAILWAY COMPANY

Wisnowski, MJ

Association of American Railroads, Research Center, Chicago, Illinois

MR-455, Sept. 1969, 38 pp, 2 Fig, 29 Phot

Two failed journals caused derailment of a loaded hopper car in Minnesota in February 1969. These two failures can be attributed to an excessive heat input resulting from high frictional forces. The high frictional forces on covered hopper car could have been the result of: unequal load distribution on the bearing and journal; the lack of journal stops on the journal box allowing longitudinal displacement of the journal bearing wedge and journal bearing; the lack of a real oil seal on the journal box; plus such factors as lack of lubrication and poor pad condition. High frictional forces on flat car KDTX 324 resulted in four secondary heat patterns which indicates that this journal was heated above the crtical temperature and cooled four different times. Chemical analysis and spot test showed the presence of copper, which possibly resulted from the journal having turned on the bearing back after the lining metal had melted.

037681
WHEEL LOAD, WHEEL DIAMETER AND RAIL DAMAGE

Code, CJ, Pennsylvania Railroad

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, 1960, pp 1219-27, 2 Fig, 1 Tab, 1 Phot

The theoretical work of several authors is analyzed to determine the wheel loading which will cause rail stress of sufficient magnitude to cause rail failure. The recommendations of the Joint Committee on Relation Between Track and Equipment limit the load on 33-in. wheels to 26,400 lb., on 36-in. wheels to 29,200 lb., on 38-in. wheels to 31,200 lb., on 40-in. wheels to 33,000 lb., and on 42-in. wheels to 34,900 lb., for worn wheels and worn rail. Since these values agree rather well with the theoretically determined values to produce rail defects, it is recommended that the Committee limits be accepted generally.

037684
CLEARANCE ALLOWANCES TO PROVIDE FOR VERTICAL AND HORIZTONTAL MOVEMENTS OF EQUIPMENT DUE TO LATERAL PLAY, WEAR AND SPRING DEFLECTION

Mills, EE

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 61, 1960, pp 549-554, 4 Fig

A method for calculating lateral clearance requirements for passenger cars on curved track is presented considering the following factors: roll of car body, due to unequal spring deflections and play in side bearings; displacement due to swing-hanger movements and lateral play and wear in truck parts, and allowances for the effect of track irregularities and dynamic behavior of equipment. The results obtained are only as good as the basic information, such as degree of curvature and elevation. For best results, it is recommended that actual field conditions be determined by actual field measurement, determining curvature by string lining and elevation by cross levels. Variation of a few minutes in curvature should not be ignored.

037685
AXLE STRESSES

Mcard, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Sept. 1940, pp 323-324, 5 Fig

A comprehensive survey of the methods used to determine axle stresses has been made. The axles are classed as carrying axles or driving axles. In this portion of the survey report, bending moment diagrams are shown for braked and unbraked carrying axles for both the inside and outside bearings. The bending moment diagram for a carriage axle including allowance for the overturning effect at speed is also illustrated.

037691
VEHICLE DESIGN RELATED TO TRACK CONDITIONS

Hancock, RM, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Apr. 1959, pp 445-446

Recommendations which may influence improvements in the safety and comfort of passenger-train rolling stock are made in a paper, Vehicle Suspension and Bogie Design in Relation to Track Conditions, by Mr. R.M. Hancock of British Railways. The paper deals with the necessity of relating vehicle suspension and bogie design to the track conditions likely to be encountered in practice, particularly where lateral and crosslevel wave shape are concerned, as these are most likely to produce discomfort. The vehicle-response basis of systematic testing main routes as carried out with the Western Region track-testing car has provided much of the experience from which the illustrations in the paper are drawn. The effects of coning and track shape, in relation to the riding of four-wheel vehicles, are considered with reference to an investigation of their derailment in fast trains.

037696
BODY ROLLING AS INFLUENCED BY BOGIE SUSPENSION–1

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Sept. 1960, pp 330-331, 1 Fig, 1 Tab, 1 Phot, 6 Ref

Considerations of design variables affecting the angle of roll of bogie vehicles is discussed. A standard Russian coach bogie with divided bolster swing links is shown. Tests carried out with modern coaches running through curves at a steady speed resulting in an unbalanced lateral force equivalent to 0.1 g show that the angular displacement varies between 0.019 and 0.032 radians. With some modern bogie locomotives using laminated bolster springs and operating at speeds of up to 90 mph the angle of roll on straight track was found not to exceed about 0.005 radians. Roll stiffness of coaches, railcars, diesel and electric locomotive bogie suspensions for British Railways stock and the angle of roll are tabulated.

037698
NON-LINEAR SPRINGS

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Aug. 1960, pp 164-166, 4 Fig, 7 Ref

The problem of ensuring satisfactory riding characteristics with vehicles operating in suburban services is particularly difficult because, as far as the bolster springs are concerned, the rush-hour load can exceed the weight of the vehicle body. Consequently, a static deflection of 4 inches under tare load will mean a static deflection of 8 inches and more under overload. General design considerations make it often necessary to deviate from the constant frequency relation, particularly when dealing with heavy overloads. To ensure a non-linear characteristic, rubber cones are used inside helical bolster springs and use is also made of suitable rubber springs sometimes incorporating helical springs vulcanised in them also to prevent undue barreling out of the hollow rubber cylinders. The use of non-linear centering devices is beneficial by reducing the degree of coupling between bogie hunting and body nosing and swaying in the range of low amplitude and frequency oscillations.

037700
BODY ROLLING AS INFLUENCED BY BOGIE SUSPENSION–2

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Sept. 1960, pp 393-396, 5 Fig, 6 Ref

The effective length of the swing links should be considered in terms of the natural frequencies of lateral and nosing oscillations, as well as swaying, frequently, the use of relatively long links is desirable to reduce the sensitivity of the suspension to lateral track irregularities and to achieve a low natural frequency of the lateral track irregularities and to achieve a low natural frequency of the lateral and body nosing oscillations. Particular attention must be paid to lateral displacement for this is determined by the effective link length and the lateral force. Another solution consists of pre-loading the bolster laterally, the centering springs action increasing usually in direct proportion with the displacement, a feature found with leading bogies of steam locomotives and some modern bogie electric locomotives. The natural frequency of oscillation for a British Railways coach is determined mathematically. Articulated swing links used in Switzerland are briefly described.

037701
FRICTION-CONTROLLED SUSPENSION FOR WAGON BOGIES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, May 1960, pp 573-574, 2 Fig, 1 Phot

British Railways has 200 cars equipped with friction-controlled trucks with unit brake beams. The integral friction-controlled suspension system for car trucks is designed to provide maximum shock cushioning at high speeds. The ends of the bolsters are supported on nests of coil springs. Sandwiched between the guide faces of the bolster and the guide surfaces of the frames are spring-loaded friction shoes. The controlled friction damping permits use of long-travel low-rate coil springs which give maximum cushioning for all loading conditions. The side frames can be supplied with either the hanger type suspension brake beams, or pockets can be cast in the frames to accommodate the unit type brake beam. The bogie frames can be arranged to accommodate roller bearing axleboxes and either integral or separate plain bearing boxes.

037702
FRICTION DAMPING

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Nov. 1959, pp 422-425, 4 Fig, 4 Phot, 4 Ref

The Alsthom truck for Co-Co electric locomotives, the S.I.G. truck for electric railcars, the Werkspoor truck for electric railcars, and Allan truck for diesel-electric railcars are photographed showing the spring systems. The action of friction (Coulomb) and hydraulic (viscous) damping is illustrated with the aid of force-displacement diagrams. The effect of friction and hydraulic damping on force transmission and oscillation amplitude ratio as a function of frequency ratio and the effect of oscillation amplitude on dynamic stiffness of leaf springs as affected by friction are also illustrated. The advantages of friction damping are mentioned.

037703
HYDRAULIC DAMPERS

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Oct. 1959, pp 362-366, 6 Fig, 2 Tab, 2 Phot, 6 Ref

As far as vehicle suspension incorporating steel springs is concerned, the number of damping characteristics can be limited to two; friction damping and viscous damping. Friction damping occurs in every system and is maintained by friction forces acting in opposition to the motion. With true (Theoretical)viscous damping the damping force opposing the oscillation is proportional to the velocity of the latter. Many hydraulic dampers meet this requirement over the lower range of their characteristic. The effect of damping on the pattern of vibration decay and the effect of damping on the force and displacement transmissibility and resultant acceleration are shown. The Askania hand vibrograph is illustrated, along with the vibrograph records of diesel-electric locomotives. Typical characteristics of various damping methods encountered with railway vehicles are graphed.

037705
A NEW METHOD OF DYNAMICALLY STABILIZING RAILWAY BOGIES, FOUR-WHEEL WAGONS, AND ROAD-RAILERS AGAINST UNDESIRABLE LATERAL OSCILLATIONS

Williams, D

Institution of Mechanical Engineers, 1 Birdcage Walk, Westminister, London SW1, England

Vol. 180, PT. 3F, Proceeding, 65-66, 1966, pp 125-139, 7 Fig, 1 Tab, 1 Ref

A new method is described of dynamically stabilizing railway bogies, four-wheel wapons, and road-railers so as to be proof against undesirable lateral oscillations. It is generally accepted that the root cause of all such oscillations is the inherent instability of the ordinary axle-set, i.e. the integral unit of live axle and two wheels. By seeking to eliminate this instability, the new method tackles the problem as its source. The principle relied upon in the method is that of the inertia-guided axle, i.e. an axle with a leading guiding arm that is integral with it in yaw and that is connected at its forward end, by means of a velocity damper, to a floating mass whose lateral inertia provides the necessary guidance. Alternate guiding arms come into action wherever the direction of travel is reversed.

037706
SINGLE-AXLE TRUCKS AND ARTICULATED CONNECTIONS FOR MULTIPLE-UNIT, HIGH-CAPACITY RAILWAY CARS

Weber, HB, Midland-Ross Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-RR-7, Paper, May 1966, 8 pp, 5 Fig, 1 Tab, 3 Phot

The development, design and functional characteristics of an articulated multiple-unit high-capacity hopper car, equipped with two 6.5 x 12 single-axle trucks, are described. Road tests of the 4-unit articulated car were conducted by Southern Railway, under empty and loaded-car conditions at speeds up to 40 mph on branch lines and 65mph on main lines. The articulated connection functioned satisfactorily during road tests in which the 4-unit articulated car successfully negotiated various curves and crossovers on main line, branch line, and in railroad yards without any signs of distress.

037711
CAR ROLLABILITY ON GRADES

Smith, FR, Union Pacific Railroad

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 58, 1957, pp 1118-24, 6 Fig

This report discusses the various factors which decrease the rollability of railroad cars. These factors include: center and side bearings of trucks; broken, scored or unlubricated bearings; tolerance of axle bearing and truck bolster in side frame; plus dragging brakes. Findings suggest methods to increase rollability of rolling stock with related savings, such as improve center and side bearings with good lubrication; use of rust resistant materials; redesign brake rigging to minimize dragging of brakes resulting in locking of the truck; and creation of a device to free brakes with air is bled from the system.

037714
MARKET PLANNING AND HIGH CAPACITY TRUCKS

Hohorst, HG, New York Central System

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 4-16, 16 Fig

Poorly designed cars, i.e. cars with poor payload to tare weight ratios result in unfavorable competitive positions. Also, low volume favors trucking, high volume favors railroads. However, railroads generally can operate faster on long distances and consequently, hold a competitive edge in this situation. The discussion covers towing costs, profitability of the FLEXI-FLO cement delivery system, profit comparisons for three types of high capacity cars, cost analyses for jumbo tank cars, and other related subjects. It is pointed out that the 125-ton car has the best payload to tare weight ratio. Analysis indicated that the 125-ton four-wheel truck as of today's technology is the next logical lower cost advance for heavier capacity trucks after the 100-ton truck.

037715
THE 125-TON FOUR-WHEEL TRUCK

Moyes, SH, General American Transportation Corporation

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 17-22, 5 Fig

The designing and building of large and more efficient tank cars requires analysis of the car cost in relation to gallonage capacity and maintenance requirements. The author offers some observations that have been made to date in progressing tank car design from the 100-ton capacity truck to the use of the four-wheel 125-ton truck and the six-wheel 150-ton truck with particular emphasis on cost and maintenance problems.

037716
THE SIX-WHEEL HIGH CAPACITY TRUCK

Hawthorne, JW, Atlantic Coast Line Railroad

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 22-26

In very recent years the operating advantages of high capacity cars and traffic advantage of incentive rates have sparked the drive for cars handling very high payloads. This trend toward equipment capable of transporting cargo in large volume, and of great weight, has for the most part been on such a competitive basis that there has been little or no coordination between the designer of the equipment and the responsible railroad officers who must operate it in trains over their road. Advantages and disadvantages of four-wheel trucks for high capacity cars are suggested. Economic trade offs are mentioned.

037717
FOUR AND SIX-WHEEL HYDRAULICALLY EQUALIZED TRUCKS

Cope, GW, Symington Wayne Corporation

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 26-30, 1 Fig

The use of a hydro-pneumatic suspension concept has enabled Symington Wayne to consider producing a six-wheel truck and also to lower the cost and reduce the maintenance problems that are associated with conventional six-wheel trucks. One of the advantages of this system is that it will permit a reduction in the size and the weight of a six-wheel truck. A big advantage is that the height of the truck can be kept down. Another advantage is that all the wheels and axles can be dropped by merely taking the journal box retainers from each position.

037720
FUTURE COUPLER REQUIREMENTS

Faris, WA, Norfolk and Western Railway

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 38-40

The author provides a historical review of coupler design from the old Type D to Types E, H, and F. The long trains of today, subjected to both pull and push, demand a coupler of higher strength than the Type "E" coupler in Grade "B" steel, with some configuration that will reduce jackknifing to a minimum. And a long car, like the Trailer Train or the High Cube Box Car, with a cushion underframe, requires a coupler with a long shank. Some of these demands are difficult, if not impossible, to reconcile with each other and since the recent trends all point toward more cushioning, larger capacities, more and more long cars and a multitude of special purpose equipment, the old hope of the Master Car Builders Association for a single, simple, easier repaired coupler, requiring a minimum of protective stock for repairs now looks like a forlorn hope.

037721
COUPLER CENTERING DEVICES

Cope, GW, Symington Wayne Corporation

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, p 34, 1 Fig

The geometry of the long cars, and the long couplers they must be equipped with, is such that there is almost as much possibility of a miscoupling as for a successful coupling. A possible solution for this problem is a coupler centering device which would automatically position the coupler head over, or sufficiently close to, the center line of track to assure successful coupling. The most difficult application of this principle occurs with cushion underframe cars. The floating still complicates the connection between the truck and the coupler. The whole design is predicted on the fact that the only time there is a need to center and coupler is when the car is uncoupled; when coupled, it is being centered by the other car. The problem of centering couplers is getting to the point where some kind of either a manual or a fully automatic mechanism will be necessary.

037722
THE FULLY AUTOMATIC COUPLER

Martin, A, Symington Wayne Corporation

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 43-48, 3 Fig

Until this coupler is made fully automatic the progress of car construction and train operation will not achieve full potential. Consideration and study of several alternative plans have resulted in the concept of a hook type coupler similar to that used on subways. This coupler basically is of the same general construction as a heavy duty subway coupler used in Rapid Transit operation. One of the basic improvements is the application of a positive lock. The Coupler comprises the main body, a hook spring, a positive lock, an operating cam with an integral lock operating lever and linkage, a cam operating lever and an air cylinder. This coupler is always ready for coupling, it is simply brought into contact with the mating coupler and the hooks engage and lock immediately after the faces are in contact. In the coupled position, the hooks are fully engaged and the positive lock is seated behind the hook nose of the mating coupler to eliminate any possiblity of an unwanted uncoupling for any reason. In order to uncouple, the air cylinder is activated and moves the cam operating lever in a counter-clockwise direction. The first increment of movement of the cam and the integral arm is used to shift the positive lock clear of the hook nose, and then the cam spreads the hooks to effect an uncoupling. Both hooks must be moved over the full limit of travel against the hook springs in order to uncouple. Since the positive lock secures the hook of the mating coupler it is necessary to provide means to operate the positive lock of the mating coupler when uncoupling manually or under certain conditions of automatic operating. To do this an interacting linkage has been provided which, when coupled, forms a parallelogram through the coupler to transmit the operating lever movements to the operated coupler to the mated coupler operating lever and thus actuate both positive locks simultaneously.

037723
FUTURE CUSHIONING REQUIREMENTS

Thomford, WE, Southern Pacific Company

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 48-52

Improved cushioning of future railroad equipment can be obtained by using the high capacity draft gears to protect car structures designed for handling bulk commodities; long travel, end-of-car devices to protect rugged to medium type ladings; and sliding still cushion underframes for medium to fragile ladings. The higher speeds and potentially higher impact forces will dictate greater cushioning effectiveness, not only in the longitudinal mode but in the vertical and lateral directions as well.

037724
THE USE OF HYDRAULIC DRAFT GEARS IN TRAILER TRAIN COMPANY

Taylor, AO, Trailer Train Company

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 52-55

The factors that influenced the decision to install hydraulic draft gears on automobile rack cars are examined. This form of car cushioning was chosen over cushioned center sills because of lower initial costs, lower maintenance and applications costs, and acceptable cushioning performance.

037725
CABOOSE CUSHIONING

Dilg, WC, Waugh Equipment Company

Engineering Interchange for Railroad Advancement (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1965, pp 55-57, 1 Fig, 1 Tab

With the influx of hydraulic cushioning and its sophisticated appeal for use on all types of freight equipment mechanical cushioning for cabooses was re-evaluated in light of present day operating requirements. As in most cushioning devices, reliability in present mechanical cushioning devices was placed on coil springs for the main cushioning and coupler buff units with a friction snubber designed to give reasonable recoil control. Since a desirable level of protection was achieved by mechanical means, the use of a hydraulic cushioning device, with its additional cost, was not economically justified, necessary, or desirable to cushion the present day caboose.

037729
CAR DESIGN PHILOSOPHY FOR CONTINUED RAILROAD GROWTH

Hart, PJ, Baltimore and Ohio Railroad

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 41-50

The author philosophizes on several railroad managements concepts, including fleet planning, productivity management, and organization. He points out that the biggest challenge facing the railroads in meeting growth is to be able to provide the quantity of fleet, the mix of fleet, and the profitability of fleet to handle the available traffic. Car design and supply are critical factors in this area.

037730
ENGINEERING AND OPERATIONAL CONSIDERATIONS IN THE DEVELOPMENT OF A FULLY AUTOMATIC FREIGHT CAR COUPLER

Cope, GW

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 30-41, 9 Fig

During the last few years, many things have been happening to railroads and railroad cars which have rendered the standard couplers of the 40's and 50's inadequate, at least for certain cars and operations. The problem develops from a number of causes, including: the use of long and extra cars; the need to eliminate the manual coupling of air hoses and operation of angle cocks; the need to eliminate manual preparation of couplers prior to coupling; and the need to reduce bypass couplers. Standard couplers are also considered a detriment to increased car utilization. The author outlines some of the areas where the use of a fully automatic coupler would require the cooperation of the car designer and car builder. One solution to the problem of providing automatic coupling is to provide a means of positioning the coupler to within gathering range of any other coupler at all times and automatically, regardless of car geometry. Once the coupler gathering and coupling problem has been licked, the way is open for fully automatic operation.

037731
FUTURE REQUIREMENTS FOR COUPLING OF FREIGHT CARS

Timpany, RD, New York Central System

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 27-29

General discussion is presented on the subject of coupling. It is suggested that a future development for integral trains might be zero slack.

037733
CUSHIONING REQUIREMENT TRENDS IN NEW CAR DESIGN

Leriche, CC, Association of American Railroads

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 18-23

The early history of cushioning and car design is reviewed. During the period from the early 1900's to the present, it is interesting to note the changes that were made in the couplers and yokes. The size of the head and shank of coupler was increased several times to what we now have, and the material was changed to high tensile steel several years ago. There has been quite a change in the yoke, too, from the old riveted type to the current designs in cast steel. During this period, the car structure was undergoing changes and modifications in an attempt to provide more strength and reduce or eliminate failures. Today, only a small percentage of impacts in classification yards occur below five miles per hour. Impacts at speeds from eight to ten miles per hour are not uncommon. The cushion underframes and end-of-car devices are doing a good job in affording better protection to the lading, and they have reduced the stresses substantially in the car structure, particularly the body bolster and ends of box cars. In the future the use of cushion underframes and end-of-car devices for fragile commodities will increase but not in general use.

037734
PROGRESSIVE DEVELOPMENT OF A HIGH SPEED TRUCK DESIGN

Warnock, EJ

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 11-18, 15 Fig

A short review of the XL Truck concept as first applied to 50-ton capacity plain bearing trucks is presented. This is followed by a discussion of the XL Truck as applied to 70-ton roller bearing trucks and specifically the PFE 70-ton Mechanical Refreigerator Car. XL-70 Trucks have separate journal housings, each with supporting coil and friction elements. This construction reduces the unsprung weight and prevents transmission of uncushioned road shock to the side frame by absorbing these shocks as closely as possible to their point of origin.

037735
ENGINEERING ASPECTS OF NEW CAR DESIGN

Mands, WP, Pullman-Standard Car Manufacturing Company

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 5-11

Assuming that marketing establishes a new project, it becomes engineering development's responsibility to define the project and develop a sound performance specification that satisfies the marketing demands; second, establish the design criteria; third, design, analyze, fabricate, and test the product; and fourth, engineer for production. The author reviews some of the engineering experiences at Pullman-Standard in designing 86-foot box cars, and piggyback flat cars.

037743
COUPLERS–LONG CAR PROBLEMS

Byrne, R, Association of American Railroads

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 23-27, 2 Fig, 3 Tab

Concern for increased car length and the resultant need generated by such cars for a 60" coupler is discussed. Included are the results of tests and effect of longer couplers negotiating various crossovers. These couplers would also reduce lateral forces and wheel lift when cars are in a buff mode.

037744
BODY STRUCTURAL PERFORMANCE

Fillion, SH, Waugh Equipment Company

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 28-30, 4 Fig, 1 Phot

When cracks begin to show up on cushion underframe castings of 70-ton cars, laboratory work was initiated to find and correct the problem. It was quickly determined the car rocking and rolling was causing cracking problems in the reinforcing ribs of the casting. A special casting was developed to provide for all rocking moments within the underframe coating itself. After running a number of laboratory tests measuring stresses at the critical areas, tests then were run on such a bolster that was built into a car. The car was loaded, detrucked, and supported at the ends of the bolster as had been done in the lab. Known loads then were jacked into the car and stresses were measured in critical areas. Field tests and lab data were compared, thereby permitting evaluation of the effect of the car structure on the bolster. It was found that the car structure does assist the bolster in resisting rock and roll and that top cover plate reinforcements were effective.

037745
SERVICE RESULTS OF TODAY'S FREIGHT CAR TRUCKS

Taylor, AO, Trailer Train Company

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 31-32

Truck design and performance are reviewed. With only slight modification, trucks in use on todays cars are the same as those that were in use thirty years ago. However, it is pointed out that there are four types of trucks currently being offered for high speed service. Attempts by Trailer Train to lower truck maintenance costs are mentioned.

037746
TRUCK PERFORMANCE

Melrose, MF, Chesapeake and Ohio Railway

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 33-38, 17 Phot

The author is also affiliated with the Baltimore and Ohio Railway Company.

This paper discusses truck performance from four aspects: rock and roll problems (defined as roadability), ride qualities, durability, and maintainability. Numerous slides depict worn truck parts from dismantled 100-ton cars.

037747
TRUCK EFFECT ON TRAIN OPERATION

Garin, PV, Southern Pacific Company

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 39-44

While specifications for freight car trucks cover bolsters, side frames, wheel, axles, springs and many other parts, the author feels that truck performance standards are needed to optimize riding qualities between the rail, the car body and the lading. It is suggested that a practical approach to truck design be maintained to insure the retention of desirable characteristics such as simplicity, interchangeability, rugged construction, and reasonable cost.

037749
HIGH SPEED TRANSIT ENGINEERING

Reed, RT, Pennsylvania Railroad

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 50-58, 10 Fig, 18 Phot

When the High Speed Ground Transportation R and D Act was enacted, a committee was established by cognizant Pennsylvania Railroad Depts to establish criteria and develop specifications for a self-propelled electric multiple unit railroad passenger car. The Pennsylvania awarded a contract for the purchase of 50 cars to the company meeting all their requirements. Details of the design are described and illustrated. Emphasis is on suspension and coupling.

037754
WHEELS OF LAMINATED STEEL, WHEELS OF SMALL DIAMETER AND WHEELS OF NORMAL DIAMETER

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

1970, 1 p

Concerning the performances of wheels in commercial service and loaded in such a way that the ratio P/D is comprised between 10 and 11, the favorable results recorded have been confirmed. From this point of view, the WT quality of steel can be considered as affording a solution. The braking tests have revealed unacceptable deformations in the case of the 920 mm diameter wheels with webs of classical shape. The results obtained with wheels with curved web show that a solution seems to be afforded. For the wheels of a diameter less than or equal to 760 mm, the wheel web shapes at present used by the French and Germans administrations give them an acceptable behavior.

037757
ASEA AND SJ TEST TILTING SUSPENSION WITH PANTOGRAPH ADJUSTMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, May 1970, p 364, 1 Phot

An electronic pendulum or accelerometer senses the lateral acceleration in a curve, and the deflection of the pendulum determines the tilting angle of the coach. The air suspension raises one side of the coach body and lowers the other side; full tilting angle is obtained within 1.5 sec. The system is stable and unaffected by irregularities in the track; the air suspension itself provides a simple level control so that the relation between coach floor and platform height remains constant irrespective of whether the coach is loaded or empty. As well as practical tests, computer simulations of the equipment have been performed. The two-car electric unit used for the tests so far has a maximum speed of 120 km/h, but its gear ratio is to be altered to permit speeds up to 200 km/h.

037758
NON-METALLIC LINERS FOR ROLLING STOCK BEARING SURFACES

Walmsley, RG, Railko Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, May 1970, pp 392-394, 4 Fig, 1 Tab, 2 Phot

Development of asbestos-based bearings and surfaces to obtained specified constant friction characteristics under working conditions is discussed. Asbestos and steel working together will quickly bed down into smooth highly polished working surfaces. This is probably due not only to the resistance to welding with the asperities of the steel, but also to the mildly abrasive properties of the asbestos which produces a lapping action and smooths off the sharper edges of the metal asperities.

037760
MAINTENANCE CHECKS FOR ROLLER-BEARINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, June 1970, pp 471, 1 Fig, 5 Phot

SKF has introduced an instrument for shock-pulse measurement of roller-bearings. The technique is based on spalling or flaking damage in roller-bearings producing mechanical shocks. Short-duration high-frequency oscillations produced by the shocks are transmitted to the bearing housing and by fitting measuring nipples to the housing at selected points, the shocks can be registered by an accelerometer. The magnitude of these is a measure of the degree of damage.

037761
BOGIE DEVELOPMENT IN RELATION TO WAGON CHARACTERISTICS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, July 1970, pp 505-507, 2 Fig, 5 Phot

The first aftermath of extensive modernization has been the realization that low freight train speeds were becoming a handicap to exploitation of the full capacity of the new types of motive power being introduced. Increases in speed with existing designs can bring about considerable increase in wear and consequently upset maintenance costs and programming. British Railways has led the way in Europe with 25-ton axleloads for bogie wagons, and gross loads of 100 tons are now widely accepted for speeds of up to 96 km/h. For speeds of 120 km/h the axleloading on BR is currently restricted to 17-1/2 tons, but loading at this speed must be matched by good riding characteristics. Design work is going ahead with higher speeds in mind. Recent French, English and U.S. bogies designed for high speed are shown.

037764
DB WAGONS FOR LARGE INDIVISIBLE LOADS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Sept. 1970, 3 pp, 2 Fig, 1 Tab, 1 Phot

The German Federal Railway has produced plans for four new bogie wagons to carry heavy out-of-gauge or over-length loads throughout the system. They are all designed to carry heavy and lengthy indivisible loads, such as girders, transformers and chemical plant, and have maximum payloads ranging from 56 to 186 tons. The pivots of all the bogies and connecting beams are without pins. A load mounted on the bearer beams can be transfered to DB heavy road vehicles without additional equipment being required. Wheelsets can be changed to enable the wagon to run on broad-gauge tracks.

037769
LUBRICATION OF PLAIN AXLE BEARINGS IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, Apr. 1955, pp 151-452

A new approach to the problem of overheating plain axle bearings consists of five separate parts assembled in a conventional axlebox. The NMB Sealed Journal Box Kit has undergone more than 2,500 miles of operational testing. Oil consumption is reduced by approximately 90 percent and the causes of hot boxes by 80 percent or more. The cost of eight kits for one car would be amortized in 18 months as freight car travel averages 17,000 miles per year in the U.S.A.

037770
RUBBER SUSPENSION IN BRITISH RAILWAYS COACHING STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Oct. 1954, p 434, 1 Phot

British railways have been conducting experiments with a new development in rubber, known as the Andre-Neidhart system, adapted to the suspension of railway vehicles. This suspension was adopted to replace the conventional method of axlebox and bolster suspension. The trials have indicated that improved vertical riding would be achieved by the fitting of a much stiffer suspension than was usual and that the transverse cushioning effect was likely to give improved riding qualities.

037771
DEVELOPMENTS IN WAGON BOGIE DESIGN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Apr. 1954, pp 466-467, 5 Phot

Cast-steel bogie frames and bolsters are being used for goods stock on many railways. Basically, there are two designs, one employing springs without friction damping and the other, springs which are friction controlled. The bogies can be of either the plank or plankless type, but the self-aligning spring plankless type gives better riding qualities with consequent reduction of wear on bogie guides and on wheel flanges and rails. There is also a reduction in cost and weight due to the elimination of the plank. Friction controlled bogies have long travel bearing springs, although they can be designed for short travel springs, with adequate reserve travel and constant control of spring action. Tests have shown friction controlled bogies give improved riding of wagons at all speeds with consequent reduction in wear and maintenance. Unit brake beams are described.

037773
RUBBER SUSPENSION FOR BOGIES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Dec. 1953, pp 626-627, 5 Fig

The object of these experiments is to determine the practicability of suspending the whole bogie on rubber, and so bring about a reduction in maintenance costs by eliminating all wearing parts such as rubber plates, hanger pins, and bushes, as well as the steel springs. Such suspension would also go a long way toward reducing if not eliminating the running noises resulting from conventional type bogie suspension, particularly in tunnels. A preliminary investigation indicated that the cost per bogie was approximately 50 pounds more than for the standard arrangement. It is anticipated that the life of the rubber units will be approximately ten years, if not longer. The saving in maintenance would more than compensate for the extra initial cost.

037788
IMPROVING THE SUSPENSION AND STABILITY OF RUNNING OF BOGIES

Lejeune, M, French National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Dec. 1951, pp 660-661, 1 Fig, 3 Phot

New coaches have been equipped with an improved Pennsylvania bogie, having reduced play about 1 mm. in new stock designed to take nearly 50 percent of the total load on the bogie. Coaches fitted with these new bogies have an excellent degree of stability in running, up to speeds of 100 mph and over. Double elliptical springs in the bogie were eliminated and were replaced by something flexible, able to damp all stock gradually. The design enabled the total vertical accelerative movements, measured inside the vehicle, to be reduced by some 50 percent, and the shocks caused by passing over the rail joints to be noticeably lessened. These bogies have a control device or system composed of longitudinal and lateral staybars, which dispenses with horn plates on the axle boxes, or guides at the ends of the swing bolsters.

037789
THE USE OF BUFFERS IN RAIL VEHICLES

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, Mar. 1945, pp 233-234, 4 Fig

Few buffers function completely except in the case of wagons, because the impact force passes to the frames through the medium of the buffers, and the design of a buffer that will modify the stress transmitted satisfactorily is a constantly recurring problem. Several buffers are illustrated, including a buffer with compound springs to give a soft response, a collision-type buffer, a hinged buffer for the front end of a locomotive fitted with a cowcatcher, and an emergency drawbar for diesel-electric railcars. By using a combination of steel and rubber springs a relatively high shock capacity is obtainable with consequent advantages to passengers, or goods, and rolling stock. The position of the buffer and coupling unit at the centre of the headstocks assists greatly towards obtaining a small deflection which the frame structure as a unit would otherwise be called on to provide. The flexibility of the coupler on curves has been proved beyond question by the reduced wear of tires and axle journals of vehicle so fitted.

037790
RIDING AND WEARING QUALITIES OF RAILWAY CARRIAGE TYRES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Mar. 1944, p 310

The article discusses testing begun in 1935 to study transverse wheel oscillation and to determine if any benefits might come to changing the 1 in 20 coned wheel to a cylindrical tread wheel. The riding qualities of each wheel type were unique to that profile, but there was a marked influence by track upon wheel motion, at times when motion was controlled by track conditions. The best riding occurred with the cylindrical profile in new conditions and a coning of 1 in 100 as a close second. After much milage the riding factor was the same as the 1 in 20 coning in new condition.

037795
NEW TYRE PROFILES FOR BRITISH RAILWAYS

King, BL, British Railways Research Department

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, No. 1, Jan. 1968, pp 60-64, 8 Fig, 4 Tab, 11 Ref

This article discusses the factors used by the British Railways in determining new wheel profiles which when adopted will result in stability of profile shape, reduced Hertzian stress and improved guidance in curves. These new profiles incorporate "hollow tread" profiles which are the result of wear between wheels and rails. The profiles were selected on the basis of tests conducted to determine the profile which would distribute wear over the tread and to achieve stability of wheel/rail contact. The characteristics of the form profiles are discussed, compared and illustrated.

037801
TANK WAGONS THAT SURVIVE DERAILMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Aug. 1971, p 290

The conclusion of a U.S. Department of Transportation study to reduce the hazards of tank car transportation is cited. A primary hazard of tank cars undamaged during derailment is explosion caused by extreme heat from burning cars in the accident. The pressure relief valves now in service are incapable of discharging the contents sufficiently fast to prevent explosion. A secondary pressure-relief device of substantial capacity such as a rupture disc is recommended for all but highly toxic materials.

037802
ONE-PIECE PRIMARY SUSPENSION BOGIE

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, Engla

Aug. 1971, pp 325, 1 Phot

This article discusses the characteristics of a one piece truck with welded rigid frames, designed for freight service. The truck is equipped with a two-stage primary suspension, load sensitive friction dampers, a hemispherical center pivot, and resilient sidebearers. The main frame is fabricated from mild steel plate, which is of welded construction. These trucks are approved for operation at 60 mph and 100-ton cars.

037814
AIR RESISTANCE OF FAST PASSENGER TRAINS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Aug. 1967, pp 710-711

The article discusses factors to be considered in the design of fast passenger trains based upon experiments with model rolling stock. Factors discussed are body shape, window shape, corrugations, space between coaches, flush lining of roof and sides, and coach ends.

037824
TESTS OF BRITISH RAILWAYS AIR-SPRUNG WAGON BOGIES

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Aug. 1967, pp 573-576, 3 Fig, 3 Phot, 6 Ref

Efforts to ensure good riding qualities for wagons at speeds up to 75 mph have led to the testing of air suspensions for freight trucks. Air springs with their ability to maintain a virtually constant height, and a stiffness universely proportional to the load, would be particularly beneficial, as it would ensure a high equivalent static deflection regardless of load. The results of the rather limited tests have shown that riding qualities of the favorable bellows characteristics which should benefit from reduced hysteresis. This should in turn improve the effectiveness of the assembly when dealing with dynamic loads.

037839
TWO-AXLE PATENT BOGIE FOR FREIGHT VEHICLES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, July 1966, pp 543, 1 Phot

A principal feature of a newly developed bogie is that each wheel can follow rail inequalities closely irrespective of the positions of the others. Thus constant loading between wheel and rail is enhanced and the guiding effect of the wheel flange remains steady. A balanced system has been evolved in which the only direct connection of the brake system and rigging with the bogie frame is through the brake-hanger pins and brackets. The free space around bogies of this type makes a wagon fitted with them well suited to the fitting of automatic centre couplers, a point which is likely to become of some importance in Western Europe.

037840
HEUMANN-LOTTER TYRE PROFILE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, July 1966, p 568, 2 Fig

The Heumann-Lotter tyre profile was evolved with the idea of giving somewhat greater safety against derailment of lcomotives and rolling-stock. This profile was applied to all engine and tender wheels, and was felt to be of particular value with tender-first running with the tender nearly empty, a condition which gave the greatest risk of derailment. Before adoption as the standard profile by the German Federal Railway, 68 percent of all tyre-turning costs were due to needed flange re-profiling. Observations showed that the tyre mileage was 30 percent greater with the new profile than with the old.

037847
GLASS-FIBRE TANK WAGON

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 19, Nov. 1963, p 607, 1 Phot

This tank car was designed for the transport of up to 3,960 gal. of chemicals. It has a welded frame, automatic couplings, rubber springs, and is fitted with air brakes and a screw brake.

037851
AUTOMATIC COUPLERS AND COMPRESSED-AIR BRAKES

Bulleid, OVS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Apr. 1963, pp 469-472, 2 Tab, 4 Phot

The article deals with automatic couplers and compressed-air brakes. Inherent advantages are cited for automatic couplers along with refinements for the future automatic coupler. The Unicupler (developed for the Russian S.A. 3 type) and the Fischer coupler designs are discussed as examples of couplers meeting U.I.C. the International Union of Railways specifications. Coupling problems are considered and the importance of practical testing and experimentation stressed. Air brakes, electrically-controlled brakes, and coupling connections are commented on relative to coupler design considerations. Finally, capital expenditure is discussed along with economics affected.

037861
HEUMANN TYRE PROFILE TESTS ON BRITISH RAILWAYS

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Apr. 1965, pp 279-283, 9 Fig, 17 Ref

A new tire profile, based on the studies of Prof. Heumann, was designed and is illustrated. This tire profile should assist in ensuring good riding qualities, increase the resistance against derailment and this in turn should reduce tire and rail wear, and ensure a favorable wear pattern. This can be done by ensuring one-point contact running and a gradual transition of the throat profile. The result of trials carried out with standard 32 ton British Railways coaches running on B4 type bogies with 3-ft. wheels, positive axle guides, 19-1/2 in. effectively long swing-links and helical springs throughout are shown. Ride index values during acceleration and wear patterns for the tires are given. The tests have shown beneficial results, although further tests are needed.

037894
ROLLER BEARINGS AND ROLLING STOCK DESIGN

Thompson, WT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, Jan. 1950, p 93

The author discusses the contribution of roller bearings to modern rolling stock design. Dealing first with the application to steam locomotives, the use of roller bearings for diesel and electric locomotive, and various types of rail cars are then considered. A major advantage of roller bearings in both starting and running modes is cited.

037896
ELIMINATING THE HOT BOX

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, May 1950, p 533

Elimination of freight car hot boxes is discussed as a result of experience on the New York Central during 1948-1949. The cars used has steel wheels, 5.5 times 10 in. journals, axleboxes fitted with tight lids, deflector strips, packing retainer springs, and drawgear protected by rubber pads. Maximum load on a bearing area in any axlebox could not exceed 199.2 lb. per sq. in. Based on the experience, the following was recommended: a packing retainer should be installed in every axlebox which would be capable of holding the packing in place under impact; journal box lids and dust guards should be kept as tight as possible, and suitable methods used to ensure that water and dirt are kept out of axleboxes; and defective wagon wheels should be replaced at the earliest possible moment. As longer-range measures, redesign of journals and bearings to reduce unit bearing pressures, of axles and axleboxes to eliminate collars on journals, and of frames and drought years of cars to minimize the effects on journal boxes of impacts between cars is suggested.

037898
WAGON STANDARDIZATION AND DESIGN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, June 1950, pp 644-45

During the past 20 years, a solid rolled one-piece, one wear wheel of which the tire is an integral part, has been developed and has been standardized for British Railways. With the increase in capacity of modern all-steel mineral wagons to 16 tons, the laden weight of which is 24 tons axles as used for the tank wagons referred to, with 9-in. times 4.5 in. journals and 5.75 in. dia. wheel seats, were adopted, the stress being somewhat lower, namely, 22,700 lb. per sq. in. behind the wheel seat. After extensive trials, axlebox dust shields, which had always given much trouble, were dispensed with. This design has been adopted by British Railways as the standard for cast-iron axleboxes. A uniform standard van was adopted with hinged doors, incorporating pressed-steel ends, having 5/8-in. thick softwood boards or other suitable materials for the sides. The vehicles will be mounted on standard steel underframes, 17 feet 6 inches long with a 10-feet wheelbase, generally fitted with vacuum brake for fast freight working, having a load capacity of 12 tons, with the latest improvement in drawgear, axleboxes, and other fittings.

037910
WELDED CARRIAGE-UNDERFRAMES, L.M.S.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, May 1947, pp 530-31

The development of the arc-welded carriage frame is discussed along with a note on future trends. Some design aspects are given as related to associated welding technology. In addition, there are several points taken from the discussion that consider economy, stress lock-up, and materials, specifically stainless steel and aluminum alloys. Adherence to standardized framing is emphasized.

037919
LIQUID SPRINGS

Bound, RH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Aug. 1947, pp 235-236, 2 Fig, 2 Phot

A brief account of the principles, construction, and application of liquid springs is presented. Experimental data are given that show the development stages leading to a patented spring. Strength consideration, compressibility, the filling process, and materials and testing are discussed in detail.

037926
INCREASING USE OF ROLLER BEARINGS IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Dec. 1947, pp 703-704, 4 Phot

Comments are made upon the use of roller bearings in the extended applications to new freight stock, and conversions of vehicles originally fitted with journal bearings. The conversions incorporate a new design of roller bearing which can be used in the existing space for an ordinary plain bearing, in bogie side-frames which have the axleboxes cast as an integral part of them.

037952
RECLAMATION OF BOLTS AND NUTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

May 1953, pp 595-596, 2 Phot

A novel system was developed by London Transport for reclaiming used bolts, nuts, and studs from its 10,000 road vehicles. More than 65,000 items are being reclaimed weekly with the present layout, which is capable of extension if required. The system shows a saving of approximately half the cost of new components, which alone fully justifies its introduction. After removal during vehicle repairs the bolts are delivered in bulk to Chiswick works where they are cleaned in a caustic wash. Sorting is carried out in two stages, first by diameter and then by length, type of head and so on.

037984
TRAIN RESISTANCES AT HIGH SPEEDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Aug. 1939, pp 171-174, 9 Fig, 2 Tab

A series of tests were conducted to determine the drawbar horsepower required to haul a 1,000-ton train at a constant speed of 100 mph on straight level track. A 16-car test train, including dynamometer car, was assembled, equipped throughout with four-wheel trucks and conventional friction bearings. The test comprised a trip from Fort Wayne, Indiana, to Grand Island, Nebraska, and back, and six locomotives in all were employed of three types. Measurements were made on constant grades at least 6300 ft. long. The resistance in pounds per ton are shown over the test stretches for each locomotive type. During the test the maximum drawbar horsepower developed by each locomotive was also recorded and was used to determine the adjusted horsepower delivered to the drawbar for the locomotive running at constant speed on straight level track. The test results and the Davis formula were used to calculate horsepower curves for a 1000-ton train travelling various speeds.

037987
RUBBER-CUSHIONED RESILIENT WHEELS FOR MAIN-LINE RAILWAYS

Hug, AM

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Feb. 1959, pp 155-158, 6 Fig, 5 Phot, 2 Ref

Most types of rubber-cushioned resilient wheels, including those for tramways and for narrow-gauge railways, consist of three metallic discs. Between these discs are placed either circular rubber blocks, positioned in one or two concentric rows, depending upon axleload, or a single pair of large rubber discs, which may be divided into segments. The central metal disc is fixed either to the wheel or to the wheel hub. Several applications of rubber-cushioned wheels, both on tramways besides main and secondary railway lines, have shown considerable reduction of maintenance costs for the mechanical parts and electric equipment, particularly collectors, because of the radial and tangential flexibility introduced by these wheels. The reduction of the wear on tires and flanges with resilient rubber-cushioned wheels, must result in a corresponding reduction of the wear of the rails.

039003
PARTIAL BIBLIOGRAPHY ON SUBJECTS RELATED TO ACTIVE VIBRATION ISOLATION AND ACTIVE VEHICLE SUSPENSIONS

Paul, IL Bender, EK

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76109-2, Nov. 1966, 35 pp

Contract C-85-65t

The report represents a partial compilation of references on subjects related to active vibration isolation and active vehicle suspensions which have been collected during the past year in connection with active vehicle suspension research. The bibliography is categorized into a number of subject headings which reveal the diversity and scope of published work in general area of vibration isolation, ranging from purely mathematical techniques for optimum vibration filter calculations to the most practical aspects of suspension hardware design. No attempt has been made to sort or classify the reference with respect to the quality, scope, or usefulness of their contents. (Author)

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039015
ACTIVE VIBRATION ISOLATION AND ACTIVE VEHICLE SUSPENSION

Paul, IL Bender, EK

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76109-1, Nov. 1966, 73 pp

Contract C-85-65t

The feasibility of using 'active' elements in suspension systems for high speed ground vehicles to improve vibration isolation characteristics is considered. The characteristics of vehicle excitations (to the suspensions and to the vehicle body) are discussed and a mathematical expression for the suspension input is obtained. Based on data of human tolerance to vertical vibrations a comfort criterion (to vibrations) is established. The problem of vibration isolation to best satisfy this criterion is considered in terms of optimizing the parameters of a given suspension configuration and in terms of finding an optimum tranfer function for an unspecified suspension configuration. The methodology for obtaining these optimum solutions for a given comfort criterion is developed and solutions are obtained for the case of vertical vibrations of a two-degree-of-freedom system in which the root mean square acceleration of the vehicle is to be minimized for a given permissible suspension excursion. The optimum suspension transfer function for this case indicates that feedback of both vehicle and unsprung mass acceleration is required.

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039035
BUFFETING TESTS ON THE HUDSON TUBE

Chilton, EG

Stanford Research Institute, Menlo Park, California

RI-P, U-53, 91, 30 pp

Contract C-209-65(neg)

Buffeting tests were made on a two-car train of the Pennsylvania Railroad as it entered the Hudson tube. The pressure outside the train was measured at its head and at two locations along its side. The pressure inside the car was also measured. Tests were made at speeds between 55 and 70 mph. Results of these tests show that the pressure at the head rises abruptly when the nose of the train enters the tunnel, and gradually to a maximum of about 6 inches of water when the tail of the train enters. Beyond that time the pressure decreases. At the sides the initial abrupt rise is apparent only near the front of the first car and even there its severity is much smaller than at the head. Halfway along the first car the abrupt jump could not be detected. The subsequent gradual pressure rise is observed on all gages and is about equally steep everywhere. The pressure inside the car, which is the pressure experienced by a passenger, rises to a maximum of about 2.5 inches of water at a rate of about 1.5 inches of water per second. This pressure rise was noticeable but not painful. Since the maximum pressure increases as velocity squared and the rate of rise increases as velocity cubed, it seems clear that buffeting will be an important problem whenever speeds are significantly increased. (Author)

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039041
INVESTIGATION OF CAR FERRY SERVICE FOR HIGH SPEED GROUND TRANSPORTATION

Association of American Railroads, Research Center, Chicago, Illinois

July 1966, 72 pp

Contract C-240-66-(N)

The report presents the results of an over-the-road investigation for determining the ride characteristics of automobiles and passengers on railroad cars incorporating three different truck suspension systems. The three rail cars used for this investigation are as follows: a tri-level auto rack car loaded with four automobiles on a freight type suspension, an end-door baggage car loaded with two automobiles on a six-wheel semi-soft suspension and a passenger coach on a four-wheel soft suspension system. One test auto on each car was instrumented and carried an instrumented simulated passenger in the drivers seat, also, a simulated passenger was placed in the coach. Test results show the tri-level rack car experienced the highest loadings and that the acceleration frequency range (0.85 to 5.00 cps) falls in the same bandwidth of 0.55 to 5.00 cps in all measured planes for the other two cars. In general, acceleration frequency appears to increase slightly with train speed, but did not exceed 5.00 cps. To design a car for its intended purpose, the truck suspension system, car body structural characteristics, and height of center of gravity of the loaded car, appear to be the areas for main consideration.

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PB-173513

039042
ANALYSIS OF OPTIMUM AND PREVIEW CONTROL OF ACTIVE VEHICLE SUSPENSIONS

Bender, EK Paul, IL

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76109-6, Sept. 1967, 75 pp

Contract C-85-65t

The analysis leading to the optimum transfer function for an active suspension excited by a random guideway input is briefly reviewed and a design chart is presented. A parameter sensitivity study of the stability is performed and shows excellent system stability. The wheel-guideway contact problem is considered and a design chart is developed to check wheel-guideway relative displacement (wheel hop) for active suspensions. The equations for the rms force required to prevent wheel hop are derived and a design chart showing the minimum rms vehicle acceleration which can be obtained while applying this force is presented. The improved vibration isolation characteristics of active suspensions using preview control are investigated for infinite and finite preview distances. It is found that for a simple model infinite preview can reduce the rms vehicle acceleration by a factor of 16 and that a preview time of .4-.5 seconds is sufficient to provide almost the same improvement as infinite preview. It is concluded that active suspension development for vehicle heave, roll and pitch control, particularly for use with preview control is warranted. (Author)

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039058
AN INVESTIGATION OF THE RIDE QUALITY OF AUTO-TRAIN SERVICE

Ullman, KB

Office of High Speed Ground Transportation, Washington, D.C.

Nov. 1967, 51 pp

The ride quality in automobiles carried aboard enclosed, air-sprung railcars traveling over conventional rail roadbeds was determined. Evaluation of the data indicates that railcars transporting automobiles with their passengers could be built with minimal securement systems and could provide a ride of good quality. Two test automobiles were inserted inside an air-sprung railcar, equipped with instrumented dummies, and transported a total of 2200 rail miles during which ride vibrations and passenger reactions were recorded. The testing included alterations to the automobiles' suspension systems and different types of trackwork. Ride quality was also determined on highways using the same instrumentation. The data was analyzed by a combination of manual and automated methods. Acceleration distribution functions and frequency spectra were generated with a digital computer. (Author)

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PB-176044

039093
WIND TUNNEL TESTS OF A SCALE MODEL RAILROAD AUTOMOBILE RACK CAR

Matthews, JT Barnett, WF

Office of High-Speed Ground Transportation, Washington, D.C.

June 1968, 36 p

Sponsored in part by Naval Ship Research and Development Center, Washington, D.C.

The document covers wind tunnel tests of scaled models of a representative automobile rack car. Various car configurations and arrangements were investigated to determine axial, normal, and side force coefficients for a single car with and without the interference effects of a leading, a trailing, and both a leading and a trailing car. Basic configurations were also tested through a range of sideslip angles. The interference effects from the leading and trailing cars caused notable differences between the coefficients for the one, two, and three car combinations of the configurations tested. (Author)

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PB-180198

039094
DYNAMIC SIMULATION OF AUTO AND PASSENGER RAIL TRANSPORTS

Robinson, RR

IIT Research Institute, Chicago, Illinois

ITRI, M616, 7, 179 pp

Contract DT-7-35086

A method of analysis and computer program was developed to generate dynamic response solutions for a bilevel auto ferry rail transport car. The analysis views the auto ferry as a system of rigid bodies interconnected by suspension system components, which include linear and nonlinear springs and rubber bumbers, bilinear rotary shock absorbers, etc. The rigid bodies consist of the rail car structure, front and rear trucks, each automobile carried (from 0 to 8) and a front and rear seat passenger in each auto. The rail suspension system is based on an air sprung truck system. The auto suspension system is based on a representative late model automobile. Five degrees of freedom are considered for the majority of the rigid bodies. The sixth degree of freedom is a prescribed function of time, equal to the current train velocity. Initially, the rail car and its contents are assumed to be traveling at constant longitudinal velocity in the equilibrium configuration. A Runge-Kutta numerical integration technique has been employed for the solution of this initial value rigid body system. (Author)

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PB-180132

039138
ECONOMICS OF RAILROAD AUTOMOBILE RACK CAR AERODYNAMIC DRAG

Luebke, RW

Office of High-Speed Ground Transportation, Washington, D.C.

Mar. 1969, 25 pp

Prepared in cooperation with C and O and B and O Railroads.

A program was established to evaluate in detail the causes of the excessive aerodynamic drag of automobile rack cars discovered by the New York Central System (now the Penn Central) and the economics of drag-reducing design modifications. The program consisted of a series of wind tunnel investigations conducted by the Naval Ship Research and Development Center, full scale aerodynamic drag tests conducted by the C and O/B and O Railroads, an analysis of the costs associated with excessive aerodynamic resistance, and an analysis of the savings that could be generated by design modifications to existing railroad auto rack cars. The first part of the program is covered in PB 180 198. The remainder is the subject matter of this report. The full-scale tests confirmed the wind tunnel test results. The economic analysis showed savings could be obtained by the addition of side and end curtains and the removal of the bridge plates. However, these savings are rather low and are quite dependent upon the actual train make up and movements involved. Consequently, the decision to modify car design must be based on the particulars of a railroad's operation and their cost of making modifications. (Author)

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PB-183845

039199
ENGINEERING DESIGN STUDY OF ACTIVE RIDE STABILIZER FOR THE DEPARTMENT OF TRANSPORTATION'S HIGH-SPEED TEST CARS

Osbon, WO Putman, TH

Westinghouse Research Laboratories, Pittsburgh, Pennsylvania

June 1969, 149 pp

Contract DOT-3-0267

This report describes an engineering design study of the application of an active suspension to one of the U.S. Department of Transportation's high-speed test cars. The objective was to establish quantitatively the ride improvement which can be expected from the stabilizer as well as to determine power requirements, vehicle modifications, and the basic equipment design parameters. Quantitative assessment of expected ride improvement was carried out through computer simulation of the vehicle and the stabilization equipment for simulated sub-grade disturbances. These results are discussed in detail with computer records for the stabilized and unstabilized vehicle. To equip a test car with the proposed Active Stabilization System involves modification of the car suspension. These modifications are listed and detailed descriptions are given. (Author)

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PB-185008

039228
INVESTIGATIONS OF BOXCAR VIBRATIONS

Luebke, RW

Chesapeake and Ohio Railway, P.O. Box 6419, Terminal Tower, Cleveland, Ohio, 44101
Chesapeake and Ohio Railroad, 2 North Charles Street, Baltimore, Maryland, 21201

FRA-RT-70-26, Final Rpt, Aug. 1970, 186 pp

Contract DOT-FR-9-0038

The vibration environment within a 50 Foot—70 ton boxcar and its running gear was measured by accelerometers and recorded on magnetic tape. The accelerometers were mounted on the car body floor over the center plate and on the unsprung mass of the trucks. The test consisted of operating a train over specially prepared track at speeds between 10 and 60 mph. The boxcar was run empty, with half load, and finally with a full 70-ton load for each series. The full test program included evaluations designed to determine the effect of load, speed, track irregularities, flat wheels, friction damping, variable rate springs, spring travel, and truck design, on the vibration environment within the car body. The results of these tests are presented in the form of vibration spectrograms, Power Spectral Density Curves, Transmissibility Curves, and plots of acceleration versus speed. It was concluded that an increase in load and spring travel reduced the vibration levels in the car body. All of the new truck designs tested produced reductions in the car body vibration levels. Friction damping levels presently used in freight car trucks were found to be nearly optimum. Flat Wheels produced a tremendous increase in truck vibrations and a smaller increase in car body vibrations. (DOT abstract)

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PB-195341

039314
BOGIE PITCHING

Koffman, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, No. 15, Apr. 1960, pp 418-421, 4 Fig, 2 Phot, 5 Ref

Mathematical studies are reported which relate the effect of bogie pitching on body oscillations. The factors considered are spring stiffness, inertia, frame pitching and wheel spinning. The prevention of undue bogie pitching should be faced in early design stages. The method of attaching the body to the bogie, spring design, incorporating provisions for dampers and prototype testing for natural oscillation frequencies are all important factors in the vehicle design.

039410
ASSEMBLY AND MAINTENANCE OF TRAILERSTOCK WHEELSETS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-25,26, 6707-6801, 5 pp, 2 Fig, 1 Phot

Question B79.

The article discusses some problems in the assembly and maintenance of wheelsets. Included are relationships between press-fitting and shrink-fitting wheels and resulting distortions and effects upon wheel wear. The several ways of changing wheel profiles and their economics are also discussed. The effects of flange thickness related to wheel stability as well as problems in designing a standardized wheel profile for various applications are considered.

039414
TRANSMISSION OF INFORMATION THROUGH THE AUTOMATIC COUPLER

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-28, Jan. 1969, pp 31-32

Question A103.

This report discusses future developments in automatic coupling and uncoupling of trains. With the advent of fully automatic couplers, it is hoped that the following will be possible: the automatic connection of air pipes for controlling and operating brakes; a collector line connection to transmit electrical current to heat cars and to feed other electrical units; the connection of a central-current supply line to transmit central orders, for data transmission-reception and for train separation signals; and connection of a line for currents carrying data between the locomotive and train.

039416
RANDOM LATERAL MOTIONS OF RAILWAY VEHICLES

Stassen, HG, Delft University of Technology

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-28, Jan. 1969, pp 16-19, 5 Fig, 1 Ref

Question B52.

The study is concerned with the random motions made with a truck of experimental design. The behavior is studied of this truck on a test track and is compared with the empirically predicted behavior. Results of the program show that there is close agreement between observed and predicted performance; spin effect results in considerable de-stabilizing of the truck.

039420
BRITISH RAILWAYS EXPERIMENTAL BRAKEVAN (CABOOSE)

Scales, BT, British Railways

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

61-WA-240, Aug. 1961, 4 pp, 4 Fig, 1 Tab

Shocks experienced in brakevans at the rear of freight trains led to the production of an experimental vehicle fitted with hydraulic buffers and drawgear. The design and testing of this brakevan is described. The experimental brakevan was satisfactory under both normal and severe conditions, and gave smooth starts free from rebound throughout. Comparative tests showed that a standard brake van was satisfactory only during normal starts. During severe starts accelerations were high.

039422
DRAFT-GEAR ACTION IN TRAIN SERVICE

Wikander, OR, Edgewater Steel Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Nov. 1944, pp 691-696, 7 Fig, 2 Tab

To investigate the most desirable characteristics of a draft gear by mathematical analysis, a study has been made of the mechanics of an elastic bar, which is subjected to external forces like those acting in trains under various service conditions. This paper contains the equations transcribed to apply to railway trains. Numerical examples are given showing the applications of these equations to assumed test trains.

039423
THE EFFECT OF FREIGHT CAR CUSHIONING CHARACTERISTICS ON TRAIN ACTION

King, FE, Canadian National Railways
Radford, RW, Canadian National Railways

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-WA/RR-4, Conf Paper, Aug. 1966, 28 pp, 24 Fig

The use of freight cars with end-of-car cushioning devices gave rise to severe coupler forces during run-in and run-out train action under certain operating conditions. Tests were made to determine the nature of this action and to compare the action of various types of hydraulic cushioning devices with that of standard friction draft gears. Modifications were made to some of the devices by their manufacturers and further tests were made. Run-in and run-out are initiated as a train passes over track having grade changes of sufficient magnitude to overcome the available tractive or braking effort. The force generated as an individual car is accelerated or decelerated is proportional to the velocity difference between that car and the preceding part of the train. The magnitude of the force generated as a standard friction draft-gear car is picked up is proportional to the weight of the car.

039424
EVALUATION OF FREIGHT CAR CUSHIONING DEVICES THROUGH SIMULATION OF TRAIN DYNAMICS

Wilson, JT, Canadian National Railways
Thiverge, J, Canadian National Railways

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-WA/RR-3, Conf Paper, Aug. 1967, 11 pp, 11 Fig, 1 Ref

The paper describes a means of evaluating freight car draft-gear designs through analytical studies of train action. Included in the paper along with the analytical approach are examples illustrating how data required for the input to simulation programs may be developed. A form of performance evaluation for draft-gear devices is suggested. Also included for comparison purposes are results of typical train simulations along with data from real-life tests of trains equipped with end-of-car dyraulic draft-gear devices.

039425
THE DESIGN OF CUSHIONING GEARS FOR RAIL-CAR APPLICATIONS

Hassenauer, RL, General American Transportation Corporation
Novak, GE

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

61-WA-256, Conf Paper, Aug. 1961, 8 pp, 12 Fig

This paper discusses the design of an air-oil cushioning gear for rail car applications using a limiting value of lading acceleration criterion and shows how to design the metering pin and orifice contained in the device to control the acceleration of the lading for a particular impact condition. A numerical example is given showing how to determine the length and contour of the metering pin for a given set of boundary conditions. A brief discussion of the experimental techniques used in determining the actual performance of the cushioning gear is presented.

039426
THE BARBER CUSHION TUBE

Williams, RC, Standard Car Truck Company
Guins, SG, Chesapeake and Ohio Railway

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

61-WA-221, Conf Paper, Aug. 1961, 5 pp, 3 Fig, 2 Tab

The Barber cushion-tube is unique in that it is essentially a combination of the two basic ideas of cushioning, which are: sufficient cushioning in the draft gear-bolster area; and, an independently acting center structure which is continuous through the length of the car underframe. The cushion tube makes possible the utilization of both draft gears of the car in buff so as to increase the absorptive capacity of the system by more than two times. This device is an economical means of increasing cushioning capacity, which has had an extremely good record of lading protection and reduction of damage claims in shipments of a variety of products.

039427
INCREASED CUSHIONING CAPACITY–A REQUIREMENT OF TOMORROW'S FREIGHT CAR

Abbott, RE, Association of American Railroads
Lanning, HK, Atchison, Topeka and Santa Fe Railway

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

59-A-224, Conf Paper, Aug. 1959, 9 pp, 8 Fig

This paper discusses the future requirements in draft gear designs in order to insure proper protection to the freight-car structure and the lading transported in the car. The economic benefits that may be derived from increased draft protection are pointed out. New devices that provide increased gear capacity at low reaction forces are discussed.

039428
EVALUATION OF RAILWAY DRAFT GEARS

Wallace, WD, Miner (WH), Incorporated

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Apr. 1957, 7 pp, 8 Fig

This report discusses the mechanical characteristics of railway draft gears. Included in the discussion is their operation; the use of chronograph and electronics to determine the work cycle of draft gears; and the use and limitations of rubber in draft gears, especially the effects of recoil and compression. It is suggested that high initial costs of draft gears which meet friction gear specification may be offset by long life and minimal slack effects.

039429
HOT BOX WARNING DEVICE FOR CONTINUOUS MONITORING TO DETECT OVERHEATED JOURNAL BEARINGS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-441, Tech Rpt, Apr. 1965, 18 pp, 9 Fig, 1 App

The devices discussed include: smoke and odor alarms, pyrotechnic devices, chemical detectors, infrared bolometer detectors, and mechanical and fusable plug devices.

039430
INVESTIGATION OF LOW PRESSURE VENTS USED IN JOURNAL ROLLER BEARINGS (DOCKET NO. RB-6)

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-442, Tech Rpt, 1965, 2 pp

The following conclusions on the performance of low pressure release vents in use on freight car roller bearings are: the size and location of passageways and ports leading to the vents are not sufficient to prevent plugging with grease; synthetic elastomeric vent elements are susceptible to hardening and permanent deformation; the method of locking the vent in the backing ring does not allow easy maintenance or replacement of the vent element; the vent element may dislodge under operating conditions which impaires performance; when the vent is ineffective for relieving pressure, the grease and pressure are relieved through the seal, which could cause seal displacement and damage; and excess grease in the roller bearing causes bearing temperatures and pressures to increase.

039431
FINAL REPORT ON THE EVALUATION OF CUSHIONED UNDERFRAMES

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-443, Final Rpt, Aug. 1965, 3 pp

Impact tests included tests of special cushioning devices having travels up to and including 30 inches. Tests were run in two series: the test car was moving and the test car was struck when placed at the head of a string of cars. The sliding sill type of special cushioning device generally provided the highest degree of protection to lading through reduction of body force and resultant acceleration in the cars tested. This was true under all sets of test conditions. The relative order of performance in descending values is sliding center sill devices, end-of-car hydraulic devices, column connected 36-inch gears, and standard 24-5/8 inch draft gear car.

039432
SURVEY OF CAST STEEL TRUCK SIDE FRAME AND TRUCK BOLSTER REMOVALS BY MEMBER RAILROADS AND PRIVATE CAR OWNERS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-446, Tech Rpt, 6607-6706, Dec. 1967, 2 pp

The critical areas for defects on truck side frames removed from service were the compression and tension members close to the journal boxes. The critical area for defects on truck bolster removed from service was in the center, especially in and adjacent to the center bearing. The percent of removal for bolsters is 2.4 times greater than for side frames. Dynamic test requirements for side frames should be made more severe and bolster dynamic tests should be formulated. The equipment to handle dynamic investigations of side frames and bolsters at the AAR Research Center has been purchased and is being installed.

039433
LABORATORY STUDY OF THE PERFORMANCE OF STABILIZED JOURNAL BEARINGS WITH INCREASED COLLAR THICKNESS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-449, Tech Rpt, 1968, 2 pp

A laboratory program was set up to study the performance of Hi-Hat and flat back bearings with increased collar dimensions when assembled with wedges of the present standard dimensions. Each bearing-wedge combination was run four days using a procedure developed for and normally used to study bearing performance. Operating a Hi-Hat or flat back bearing with the collar dimension increased by 1/8 in. in combination with the respective present standard wedge did not affect the performance on the AAR's full-scale machine.

039434
INVESTIGATION OF AUTOMOBILE CARRIER CARS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-RD3, Tech Rpt, May 1964, 2 pp

The report is concerned with the cause of progressives or fatigue failures in deck beams and posts of automobile carrier cars. Impact tests of cars were conducted to determine rack action present. Results are that stresses in decks and posts during loading were small compared to stresses present when cars were rolling. Stresses changed from tension to compression as the rack rolled sideways, as a result the racks acted as rigid frames to resist rolling induced forces.

039435
INVESTIGATION OF TIE-DOWN EQUIPMENT USED ON A TRI-LEVEL AUTO CARRIER RAILROAD CAR

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-RD4, Tech Rpt, May 1965, 2 pp

The forces developed in the tie-down equipment during normal running and coupling impact conditions were studied. The conclusions of this investigation are: chain force varies with car coupling impact speed; the forces recorded during the coupling impact and running conditions are the result of the weight of the automobile and its longitudinal and vertical acceleration; and maximum chain forces recorded during this particular field investigation are not necessarily the maximum forces that could ever be experienced under such operating conditions.

039442
EVALUATION OF CUSHIONED UNDERFRAMES

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-437, Tech Rpt, Aug. 1963, 3 pp

This report is an evaluation of cushioned underframes, which indicates that protection of commodities shipped is related not only to draft gear but to loading methods and packaging. Impact tests used include tests of special cushioning devices with travel to 24 inches. As a result, the sliding sill cushioning device provided most protection to lading, the hydraulic draft gear provided most protection to the car underframe.

039444
ECONOMIC SURVEY OF AXLES WITH OVERHEATED JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-439, Tech Rpt, Apr. 1964, 2 pp

The AAR Interchange Rule No. 84 is discussed, which requires an axle that overheated in service to be removed, the journal scored and cut, and the axle scrapped. This action was justified since a principal cause of broken journals is a result of continued use by not being detected when overheated. The net costs of scrapping these axles are discussed. The costs are expected to be more than offset by a reduction in journal failures.

039461
20 YEARS OF ULTRASONIC AXLE TESTING—ESTABLISHED METHODS AND MORE RECENT DEVELOPMENTS ON THE DB AND OTHER RAILWAYS

Egelkraut, K, DB Research Institute

International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium

Jan. 1970, 23 pp, 11 Fig, 36 Phot, 7 Ref

Ultrasonic tests of rolling stock axles, which several Railway Administrations introduced as early as 20 years ago, are now part of regularly performed maintenance work. The present article describes test methods as well as probes and auxiliary equipment which were developed by the DB and which have found general acceptance. Information is given on which zones of the axles can be tested, on which detection sensitivity can be obtained and on which expenses have to be undergone. These considerations indicate which axle designs are suitable for testing and point to ways for testing even more complex axle design with justified expense.

039466
CATALOGUE OF DEFECTS ON THE WHEELS OF RAILWAY TRAILER STOCK

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1971, p 563, 1 Fig

The catalogue is solely concerned with the qualitative aspects of the defects without indicating their size. The catalogue is deliberately confined to defects of a mechanical or thermal origin without taking into account wear, or defects of a geometrical nature. For each type of defect the following are given: a brief description; one or more means of detection; recommendations relating to the measures to be taken for the wheel set to be returned to, or kept in, normal service; and, the probable cause of the defect.

039467
PERMISSIBLE OUT-OF-ROUNDNESS AND OUT-OF-BALANCE OF THE WHEELS OF PASSENGER COACHES

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

June 1971, pp 561-562, 2 Fig

These tests are carried out with three coaches: one SNCF coach equipped with Y 28 BR bogies, one DB coach equipped with MD 50 bogies, and one FS coach equipped with V 920 (prototype) bogies. The SNCF coach was also subjected to tests on the line. The bench tests were carried out on the SNCF dynamic test rig for vehicle suspensions, at simulated running speeds ranging from 0 to 250 km.p.h. The various degrees of out-of-roundness were simulated by a vertical movement, at sinusoidal speed, of the motor-driven rollers. Bench tests have shown that out-of-roundness values higher than the limit values was confined to relatively weak vertical accelerations. For an out-of-balance value not exceeding the limit value, the three coaches show a favorable behavior with the exception of the FS coach at a speed higher than, or equal to, 200 km.p.h.

039469
DESIGN OF SPRINGS

Frost, WE, John Spencer & Sons, Ltd.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Dec. 1952, pp 705-706

Due to high stresses and abrasive action between laminated spring plates causing a reduction in thickness, it is recommended that a service life be established for the springs and the springs then be replaced. Several other design weaknesses are described, including the center fastening.

039478
THE BARBER STABILISED FREIGHT-WAGON BOGIE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Oct. 1946, p 416, 1 Fig

Roller bearings in conjunction with a lateral control device are the chief features of this new American design. Separate axleboxes of special design incorporate a built-in friction device for damping out vertical movements and shocks. The new Barber bogie is considerably lighter than the conventional four-wheel cast-steel freight-wagon bogie. Wheel changing is exceptionally easy, as the stabilizer parts, springs, or axleboxes need not be removed when a wheel change is made.

039479
RESILIENT WHEELS FOR RAILWAY VEHICLES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Oct. 1946, p 386, 1 Fig

Radial thrusts between tire and hub are transmitted through rubber inserts, giving better riding qualities and reduced wear on track. A suggested method of fitting Silentbloc bearings to eliminate metallic contact between the hub and tire of a wheel is shown.

039480
WHEEL HUNTING AND IRREGULAR RAIL WEAR

Torns, AH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Dec. 1945, p 636

In addition to the "hunting" of rolling stock wheels, there is the constant side-to-side movement of individual pairs of wheels. The standard taper of coning of wheel-treads is at 1 in 20, so the tread of a new tyre may be at right-angles to the centre-line of the rails. Experiments have been tried in varying the angle of taper of the treads and the radius of the railhead, but the wear of tires and rails complicates the problem, and hitherto has made it difficult to come to any final conclusion as to how the hunting problem may be solved. Persistent bogie hunting can cause bogie stock to ride uncomfortably. Of even greater importance is the wear-and-tear of rolling stock and the damage to rails caused in this way.

039483
SIX-WHEEL OR FOUR-WHEEL BOGIES?

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, Mar. 1945, p 361

The principal factors in smooth riding are the method of suspension and the quality of maintenance which can affect the running in considerably greater degree than the provision of one axle more or less in the bogie. A test with four-wheel bogies was to show that the coach had suffered no deterioration in its riding qualities, and that the eight-wheel coach with bogies of 11 feet wheelbase rode no better than a similar vehicle carried on four-wheel bogies of the more usual 8 feet wheelbase. After prolonged experiments directed towards the improvement of riding, the four-wheel bogie, even with vehicles up to 80 feet in length and 10 feet wide, retains an unchallenged position.

039486
THE HEART OF THE MATTER

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

Vol. 126, Oct. 1970, pp 23, 1 Phot

This document is an advertisement for the Gloucester cast steel freight truck which has a "Metalastik" rubber suspension. The "Metalastik" springs consist of bonded rubber springs of chevron shape which give angular and vertical flexibility. Derailment and wheel wear is minimised by the transverse angling of the side frames. The use of the simple suspension eliminates the need for bolster springs, guides and lubricating surfaces.

039487
WELDED ALUMINUM ALLOY BOGIE

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

Oct. 1970, p 755, 1 Phot

A prototype unit with a one-piece frame and axleboxes fabricated from aluminum alloys has been on trial in Switzerland. Use of the alloys in construction has resulted in a weight saving of about 20 percent over the equivalent steel bogie. Experience in service, mounted under a tank wagon on the metregauge line where conditions are more severe than encountered on standard-gauge main lines, with sharper curves and steep gradients has resulted in no operating problems.

039498
CHALLENGE TO ENGINEERS TO INDICATE FREIGHT CAR AVAILABILITY

Humbert, JC, Illinois Central Railroad

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 5-9

Technical Proceedings from 1969 Railroad Engineering Conference.

Statistics are presented for train payloads, car capacity, train size, and average speed in 1947 and 1968. Statistics on revenue active employees, average hauling distance, tonnage, and cost per mile are compared for the rail industry in 1947 and 1967 with the trucking and airline industries. The rail industry compared very unfavorably in the 1967 figures due to the slow rate at which freight is moved by rail. The author suggests redesigning trains and cars with customer interests in mind. Lightweight equipment, run frequently and to the customers door, and inexpensive cars that can be replaced rather than repaired are the suggested methods to increase speed per day and customer acceptance of rail hauling.

039499
EFFECT OF CAR CONDITION ON SALE OF THE TRANSPORTATION PRODUCT

Deines, FE, Chicago, Burlington and Quincy Railroad Company

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 9-12

Technical Proceedings from 1969 Railroad Engineering Conference.

Railroads are under pressure by customers to provide modern freight cars in very good operating condition. A shipper desires a car which will handle his lading to the receiver in a damage free condition, in the shortest possible time, and at the lowest possible total cost. Average cost of freight cars has increased by 230 percent from 1950 to 1968, while revenue per car per year has increased only 26 percent over the same period. A major problem of the rail industry is better utilization of equipment. The design and potential uses for the mini-max car designed for General Mills is mentioned. A concern of the industry is abuse of freight cars by customers during loading and unloading.

039500
EFFECT OF CAR CONDITION ON THE OPERATING DEPARTMENT

Toler, JM, Missouri Pacific Railroad

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 13-15

Technical Proceedings from 1969 Railroad Engineering Conference.

The problem of car availability due to car maintenance schedules is discussed. Suggested changes in maintenance schedules and car design to decrease down time are made. Some common complaints by shippers concerning car condition and loading problems are given.

039502
ENGINEERING CRITERIA FOR FUTURE FREIGHT CAR TRUCK DESIGN AND PERFORMANCE

Garin, PV, Southern Pacific Company

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 26-30

Technical Proceedings from 1969 Railroad Engineering Conference.

To establish the criteria for design and performance of freight car trucks, the environmental effects on the truck must be examined. These environmental effects are grouped as: external environment from track conditions, carbody and train speed; and internal environments which are induced by the truck design, the specialty components, such as roller bearings and the state of the art in developing the most desirable elements in the truck assembly. Each of these effects is described. The lack in the U.S. of a full-scale wheel-rail dynamics research facility to test trucks and tracking has hampered the efforts on truck design. A British Railways test using a U.S. truck design and their Freighliner test equipment is briefly described.

039503
THE PROBLEMS

Seel, M, Trailer Train Company

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 30-32

Technical Proceedings from 1969 Railroad Engineering Conference.

Considerable fore and aft wear in the body and bolster Center plates on cars in service up to 1962, was due to action when the car is in motion. By applying manganese steel wear rings into the truck bolster, the wear disappeared. It was also found that the body center plate was cracking. When a change of construction material was unsuccessful in correcting the problem, a fillet weld was tested. After three years, no center plate cracks around the bowl have been found. Several design changes for the center plates being considered to increase strength are mentioned.

039504
CARBUILDER'S APPROACH TO THE SOLUTIONS OF THE TRUCK–CAR BODY RELATIONSHIPS

Ruppecht, WJ, ACF Industries, Incorporated

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 32-39, 18 Fig, 3 Phot

Technical Proceedings from 1969 Railroad Engineering Conference.

Three failure modes for center plate areas are discussed and illustrated. Wear of vertical wall inboard and outboard has been reduced by the wear ring and harder center plate. By use of these modifications, the 50 and 70 ton service experience should be approached. Cracking of center plates was prevalent prior to 1967, and was a function of the center plate center filler contact area. Failures had not occurred at conference time of the solid forced plate designed to eliminate the cracking problem. Cracking of the cushioned underframe center plate is a function of the overall bolster design and with proper design and reinforcement, this mode of failure should not occur.

039505
PULLMAN'S APPROACH TO CENTER PLATE PROBLEMS

Rousseau, GL, Pullman-Standard Car Manufacturing Company

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 39-41

Technical Proceedings from 1969 Railroad Engineering Conference.

Tests were conducted on fabricated cushioned underframe center plates using a Hy-Cube car, using a car rocking device designed to excite a fully-loaded car at its natural roll frequency. Results were correlated with field service reports. Tests were in progress on the rocking device using a 100-ton covered hopper car. The conclusion of the two-year test program on cushioned underframe cars has indicated these results: rock and roll is instrumental in center plate wear and breakdown; breakdown originates in the transition radius and propagates into the transverse and longitudinal reinforcement; the 3/8" radius is not satisfactory for today's fatigue environment; longitudinal reinforcement on the center plate should be located over the outer circumference of the bowl; a flat center plate application significantly reduces the attachment pre-stress in the transition radius; both fabricated and cast center plates can develop cracking unless fatigue design is considered; the center plate application is related to car configuration; and supplemental snubbing devices that reduce car body roll would increase the fatigue life of center plates.

039506
CARBUILDER'S APPROACH TO THE SOLUTIONS OF THE TRUCK-CAR BODY RELATIONSHIPS

Krause, JF, JR, General American Transportation Corporation

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 41-42

Technical Proceedings from 1969 Railroad Engineering Conference.

In early 1967 General American standardized on a cast steel combination center brace, center plate, and rear draft lug. This casting is attached using the two-piece rivet; that is, the Huck or Townsend bolt. Laboratory tests were conducted for all capacities through 125-tons with impact loads beyond AAR design requirements. This design has operated successfully in service. Test results on the center plates on car built from 1960 to 1967 are given. The test showed that a solid bowl is not as good as the recessed type bowl because of slight deviations in the bolster.

039507
DRAFT RIGGING AND CONNECTIONS AND THEIR EFFECTS UPON AVAILABILITY AND PERFORMANCE

Simpson, WW, Jr, Southern Railway

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 44-49, 4 Fig, 10 Phot

Technical Proceedings from 1969 Railroad Engineering Conference.

The main discussion concerns failures of unit train equipment due to the excessive train load, gradients and curves through mountainous areas, and car impact. Photographs show wear and deformation of couplers, draft gear and yokes. In tests of a general service car operating on a mixed freight train from Washington, D.C. to Birmington, Alabama, a peak drawbar pull was recorded in excess of 300,000 lbs. in slack action territory. The average drawbar pull over eight grades was recorded as 218,000 pounds. Southern specifies Grade E couplers and yokes on all 100-ton equipment. Magnafluxing all knuckles is being considered.

039508
ENGINEERING GOALS FOR GREATER FREIGHT CAR UTILIZATION

Hawthorne, JW, Seaboard Coast Line Railroad

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 49-51

Technical Proceedings from 1969 Railroad Engineering Conference.

Freight car availability by reduced down time for maintenance is stressed. The construction of freight equipment which will have a reasonable service life and require no repairs, excluding accidents, during that service life is within the limits of today's technology. Design efforts should be expanded in this direction. The regular servicing intervals of items such as brakes weighing and journal boxes are cited as areas where changes are needed to reduce down time. Non routine servicing for bolster repair, and broken or worn flooring and lining is also cited.

039509
MAINTAIN, REBUILD, OR REPLACE

Whipple, BRR, Southern Pacific Company

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 51-56, 1 Fig

Technical Proceedings from 1969 Railroad Engineering Conference.

The computer program used by Southern Pacific to make repair-replace decisions for railways cars is described. The physical and use characteristics of both the new cars and the old repaired cars operating costs for both options are known. The price of new cars, equipment trust interest rates, and so forth are known, so the capital costs of new equipment are fully determinable. The only unknown is the capital cost of the old equipment, if repaired. The repair limit formula determine the repair outlay which produces a capital cost which, added to the old car operating cost, gives a total cost equal to the new cars total cost to handle the traffic in question. Input for the program and limitations are described.

039510
AUTOMATIC-PNEUMATIC COUPLING FOR INCREASED UTILIZATION

Punwani, SK

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 56-59, 4 Phot

Technical Proceedings from 1969 Railroad Engineering Conference.

The Automatic Pneumatic Coupling System design by Dresser Transportation Equipment is described and illustrated. The system consists of a train line connector for making the physical connection between car ends; valves to control the air; and, a means to initiate the coupling and intentional uncoupling of air and to sense unintentional uncoupling. The system is compatible with knuckle couplers already in service. Field tests were scheduled for 1970.

039511
TOTAL CAR DESIGN FOR OPTIMUM CAR UTILIZATION

Giesking, PF, National Steel Car Corporation

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 59-63, 12 Phot

Technical Proceedings from 1969 Railroad Engineering Conference.

A new hopper car is described, which was to be tested by the Canadian National in late 1969. Truck and car design to minimize rail corrugation are described. Illustrations show rail corrugation being measured, track locations subject to corrugation, and bearing configurations,

039514
ENGINEERING ASPECTS OF LONG CAR TRACKING AND CURVE NEGOTIATION

Martin, AE

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 2-10, 5 Fig, 7 Phot

Technical Proceedings from 1964 Railroad Engineering Conference.

A test was conducted using long, flat cars of 89 feet length coupled with 43 inch and 60 inch couplers to short, loaded hopper cars. Photographs show the wheel lifting present when using each coupler. A summary of the push and pull tests, including the tractive effort and lateral load at wheel lift, are presented. Static jackknifing compression tests are summarized for types E and F head couplers. Results of these studies have suggested the design of 72 inch articulated coupler with a type F interlocking head.

039515
NEW COUPLER CONCEPT FOR LONG CARS

Cope, GW

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 10-18, 13 Phot

Technical Proceedings from 1964 Railroad Engineering Conference.

The "LC" coupler was developed specifically as a solution to the long car tracking and curve negotiation problem. Lengthening the coupler increases the problem of jackknifing of the couplers. To avoid this problem, a type F interlocking coupler head was used, which limits the amount of contour angling. The length of 72 inches was chosen on the basis of calculations on stress, track curve negotiability and derailing components. Photographs show the coupling system.

039516
A SINGLE STANDARD DESIGN COUPLER FOR CONVENTIONAL FREIGHT CARS

Tarbox, IF

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 18-24, 3 Fig, 4 Phot

Technical Proceedings from 1964 Railroad Engineering Conference.

A coupler is illustrated and described which is an improvement over the standard type E 60 rigid and E swivel couplers. It is hoped that the coupler designed by Symington Wayne, will be adopted as a single standard E coupler for conventional freight cars. The coupler has a controlled swivel coupler assembly which permits maximum angularity of 15 degrees. At all angularity beyond 4 degrees, a seat compresses the draft gear, which returns the coupler to the 4 degree position, when the lateral force is removed.

039517
DEVELOPMENT IN FULLY AUTOMATIC COUPLERS AND POTENTIAL ON AUTOMATED FREIGHT TRAINS

Cope, GW

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 24-30, 1 Fig, 9 Phot

Technical Proceedings from 1964 Railroad Engineering Conference.

The automatic coupling system developed by Symington Wayne for subway and rapid transit cars is illustrated and described. This equipment manufacturer is now considering the design of an automatic coupling system for freight trains.

039518
TRUCK PROBLEMS FROM CURRENT OPERATING DEMANDS

Adams, DW, Pennsylvania Railroad

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 30-34

Technical Proceedings from 1964 Railroad Engineering Conference.

Increasing axle loads, vertical vibration causing damage to lading wheel lift on autorack flat cars, long cars and heavy hoppers, and fabrication and durability problems connected with recent truck designs are discussed. The economic desirability of adopting new truck designs is briefly mentioned.

039519
A TRUCK DESIGN FOR TODAY'S CAR AND OPERATING CONDITIONS

Warnock, EJ

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 34-40, 3 Fig, 6 Phot

Technical Proceedings from 1964 Railroad Engineering Conference.

Early 4-wheel trucks with coil spring suspensions are briefly discussed. The XL-70, 50-ton capacity truck is illustrated and described in detail. The XL-70 can use the AAR type hanger brake device, but can also be adapted for other types of brake devices. The journal box assembly and a sectional view of the frame and bolster assembly are shown.

039520
EVOLUTION OF FREIGHT CAR CUSHIONING

Danahy, FA, New York Central System

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 43-46

Technical Proceedings from 1964 Railroad Engineering Conference.

The evolution of freight car cushioning is traced from the early 19th century to the early 1960s. By 1965, 50,000 car sets, of the sliding center sill car and the hydraulic end of car cushioning types, will be in service. Concern is expressed about long train tests to run with this type car.

039522
PARTICULARS OF CAR IMPACT AND ROAD TEST DEMONSTRATIONS

Suckow, FG

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 49-54, 7 Fig

Technical Proceedings from 1964 Railroad Engineering Conference.

The Symington car impact test plant is briefly described. The results of a road test taken during this conference is included. The type XL-70 truck was being evaluated in the test. The portion of the test from Depew to Batavia was very good with a considerable amount of high speed running. The XL trucks gave their usual good performance, while considerable periods of truck swiveling with accompanying car nosing was noted in Car SX-107 having the A-3 trucks.

039530
RAILWAY BEARING METALS: THEIR CONTROL AND RECOVERY

Bradley, JN, London Midlands Scottish Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 77, Dec. 1942, 3 pp, 3 Tab

The composition and mechanical properties of four alloys used in bearing by the L.M.S.R. are listed. The alloys are tin and lead-based alloys. Hardness and Young's modulus are reported. The authors process for reclaiming scrap is described.

039531
MEASURING LONGITUDINAL WEAR ON JOURNALS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 70, Jan. 1939, pp 140, 1 Fig

A gauge which permits the longitudinal wear on the journals of railway carriage azles to be measured, has been devised at the shops of the former P.O.-Midi Railways (now South-Western Region, French National Railways). It is designed so that a comparison of the standard with the actual dimensions is easily possible, the difference between the two representing the amount of wear. The use of the device is described and the device is illustrated.

039536
SURVEY OF CAST STEEL TRUCK SIDE FRAME AND TRUCK BOLSTER REMOVALS BY MEMBER RAILROADS AND PRIVATE CAR OWNERS

Association of American Railroads, 1920 L Street, Washington, D.C., 20036

MR-446A, Tech Rpt, 6607-6706, Apr. 1968, 7 pp

Docket No. CC-223.6.6.

A survey was made of cast steel track side frames and truck bolsters removed from service for reasons other than normal wear. Critical areas for side frames were compression and tension members close to journal boxes. Critical areas for track bolsters were in the center near the center bearing. The incidence of removal of these units increases with service life. Bolsters are removed 2.4 times more often than side frames. Changes in specifications should equalize this replacement rate.

039539
THE AUTOMATIC COUPLER

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-25, July 1967, pp 15-18, 7 Phot

Question B51.

The conversion of existing cars to automatic couplers is discussed. The various operations for replacing the couplers are shown. A brief report is made on the testing of 300 of the couplers. Five series of tests were made in the climatization chamber of the Vienna Arsenal Federal Research Institute. Field tests were also conducted under severe climatic conditions. The pipe joints were not capable of coping with the extremely low temperatures. A 100-axle freight train was tested during the summer, to determine the effects of longitudinal play between the couplers on ride quality. Four cars in the middle of the train derailed during emergency braking from 10 km/h.

039543
SPRING STRESSES AND DEFLECTIONS

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Jan. 1959, pp 126-132, 6 Fig, 14 Ref

This document discusses qualities of various suspensions, with emphasis on helical springs. The author includes formulae for determining vertical and lateral stiffness and spring deflection of these springs. It is concluded that spring dimensions should be based upon service connected dynamic stresses. These will depend upon track conditions, spring stiffness, mass of bogies and vehicle body as well as damping provided by dampers and the damping of the suspension system.

039550
HOT BOXES ON FREIGHT WAGONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, July 1953, p 33

The University of Illinois Engineering Experimental Station has recently undertaken research into the behavior in service of solid journal bearings; and hot box incidents with relative costs. The greater number of hot boxes occurs within relatively short distances of the point of origin, which suggests that minor defects may be present in the axleboxes of empty stock which cause overheating when the wagon is loaded. Shunting operations may set up conditions which result in overheating, waste grabbing, and so on resulting from the wagon being stationary for some time. On a wagon being moved after standing for a period in a low temperature, there was a tendency for the packing to stick to the journal, and to move to a position from which it could not properly feed oil from the bottom of the axlebox to the journal surface. It is further found during the course of the investigations that the effect of summer temperatures on hot box occurrence was not in all cases due to the immediate elevation of the running temperature of the bearing, but in a large measure arose from the corollary effects on the lubricating materials used in the bearings.

039553
ROLLING STOCK SHOCK ABSORBERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, July 1953, pp 100-101, 1 Fig, 1 Tab, 2 Phot

Tests were conducted in America under actual running conditions by Waugh Laboratories on the Woodhead-Monroe shock absorber which is of the bleed and blow-off type. Resistance characteristics are extremely versatile since there are six variables on both compression and rebound strokes. Results on a 40-ton refrigerator car were expressed as a percentage of that experienced without shock absorbers, and ranged as low as 7 percent in the vertical plane and 53 percent in the lateral plane for a 25,000 lb. load.

039561
CENTRELESS GRINDING OF ROLLING STOCK AXLES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Nov. 1953, pp 577-578, 4 Phot

A centreless grinding machine for finishing the wheelseats and journals of rolling stock axles is described. The machine is capable of dealing with both plain and roller-bearing type axles. Extreme accuracy both diametrically and in profile is guaranteed by this method, which is effected with built-up grinding wheels located on a patent spindle of special design having one fixed, and one axially adjustable grinding wheel. The form of the grinding wheels on the spindle is rigidly maintained by means of a special turning device.

039563
WEARING PARTS OF ELECTRIC ROLLING STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Jan. 1954, p 116

The subject of wear and tear on vehicles is considered. Focus is on two aspects; wear resulting from the work accomplished by the rolling stock and wear, particularly bogie frame wear, resulting from vibrations generated during operation. Tyre wear is also mentioned. This results in sharp flanges, deep flanges, thermal checking and flaking, and hollow treads. Each of these problems is briefly examined.

039571
LONG WELDED RAILS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, June 1954, p 687, 1 Ref

If very long weld rails are used to circumvent the many disadvantages of the jointed form of track, important safeguards are essential. The standard types of doubly-flexible rail-to-sleeper fastenings in use on the French railways are among the most efficient deterrents to the risk of fracture due to tension. With an 800 m. length an expansion joint of the sliding switch-blade and stock-rail type is used, allowing of a relative movement of up to 7 in. between the rail-ends. The French railways use arc-welding plant equipped with special finishing devices, in the shape of precision grinding and truing units working in both plan and profile, assisted by hydraulic jacks. It is too early to access precisely the economies resulting from welded track, but the smallest calculated saving so far is about 30 percent, and was secured on the Paris-Marseilles line near l'Etang de Berre.

039572
AUTOMATIC METALLIC ARC WELDING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, July 1954, pp 69-70, 4 Phot

An automatic metallic arc welding machine, which was designed and manufactured by Metropolitan-Vickers Electrical Co., Ltd., consists of a motor-operated, rotating jig; on to which the folder U-shaped end of the wagon body is located and clamped together with the stiffening bars, which are also located by clamps. Long straight butt or fillet welds, whether longitudinal or circumferential, are obvious choices for automatic welding. A typical application for the use of continuous automatic welding is that of welding tee or angle stiffener bars on railway mineral wagons. The estimated hand-welding time for each 40 in. pass was six minutes, and the automatic welding time five minutes. In the case of an axlebox made up of 1/4 in. thick pressed U-shaped section forming the bottom and sides and involving 13 welds, a comparison shows a saving of one minute with automatic welding.

039587
SHOCK ABSORBER FOR GOODS WAGONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, July 1951, p 69, 1 Fig

The French National Railways have been experimenting with a shock absorbing device designed to prevent damage to goods arising from heavy impact during shunting operations or movements occurring during rail transit. The equipment can be installed in ordinary goods wagons and its essential feature is the ability of a chassis mounted on wheels to move up or down inclined ramps in accordance with the movements of the wagon on which it is fixed. Movement of the chassis is restricted by springs. The shock absorber has been subjected to severe tests, including collisions with vehicles travelling at 12 mph, and it has also been tried out under normal service conditions.

039595
NEW WAGONS FOR CARRYING IRON ORE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Dec. 1951, p 695, 1 Phot

A special freight car was designed by British Railways to transport iron ore. It is a 56-ton capacity car with pneumatically operated side-discharge doors. Design dimensions and features are listed.

039596
BALL AND ROLLER BEARINGS IN MODERN ROLLING STOCK

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Jan. 1952, pp 39-43, 15 Fig, 1 Tab, 2 Phot

An increasing number of specifications calls for ball or roller bearings to be fitted at all vital points for locomotives and coaches. Advantages which have been realized include: (1) up to 85% lower starting and about 10% lower running resistance. (2) Reduced charges for inspection and maintenance. (3) Fewer hot boxes, resulting in an increased availability factor. (4) More economical use of lubricants. (5) Maintenance of axle and valve gear centres as designed, by virtue of the absence of wear. In the construction of locomotives and rolling stock generally, the following gives a fair idea of the extent to which this type of bearing has been used: locomotives: axleboxes, bogie driving, truck, and bogie pivots; spring compensation beams. Rolling stock: axleboxes bogie pivots. Diesel-engine vehicles; axleboxes; gearboxes; engine bearings; generator, armature bearings; motor armature bearings.

039597
ULTRASONIC EQUIPMENT FOR METAL FLAW DETECTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Jan. 1952, pp 94-95, 1 Fig, 2 Phot

In all the principle locomotive and carriage works of British Railways and also in the Acton Works of the London Transport Executive, ultrasonic flaw detectors have become routine testing instruments. This convenient method of non-destructive testing is providing even higher standards of safety for surface and underground rail travel by the location of hidden flaws which cannot be detected by the X-ray method. The use of ultrasonic methods allows every section of the wheels and axles to be rapidly and thoroughly inspected without dismantling the bogies, the saving in time and trouble being thus considerable. Pipe porosity hair-line cracks, slag inclusions, blow holes, laminations, fatigue cracks, and welding flaws are among the many defects which can be detected by this equipment.

039607
CONTINUOUS PROCESS WHEEL ROLLING MILL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, May 1952, pp 489-492, 1 Fig, 8 Phot

The design and operational features of a rolling mill for the manufacture of railway car wheels is described. It is claimed that production was increased by approximately 40 percent, and production costs were decreased by some 33 percent.

039608
A CENTURY OF RUBBER SPRINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, May 1952, p 565

A brief historical account is given of the development and use of rubber springs on railroads.

039610
AUTOMATIC COUPLER EQUIPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, June 1952, pp 633-634, 5 Phot

This article describes an automatic coupler known as type N.C.D.A. It will be capable of coupling with the Norwegian coupler. Each coupler head is identical and by the interpolation of a single pin, can be converted into a hook coupler head or a yoke coupler head.

039617
RUBBER TIRES AND SOLEPLATES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Nov. 1952, pp 564-565

This article describes various conference papers. In one, the French experience with rubber soleplates is reviewed. An unsuspected fact was a sound-frequency vibration in the neighborhood of 700-800 cycles, with upward and downward accelerations easily exceeding 100 g. The amplitude was about a tenth of a millimeter, which falls well within the elastic movement of the rail permitted by the rubber soleplates. These phenomena made it necessary to find a fixing that would allow slight vertical movement of the rail, but keep the rail firmly in contact with the soleplate throughout. The requirements have been met by adopting the R.N. elastic clip. In another paper, rubber tires in use in France are examined.

039618
ROLLING STOCK WHEEL MANUFACTURE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Dec. 1952, pp 628-633, 1 Fig, 8 Phot

Wheel manufacturing for rolling stock is described and illustrated. The major items comprise a 69 ft. diameter rotary hearth furnace, a forging press of 8,500-ton capacity a 1,000-ton punching press, an electrically driven rolling mill, a 2,000-ton dishing press, and ancillary fully automatic handling plant.

039621
APPARATUS FOR DETECTING WHEEL-SEAT FLAWS IN RAILWAY AXLES

Johansen, FC

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 78, Feb. 1943, pp 190-192, 8 Phot

The Research Department of the London Midland and Scottish Railway Company undertook the task of devising and developing a method of detecting wheel-seat flaws in railway axles without removing wheels from axles or even wheel and axle assemblies from the coach. The essential item consists of a rigid steel ring of square cross section, split diametrically to allow it to be clamped to the axle under test. Contact with the axle occurs at three spherical seatings, of which two are fixed to the inside of the ring and the third is adjustable and is screwed to grip the axle firmly after the two halves of the ring have been bolted together. The system described comprises essentially, two nominally rigid reference planes, fixed normal to the axle and set one on each side of a possible flaw situated near the inner end of the wheel seat. If such a flaw does exist the strength of the axle will be less in the direction passing through the center of the axle and the centroid of the flaw than in the direction at right angles to it. Details and case histories are given.

039623
ALL WELDED RAILWAY TANK WAGONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 78, Apr. 1943, pp 360-361, 4 Phot

Some time ago the Swedish firm commenced building all-welded tank wagons differing considerably in design and construction from the usual type. The Olsson wagon has no separate underframe but instead, at each end, a fixed two-wheel frame welded to the tank, and consisting of bearing forks, buffer beam, draw box, and cross bars. These end parts carry buffer, draw gear, spring suspension, brake mechanism, and so forth. The tank is strong enough by itself to support the load, and also to withstand all drawgear and buffer forces.

039626
REDUCING DERAILMENT HAZARDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 78, June 1943, pp 583-584, 2 Phot

A derailment safety-guide, now applied by the Southern Pacific Railroad to the bogies of passenger coaches, keeps the vehicles in line in the event of derailment. This device was designed on principles which kept the five leading cars in line during the sabotaged derailment of the City of San Francisco. This accident, which took place in 1939, near Harney, Nevada, is briefly described. A series of tests of deliberate derailments at 10,20 and 30 mph were conducted to test the device. All tests and actual applications of the device have proved the value of the device.

039635
TORSION BAR BOGIES ON THE RHAETIAN RAILWAY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, Feb. 1955, p 158, 2 Fig

As a result of experiments with a novel type of bogie designed to provide improved riding at speeds up to 40 mph on their metre-gauge electrified system, the Rhaetian Railway are equipping four types of carriages with a bogie built by SIG. The results of road tests with the SIG bogie are shown, along with the road tests of the bogies originally on the carriages. These latter bogies were built before 1930. Transverse oscillations have been reduced considerably when compared to that experienced with the original bogies. Longitudinal movement is little influenced by the type of bogie, and this was slightly reduced. Tare weight of the cars is approximately one ton less than the original weight.

039643
TESTING OF AXLEBOXES AT HIGH SPEEDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, July 1955, pp 47-49, 4 Tab, 4 Phot

Laboratory tests, conducted by the S.G.I. Generale Isothermos, were made to determine the high-speed characteristics of Athermos mechanically lubricated axleboxes at speeds of 248 to 280 mph. Various loads were applied to the axles to simulate actual running conditions. The speed, oil pressures, oil temperatures and bearing temperatures are shown for several tests and the test conditions are described.

039646
BOGIE TYPE CONTAINER WAGONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Aug. 1955, p 218, 2 Phot

Among the recent developments in the U.S.A. for the conveying of granulated and powered products by rail is a new type of container and platform bogie wagon. This special equipment was developed by the Shippers' Car Line Corporation. The bogie wagon which is standard gauge, is 54 ft. 2 in. over buffers, and has an overall width of 10 ft. 1-1/4 in. The total container area is 2,072 cu. ft. and the loaded weight is 50.6 short tons. The wagon is capable of carrying 28 containers each of 74. cu. ft. capacity, and can be loaded or unloaded by fork lift truck. The placing of the containers on the wagon is simplified by means of inserts let into the flooring, and the containers are locked in position by means of side and top transverse bars.

039658
TALGO TRAINS IN ARGENTINA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Oct. 1955, pp 412-413

The inventor of the Talgo train conducted technical studies in Argentina in 1954 and 1955, during which scale models of tank cars and box cars were built and tested. Experimental passenger and freight trains are being constructed. This is the first application of the Talgo principle to freight train design. A cost estimate was made for constructing an elevated track for the train. The estimate was ten times the estimated cost of ground level track.

039661
HEAVY-DUTY CAST-STEEL WHEELS FOR FREIGHT CARS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Dec. 1955, pp 706-707, 1 Fig, 1 Phot

American Brake Shoe Company has developed a wheel now in volume production for hard service on freight vehicles for heavy commodity loads. During service testing on 23 U.S.A. railways in 1947-55 the wheels have run more than 5,600,000 miles on van, hopper, tank, flat, refrigerator, and other types of wagon of 40, 50, and 70 tons capacity. Five of the vehicles averaged 275,000 miles of operation and one totalled more than 350,000 miles. Measurements of rolling and braking wear on 1,000 of the new wheels showed only equal results to that of other steel wheels and was less in some service conditions. The Casting process is described and a cross section of the wheel, known as the Southern wheel, is shown.

039679
ALUMINUM ROLLING STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, July 1960, pp 45-47, 6 Phot

Exhibits from eight different countries showed what could be done with the latest techniques in fabricating rolling stock and constituents from aluminum alloys. Examples are given for electric and diesel stock, and for passenger coaches in particular. There is a considerable amount of detail and data provided for these vehicles and specific characteristics are given for selected vehicle types.

039680
TUBULAR CONSTRUCTION OF LIGHTWEIGHT STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, July 1960, pp 93-94

Experiments with tubular structure under impact conditions revealed that buckling in both circular—and square-section thin-wall tubes under dynamic loading always started at an end, and at high speeds it was largely confined to that part of the specimen. As related to conventional railway-coach structure (where the longitudinal strength resides mainly in the heavy underframe) the tubular structure can absorb more collision energy for a given shortening. Some projections to coach construction are also given.

039684
PRESSURE-LUBRICATED AXLEBOXES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 113, Oct. 1960, pp 446-448, 4 Fig, 3 Phot

The Isothermos or Athermos axlebox is described in considerable detail. To ensure continuous hydrodynamic lubrication a forged steel flinger arm is bolted to the end of the journal, and when rotating this lifts up the oil contained in the bottom part of the cast-steel body of the axlebox and pours it on to the top of the bearing. An adjustable substantial bottom bearing keeps, prevents, or restricts movement of the axle inside the box. Increased steadiness of the axlebox is obtained owing to the limited movement of the axle. The current Athermos axlebox incorporates a cast or forged steel front cover held in position by an embedding groove, tightened by bolts against this groove in which a flat synthetic rubber joint is fitted. The sealing device for the inner face of the box is designed on the principle of a deflector ring. After proofing the box against oil leakage, it is also necessary to prevent any infiltration of dust or water. Various materials and designs have been tried including the use of laminated pressed wood impregnated with synthetic resin or synthetic rubber compounds. A self-centring sealing gasket made of synthetic rubber compound has been designed for tipping and other wagons.

039685
STANDARD GERMAN PASSENGER BOGIE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Dec. 1960, pp 652-654, 5 Fig, 1 Phot

The Minden-Dentz standard passenger bogie is described in detail. Development objectives are stated and the methods for achieving these objectives are given. Modifications to the basic design are mentioned as well as indications of experimental work to incorporate the latest forms of rubber and pneumatic springing.

039686
LARGE BOGIE TANK WAGONS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Dec. 1960, p 709, 1 Phot

Bogie tank wagons of standard-gauge design with a welded light-alloy tank of 3,500 cu. ft. capacity for gas transport have been completed recently. The tank is 3.0 m dia. by 15.0 m overall length. It is welded from an alloy steel, 60/72 kg per sq. mm (38/45 tons per sq. per sq. mm (29 tons per sq. in.). Discharge of the contents is through a quick-acting valve supplemented by an outside shut-off valve.

039689
EFFECT OF SPRING TRAVEL, HEIGHT OF CENTER OF GRAVITY AND SPEED ON FREIGHT CAR CLEARANCE REQUIREMENTS ON CURVED AND TANGENT TRACK

Schinke, R

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

ER-28, Tech Rpt, Jan. 1963, 25 pp, 21 Fig, 3 Tab, 1 Ref

This test report discusses the effects of partially loaded freight cars, branch line standards of track maintenance for clearance requirements. The test vehicles were two 70 ton, gondola cars with differing spring travel which were run on main and branch lines at varying speeds.

039912
RIGHT-OF-WAY ENGINEERING INPUT

Hay, WW, Illinois University

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 18-27, 7 Fig, 1 Tab, 7 Phot

Proceedings of 1968 Railroad Engineering Conference.

The need to consider track as a variable to be accounted for in vehicle design and evaluation is discussed. The forces present in the interaction between car and track are enumerated and their effects are discussed. Factors of heavy wheel loads and body roll are among those considered.

039913
MAINTENANCE OF EQUIPMENT INPUT

Taylor, RE, Burlington Lines

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 27-30

Proceedings of 1968 Railroad Engineering Conference.

The need for railroads to determine the actual utilization costs for freight cars and then to place for the most efficient operation are discussed. Some ways are suggested such as train yard repairs, repair facilities where operation as a 24 hours, 7 days a week schedule is feasible, plus improved inventory control, and retrieval of average cars. Other suggestions to car designers include cars which allow the replacement of components, easier inspection as outside means to efficient operations.

039914
CARBUILDER'S RESPONSE TO INPUTS

Reed, GE, ACF Industries, Incorporated

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 30-34

Proceedings of 1968 Railroad Engineering Conference.

This article discusses the relation between car designers and railroads hardware manufacturers and shippers. The need for inputs from the various users in order for the manufacturers to respond is stressed. A number of examples are cited and discussed.

039915
INNOVATION POTENTIAL INPUTS

Cope, GW

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 34-38, 3 Phot

Proceedings of 1968 Railroad Engineering Conference.

The article is a discussion of problems in coupler design caused by the use of long freight cars. The problems of length and overhang require use of coupler positioning devices. Three of these devices are described a mechanical, hydraulic and a "swing draft sill", all developed by Symington Wayne.

039917
CUSHIONING AND SPECIALIZED UNDERFRAMES

Fillion, SH, Waugh Equipment Company

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 43-45, 6 Fig

Proceedings of 1968 Railroad Engineering Conference.

The height of a heavily insulated floor above rail level presents loading problems from most loading docks. The solution to the problem of lowering floors in cushioned freight cars is applied to refrigerator cars, flat cars and tank cars. The problems of special cushioning devices and fabricated center sills are discussed.

039918
CAR TEST FACILITY

Voorhees, JE, Battelle Memorial Institute

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 45-51, 18 Phot

Proceedings of 1968 Railroad Engineering Conference.

The article describes a car testing facility to test full size rail vehicles. A comparison between the capabilities of Japanese, British and French test facilities is included with a detailed facility projected by Battelle Memorial Institute, which would provide simulation of actual track conditions with the addition of curves and coupler forces.

039939
WIND-TUNNEL STUDY OF STREAMLINER PASSENGER TRAIN

Lesher, EJ, Michigan University

Michigan University, Ann Arbor, Michigan

M883, Tech Rpt, Feb. 1951, 48 pp, 29 Fig, 3 Tab

In the subsonic wind tunnel of the University of Michigan, tests were made in which the six components of aerodynamic force acting on a 1/12 scale model of a car of Train X were measured. The purpose of the tests was to obtain data for calculation of the stability of the train in high winds. Tests were made on the car by itself and in the presence of other cars. Tests were made with and without rails, and with and without a raised roadbed. Parameters varied in the tests were: (a) angle of yaw of the train to the wind; (b) angle of lateral rail of the car to the horizontal; (c) height of car above ground; and (d) wind-tunnel speed. Tests were also made on a 1/12-scale model of a standard boxcar, to obtain a standard of comparison. The results of the tests are presented in tables and figures.

039947
BEHAVIOR OF THE METAL OF RAILS AND SMALL DIAMETER WHEELS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub No. 25,26, Report, 6707-6801, 4 pp, 1 Fig

Question C 53

This question is concerned with small diameter wheels on rail vehicles and stresses present which limit wheel diameters. Tests were performed with a derailment test stand and at an actual crossing to measure stresses. The test results were fragmentary and inconclusive.

039950
RADIAL-AXLE CARRIAGE BOGIE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Oct. 1955, p 423, 2 Fig

British Patent No. 717,965 for the new design of a radial-axle bogie which will permit railway vehicles to negotiate sharp curves at higher speeds with safety, than is possible with bogies having a rigid wheel-base has been granted. The elevation and plan of the six-wheel bogie are shown to describe the design and the arrangement of pivots. The links and pivots are so proportioned that, when the vehicle is negotiating a curve, the axes of the leading and trailing axles intersect at the center of the curve.

039956
DEVELOPMENT OF AXLEBOX DESIGN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, May 1956, pp 415-416, 4 Fig

The Skefko Ball Bearing Co. Ltd. manufacture double row spherical roller bearings, a type specially designed and introduced to solve the problems arising with railway vehicles. Single bearing axleboxes are also used on the driving and coupled axles of locomotives. The spherical roller bearing gives no less than a 40 percent increase in its carrying capacity. Typical examples of axleboxes incorporating the redesigned spherical roller bearing are illustrated. Spherical roller bearings occupy a central position in modern railway bearing engineering because their special features offer advantages which can be used in a wide range of applications. On four-wheel wagons two bearings are used in each axlebox.

039967
CAST STEEL BOGIE FRAMES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Nov. 1954, p 584, 1 Phot

Several Belgian stainless-steel multiple-unit electric train are fitted with bogies with one-piece cast steel frames housing one 250—265 hp nose-suspended traction motor. In view of the number eventually to be required over a period of several years, a decision was made to subject one of the first castings to comprehensive dynamic tests so that the accuracy of the designers' calculations could be checked, and so that any weak points might be brought to light before serious production began. Loads were applied at a rate of 250 cycles a minute for 133 hours or 5-1/2 days on end without interruption, to give a total of 2 times 10 (super 6) cycles. Horizontal and vertical loads were applied at the same frequency so that diagonal forces would be at a maximum at the same time. Stresses in the frame under static and dynamic loads were checked by 14 strain gauges. Under variable dynamic loading applied vertically and horizontally at the same time, maximum stress did not exceed 3-1/2 tons per sq. in. and maximum amplitude of stress variation at any one point was not above 2-1/4 tons per sq. in.

040002
ALUMINUM IN ROLLING STOCK: HOPPER CARS ON THE ROBERVAL AND SAGUENAY RAILWAY

Campbell, RA
Campball, WF, Roberval and Saguenay Railway Company
Dunlop, EG, Canadian Car Company, Limited

Aluminum Company of Canada, Limited, Montreal, Quebec, Canada

Mar. 1958, 39 pp, 4 Fig, 3 Tab, 7 Phot

The world's first welded all-aluminum open hopper cars went into service in May 1957, carrying bauxite. The 2300 cubic foot capacity cars offer several technical advances in design and construction. They are eight tons lighter than steel cars and have a payload to deadload ratio of 5.5 to 1. Extensive tests demonstrated that welded aluminum structures can be designed to stand up as well as steel under dynamic loading. It was concluded that special cars for specific jobs can result in marked economies, particularly if the cars are operated in a closed circuit. Lightweight cars when used in ore service reduce the number of train loads moved per year.

040005
SPECIFICATIONS FOR APPROVED JOURNAL ROLLER BEARINGS APPLICABLE TO INTERCHANGE FREIGHT CARS

Association of American Railroads, 1920 L Street, NW, Washington, DC, 20036

1971, 8 pp, 1 Fig, 1 Tab, 2 App

The revisions to these specifications for journal roller bearings for interchange freight cars include: design changes regarding life expectancy, lubrication seals and lubrication; manufacturing requirements regarding material quality, dimensions, and markings; instruction changes for assigning approval numbers when making application to the AAR; and the laboratory inspection and tests required for AAR approval. Clearance outline and limiting dimensions are shown for seals and seal fit for freight car roller bearings.

040012
THE BEHAVIOUR OF THE MOTIVE POWER AXLES (WHEELS) ON THE S.N.C.F.

French Rail News (Federation des Industries Ferroviaires, 12 rue Bixio, 75007 Paris, France)

N4, 1969, pp 52-54, 9 Phot

Wheel-set stresses are modified by the action of the strains inherent in service which may be categorized as follows: those affecting the shrinking-on; those which correspond either to vertical effort exerted by the wheel on the rail, essentially cylical, or to the lateral reactions of the rail on the wheel both cyclical and erratic (abnormal shocks); and those set up by a temperature rise, due to braking. The SNCF has tested, both in the laboratory and in service, the diverse stresses as they are linked up with strains. Common damages to wheelsets are described and are shown. Wheel manufacturers are using the test results to enhance wheel design criteria.

040013
SURFACE-TREATED MONOBLOCK WHEELS

French Rail News (Federation des Industries Ferroviaires, 12 rue Bixio, 75007 Paris, France)

N4, 1969, p 55, 2 Tab

Ten years of experience is reviewed with the use of carbon and manganese low-alloy steels for monoblock wheels. The service-life of these wheels is shown. Compared to tired-wheels for electric locomotives the surface-treated wheels can last twice the distance. Compared to chromium-molybdenum wheels, the surface-treated wheels had 20 percent lower cost, an increased service life of 30 percent, and a longer time-lapse between non-destructive test inspections.

040023
STRENGTH OF A HORIZONTAL RESERVOIR SUPPORTED PARTIALLY BY EQUIDISTANT SADDLES

Mizoguchi, K, Osaka University, Japan
Hatsuda, T, Osaka University, Japan

JSME Bulletin (Japan Society of Mechanical Engineers, 1-24 Akasaka, 4-Chome, Minato-ku, Tokyo 107, Japan)

Vol. 14 N4, Aug. 1971, p 745, 12 Fig, 1 Tab, 7 Ref

This theory could be considered in the designs of railway tank cars, especially those of the "jumbo" size. In a horizontal reservoir, partially supported by saddles, great stresses arise near the supports, and the magnitude of these stresses is closely related with the form of the saddle supports. The strength is discussed of such a reservoir and its relationship to the form of the saddle supports, utilizing the fundamental differential equation of cylindrical shells, and the importance of the form of the saddle supports is pointed out. To decrease the magnitude of the stresses arising near the supports, research on the optimum form of the saddle supports was made. The deformation of such a reservoir was very large.

040033
TURNING RAILWAY WHEEL AND TIRE TREADS BY OPTICAL MEASUREMENTS

Heckner, J, Bundesbahn-Zentralamt, Munchen

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 10, Oct. 1970, pp 417-425, 8 Fig, 4 Ref

The restoration of the profile on wheel and tire treads must be accomplished economically and exactly, with the least loss of tread metal. The mechanical means of measuring wheel profiles and diameters setting the machine tools for the most economic turning-down the treads of wheels and tires to the standard profiles assuring concentricity, equal diameters from wheel to wheel and central spacing of the wheel set, is an involved and lengthy process. This article describes the development of an optical scanning and measuring means of assuring all these essential relations of the turning of wheel and tire profiles, involving the projection on screens of the relative wheel profiles compared to the standard, and the positioning the axle journal shoulders to exact dimension lines. The turning of the treads and flanges is then accomplished through electronic controls.

040039
A CONTRIBUTION TO THE NOTCH-EFFECT STRESS PROBLEM ADJACENT TO THE WHEEL-SEATS OF AXLES OF RAILWAY VEHICLES

Brinkmann, P, Klockner-Werke AG

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20 N5, May 1971, pp 219-230, 10 Fig, 5 Tab, 4 Phot, 16 Ref

The theoretical consideration are presented of the stress conditions obtained in the axles of railway vehicles at and adjacent to the wheel-seats, together with a critical appraisal of test results and other studies of this problem. Charts and tables of the values of coefficients and sizes relating to the design calculations of axle strength as affected by the changes of diameter and configuration of these changes adjacent to the wheel-seats, are given in detail.

040047
THE PIONEER III TRUCK-TECHNICAL ASPECTS

Dean, AG, Budd Company

American Society of Mechanical Engineers, 345 East 45th Street, New York, New York, 10017

64-RR-2 Conf Paper, 640415, 8 pp, 4 Fig, 7 Phot

During a major effort at weight reduction it was felt that there was considerable opportunity for reductions in trucks without digressing to radical systems. The resultant was Pioneer III truck with air springs, inside journals, and frame equalizing. It has been thoroughly tested including transit, electric MU suburban, self-propelled diesel and mainline passenger versions. The various features are described including improvements required by service experience or made possible by new materials and new knowledge learned in actual operation. Basically Pioneer III is a 4-wheel equalized truck with inside journals. In the Pioneer III the load travels a short distance along the body bolster to the spring, part way along the truck bolster to the side bearing, directly to the wheel piece and along it to the journal clamp, from this through a rubber ring direct to the outer race of the journal. To minimize wear, all sliding metallic contacts have been eliminated and the number of wear points drastically reduced.

040048
STRENGTH REQUIREMENTS FOR SPECIAL CARS TO TRANSPORT 40-FT TRAILERS

Decker, HL, Pennsylvania Railroad

American Society of Mechanical Engineers, 345 East 45th Street, New York, New York, 10017

60-WA-263, Conf Paper, Dec. 1960, 8 pp, 10 Fig, 1 Tab, 3 Phot

The need for a lightweight flat car capable of carrying two refrigerated highway trailers 40 ft. in length is pointed up. The design parameters for such a car are discussed; basic dimensions of 85 ft. length, 8 ft. 6 in. width, and 62 ft. truck centers are established, and the expected static and dynamic forces including those engendered by the use of the trailer hitch on the car structure are analyzed. Three design solutions fulfilling the necessary basic dimensions and strength requirements are described along with subsequent changes which service experience and later testing indicated.

040049
MOBILE REFLECTOSCOPE INSPECTION OF RAILWAY CAR AXLES UNDER ROLLING EQUIPMENT ON THE CHESAPEAKE AND OHIO RAILWAY COMPANY

Melrose, MF, Chesapeake and Ohio Railway
De Vilbiss, TE, Chesapeake and Ohio Railway

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

59-A-228, Conf Paper, Dec. 1959, 9 pp, 1 Fig, 1 Tab, 22 Phot

The Sperry Rail Service ultrasonic reflectoscope was tried to determine if this instrument could be used for fast inspection of caraxle journals for defects while they were still located in place in the rolling equipment. Having established that the reflectoscope was satisfactory for locating the faulty journals under freight cars, it was decided the best place to check these car journals would be the railway freight car repair yards. The King Midget automobile using an 8-1/2 hp driving engine, was modified to become the reflectoscope mobile carrier. This car is described and illustrated. A record is shown of 65 months of operation of the mobile reflectoscope units. A total of 363,821 freight cars have been checked. From this number of cars have been found 1002 cracked or defective journals.

040070
CAR ROLLING CHARACTERISTICS DATA DEVELOPED BY USSR RAILROAD

Railroad Transport (Railroad Transport Editorial Board, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

N2, 1967, pp 21-24, 4 Fig, 5 Tab, 1 Ref

The USSR Railroad collected data on car rolling characteristics on two hump yards. Results are expressed in W—Kilograms/Ton resistance and were analyzed in the following groupings: by car weight; by speed of cars; by type of car; by ambient temperature; by weather conditions; for wind velocity. Table I gives effect of wind on rolling resistance for various kinds of cars. The larger discrepancy in flat cars is explained by the varieties of loads carried that would affect frontal area. The tests established that the effect of weather on rolling resistance is not significant. Since variations due to wind and weather were small, these variables were eliminated in development of distribution curves and evaluation of the other variables. By use of statistical methods a mean value and standard deviations were calculated, extreme values eliminated, and a new mean determined. Fig. 1 gives a distribution curve for both yards studied during the summer months. The major number of cars have an average rolling resistance value.

040081
OBTAINING A SMOOTH-RUNNING BOGIE–2

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 114, Jan. 1961, pp 74-77, 2 Fig

An approach to improve the conventional type truck as used on multiple-unit and locomotive-hauled stock by considering its faults is suggested. The tendency of the bogie to snake can be greatly reduced by guiding both axles rigidly in the frame and so forcing them to remain parallel, i.e., within 0.04 in. by using roller bearings. The second method of attacking hunting is to prevent the whole bogie frame from snaking by deliberately introducing friction to discourage it from rotating slightly about its pivot. The sidebearer friction will rise in step with tire wear and snaking tendency if the sidebearers are greased only once when the tires are profiled.

040083
CARRIAGE AND RAILCAR BOGIES: THEIR DESIGN AND DEVELOPMENT–IV

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Aug. 1961, pp 216-218, 4 Fig, 3 Phot

Design factors considered in this part include brake ratios; axle fatigue; adhesion, and P.D. More effective braking will require ratios 1:1.5 to 2.2 of the tare weight, cut back to 0.8 at lower speeds. A routine method of axle fatigue calculation indicating the influence of such design variables as fillet radii, type of vehicle, speeds, whether four-wheeler or bogie, and so on, relating to dynamic load allowance and other factors is long overdue. Adhesion improvement through truck linkage to the body at low level requires care that bogie pitching will not cause high stress peaks at the kingpin or cause intense shuttle of the body.

040084
CARRIAGE AND RAILCAR BOGIES: THEIR DESIGN AND DEVELOPMENT–V

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Temple Press Limited, London EC4, England)

Vol. 115, Sept. 1961, pp 363-366, 8 Fig, 1 Phot

The determination of bolster-spring oscillation amplitudes, swing-link displacements, and their phasing using oscillographic instrumentation can be used for definite assessment of riding qualities. Vibrograph wedge tests permit determination of damping factors. The frequency of lateral/swaying oscillations can be determined by placing the vehicle on a transfer table and imparting an impulse by suddenly stopping the moving table. Similarly, body-nosing can be excited by placing the vehicle on a turntable, the center of gravity of the body being in line with the center of rotation. A sudden stop of the turntable will then excite body-nosing oscillations at their natural frequency. It should be stressed, however, that as far as vertical body oscillations are concerned wedge tests are not fully representative of road conditions.

040085
SOME ASPECTS OF THE THEORY AND PRACTICE OF DAMPING–II

Batchelor, GH, British Transport Commission

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Dec. 1961, pp 628-630, 2 Fig, 9 Ref

When mounting dampers across the secondary suspension of a vehicle body pitching and swaying oscillations must be accounted for. The lateral motion on the swinglinks can be damped without difficulty, however, rolling on the bolster springs is difficult to damp with hydraulic units since the frequency of the oscillations is often low (about 0.5 to 0.8 c/s) and the moment arm short. Resonance conditions in the swaying mode must if at all possible be avoided at the operationally important speeds since control by hydraulic damping is unlikely to prove an acceptable solution.

040089
CAST STEEL FREIGHT BOGIE WITH FRICTION DAMPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 116, Apr. 1962, p 484, 1 Fig, 1 Phot

The Gloucester cast-steel freight bogie is of the springplank-less type which, in its latest form incorporates a patent constant-friction damping device. This feature permits the use of long-travel coil springs by preventing spring breakage arising from low-frequency oscillation. This bogie is available to suit all gauges from 2 ft. 6 in. to 5 ft. 6 in. and for axle-loads up to 17-1/2 tons.

040095
HIGH SPEED WAGON BOGIES FOR JAPANESE NATIONAL RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Nov. 1965, pp 902-904, 4 Fig, 2 Phot

Two types of bogie with air and steel springing were developed for 70 mile/h fast freight services in Japan. The axleload has been set at 13.2 tons, and 860 mm diameter solid-rolled wheels have been used. Taperroller bearings are used to take both vertical and lateral loads. The restraint between the axlebox and the bogie frame is 2,000 kg/mm longitudinal and 500 kg/mm laterally. Either steel coil or air springing will be used in the bolsters. The air springs are of 550 mm diameter and are of the three-ply bellows type.

040100
VIBRATION DAMPER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Feb. 1966, pp 144-146, 4 Fig, 2 Phot

A vibration damper recently developed by a Swedish company possesses a damping constant that can be set within wide limits and characteristics that are almost completely independent of temperature over the range plus 40 degC to minus 25 degC, likely to be experienced in countries such as Sweden. Its life is long and an operating time between overhauls equivalent to 1,000,000,km is claimed.

040101
LAMINATED SPRING FRICTION

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Apr. 1964, pp 279-284, 11 Fig, 11 Ref

The advantages and disadvantages of using properly designed laminated springs for rolling stock are explored. Attention is focused on the static aspects of spring friction, the effect of twisted track on vehicle performance, derailment tests and performance characteristics of laminated and helical springs.

040103
RAILWAY PASSENGER COMFORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, Longon EC4, England)

Vol. 120, Sept. 1964, pp 767-770, 4 Fig, 4 Phot

Seat and baggage rack designs for British passenger trains are illustrated and described. Designs for the British Railways, Kowloon Canton Railway (British Section in China), the Egyptian State Railways and the Jamaica Railway are included. Thermal and sound insulation used to reduce noise levels are discussed and a typical crosssection for the floor insulation for a prototype, British Railways passenger car is illustrated.

040125
THE DYNAMIC STABILITY OF A SIMPLIFIED FOUR-WHEELED RAILWAY VEHICLE HAVING PROFILED WHEELS

Wickens, AH, British Railways Board

International Journal of Solids and Structures (Pergamon Press Incorporated, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 1, 1965, pp 385-406, 10 Fig, 3 Ref

The dynamic instability of a four-wheeled vehicle, due to the combined action of the creep forces acting between the wheels and the rails and the conicity of the wheels, is investigated in the case where the vehicle body is attached to the wheels by means of an elastic suspension. The suspension is assumed to have negligible stiffness in the longitudinal direction, and the wheel treads are profiled instead of being purely conical. It is shown that there are two possible types of instability; the wheelset instability which occurs at high speeds and which involves mainly wheelset motion and the body instability which occurs at low speeds and involves large displacements of the body. The effect of the restoring force which arises from the lateral component of the variation of the normal reaction between wheel and rail with lateral displacement is shown to have an important effect on stability, and it is indicated how this effect can be exploited in conjunction with suspension damping in the proper design of a railway vehicle for stable running at high speeds.

040126
COMBINED EFFECT OF FRICTIONAL AND ELASTIC MOMENTS AGAINST TRUCK TURNING UPON HUNTING OF TRUCK

Matsudaira, T Arai, S Yokose, K

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7 N3, 1966, 6 pp, 9 Fig

The hunting of a truck is analyzed theoretically and a numerical calculation for an actual example is made to provide the data on truck design. By a numerical example, combined effect of friction and rigidity against truck turning upon the hunting speed was investigated and was checked by analog computation. The spring action against truck turning plays the leading role to increase the hunting speed and the frictional resistance plays an important supporting role to make the spring action effective to the range of a large amplitude though the friction itself has no action to prevent truck hunting. In order to determine appropriate magnitudes of these factors, the supporting stiffness of the axle with respect to the truck frame should be taken into consideration.

040134
THE GENERAL 70, A NEW FAMILY OF TRUCKS FOR RAPID TRANSIT, COMMUTER AND MAIN LINE EQUIPMENT

Lich, RL, General Steel Industries, Incorporated

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

63-WA-331, Conf Paper, Nov. 1963, 6 pp, 3 Fig, 1 Tab, 11 Phot

The development is described of an improved passenger-car truck concept arrived at meeting the equipment requirements of future rapid transit and commuter systems. The new arrangement is designed to provide an optimum combination of low cost, light weight, good riding qualities, overall stability and flexibility. Numerous photographs of the trucks are included.

040143
ADAPTING THE AUTOMATIC COUPLER TO FUTURE DEVELOPMENTS ON THE RAILWAYS

Bobbert, G, Salzgitter AG

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18 N3, Mar. 1969, pp 94-97, 2 Fig, 2 Phot, 3 Ref

Consideration is given to certain desires and requirements of the railways for the development of the fully automatic coupler, which will not only serve as a coupling, but also will absorb the buff between cars, and make the pneumatic and electrical connections as well. This coupler must be adaptable to use with other designs of center couplings. the opening and closing of cut-out cocks on the air lines is to be automatic, actuated by coded signals from the locomotive or the train yard. Consideration must be given to operation with container cars, where overhanging must be limited. The desired coupler travel will have to be determined. A description of the "Eurocoupler 1968" is included.

040144
DEVELOPMENTS BY THE MASCHINENFABRIK AUGSBURG-NUERNBERG A.G. IN AIR SPRUNG TRUCKS FOR RAIL VEHICLES

Kayserling, U, Maschinenfabrik Augsburg-Nurnberg A.G.

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18 N4, Apr. 1969, pp 127-133, 2 Fig, 7 Phot, 3 Ref

With increased train speeds on existing track structures, designs of truck suspension systems, which would permit higher speeds on curves by tilting the coach inward to compensate for the centrifugal force, have been designed and tested recently. An important factor in such designs has been the development of air-spring suspension systems for the trucks, which are described.

040155
REPORT OF COMMITTEE ON WHEELS AND AXLES

Pilcher, RM, Norfolk and Western Railway

Association of American Railroads, 1920 L Street, NW, Washington, DC, 20036

CIRCULAR NO DV-162, 8, 32 pp, 5 Fig, 6 App

Three recommendations were suggested. The first was to the Committee on Specifications for Materials that Specifications M-208–Cast Steel Wheels be revised to include locomotive wheels. The second was to the Specifications Committee that Wrought Steel Wheel Specification M-107 be revised as to hot and cold stamping requirements. The last was to the Specifications Committee that Specifications M-101 and M-126 covering axles be revised to strengthen the heat treating requirements. It has also been recommended to this committee that for grade F steel the tensile test requirements for per cent elongation of the three thickness ranges to be lowered three percentage points and that the per cent reduction in area of the three thickness ranges be lowered three percentage points.

040157
TRUCK TO DETERMINE TRUCK ACTION

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 85 N17, Oct. 1928, pp 798-800, 1 Tab, 1 Phot

Static effects of warped track surface in causing derailments under varying truck conditions are measured. The tests were confined to the determination of the amount of depression or super-elevation in the outside rails of curves, measured in terms of track warp in a distance equal to that between the truck centers, required to cause derailment of a box car of rigid body construction which had a total weight of 82,000 lb., and to the determination of the turning resistance of trucks under various conditions. The results of the tests are shown in the table. They indicate that center plate resistance is not the major factor in the resistance to turning, which must be overcome by rail pressure at the flange, under the truck conditions prevailing when such turning is normally required. The flange pressure required to turn the truck on level track ranges approximately from 600 to 1,000 lb. with center plates greased. Forces greater than these are the result of side-bearing friction caused by the tilting of the center plate in the bearing as the side bearings on one side of the truck are brought into contact. The results do not indicate that the presence of graphite or grease on these center bearings had any consistent influence on total truck resistance under track conditions which bring the side bearings into action.

040169
LATERAL OSCILLATIONS OF BOGIE BOLSTERS

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, No. 9, Feb. 1960, pp 245-250, 7 Fig

It is imperative to break away from the adherence to general recipes regarding spring rates and swing link angles of inclination often regarded as a universal panacea against ailments generally diagnosed as "bad riding." Vertical leaf springs succeed only in increasing the lateral centering force thus reducing the effective length of the swing link arrangement and increasing its natural frequency, inadvertently acting as swing link spoilers. So far as design layouts are concerned detail components should be used along rational lines, each component being allowed to perform the basic function allotted to it. Thus swing links should be permitted to swing and dampers used to ensure damping. Excessive body amplitudes sometimes encountered with some designs can be controlled with the aid of lateral centering springs preferably with a non-linear characteristic and here suitably shaped rubber units can be of great help.

040175
STRENGTH TESTS ON PASSENGER COACHES SUITABLE FOR TAKING THE AUTOMATIC TRACTION AND SCHOCK COUPLER

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

Rpt, Jan. 1969, pp 27-28, 1 Tab

Question B85

Highlights of an ORE study on the application of automatic couplers to passengers coaches are given. The program consisted of strength tests on vehicle bodies; riding stability tests; study of the coupling possibilities of vehicles under difficult conditions. Only the strength tests were completed at the time of this publication. In these tests, stress measurements taken on coach bodies were limited to the following loading cases: compression of 200 t, transmitted by the buffers; compression of 50 t, transmitted by two diagonally-opposite buffers; compression of 200 t, transmitted by the traction and shock coupler; and, tractive force of 150 t, exerted by the traction and shock coupler. Distortion measurements were also made. The results show all the unfinished coach bodies tested to be suitable for the installation of the automatic traction and shock coupler.

040176
DETECTION OF WHEELS WITH DEFORMED TREADS

International Union of Railways, Office For Research and Experiments, Utrecht, Netherlands

ORE PUB NO 29, July 1969, pp 29-30, 4 Fig

Question A110

The operation of rolling stock with defection wheels can have a detrimental effect on the track, causing additional rail stress and ultimately rail breakage. In addition, axleboxes and underframes can be damaged and to a lesser extent vehicle bodies. The degree of damage depends on the depth and length of wheelflat and the train speed. Presently, harmful effects of defective wheels are controlled through the implementation of regulations which define tolerances for wheelflats and wheels with material accumulations. Also, some administrations have adopted certain braking designs and procedures to minimize wheel damage. However, it is suggested that what is needed is better detection methods for early identification of problems.

040183
IMPACT TEST OF C.&O. RY.CO. 70-TON GONDOLA CAR WITH FLOATING PALLET CAR NO. 218924

Kell, JA, Chesapeake and Ohio Railway
Sammet, EH

National Malleable and Steel Castings Company, 10600 Quincy Ave, Cleveland 6, Ohio

PROJECT J-9706, Jan. 1955, 24 pp, 9 Fig, 1 Tab, 4 Phot, 6 App

Company Report

The object of these tests was to determine reduction in end shock transmitted to lading, obtained with installation of floating pallet and rubber draft gears in a standard gondola car. The test car was loaded with 95,840 pounds of rolled steel sheet to a total car weight of 170,140 pounds for all tests. The striking car was a 70-ton gondola loaded with heavy steel scrap to a total weight of 210,940 pounds and was equipped with friction draft gears. Impacts were started at 2 mph and speeds were increased in 2 mph increments. Tests were continued in each series to a point where the shocks on the pallet attained a force approximately equivalent to six times that of gravity. Peak acceleration records with the peaks corrected for frequency were used to intrepret accelerometer shock records. It was found that the shock transmitted to lading in a gondola car with floating pallet and rubber draft gear was approximately the same at 8 mph as the shock in a standard car with friction draft gear at 4 mph, thus four times as much energy was absorbed by the experimental car.

040194
ON THE RELATION BETWEEN SUPERELEVATION AND CAR ROLLING

Nakamura, I, Japanese National Railways

Japan Railway Civil Engineering Association, Kyodo Building, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Toyko-110, Japan

Vol. 9 N1, Dec. 1961, pp 10-16, 14 Fig, 5 Ref

Weighting function of the track inspection car for rolling is obtained by random data analysis and this weighting function is verified practically. Some applications of this function are shown.

040195
VEHICLE SUSPENSION AND BOGIE DESIGN IN RELATION TO TRACK CONDITIONS

Hancock, RM, British Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England) 322 pp 457-565, 35 Fig, 10 Ref, 6 App

The relationship of vehicle suspension to track conditions is expressed analytically. Significance of coning lies in its property to transmit and magnify the effects of track misalignment to the vehicle body. This effect will become greater as tread wear develops. In the event of build-up of wheel movement, flang-climbing and bogie hunting oscillations may occur. The effects of conicity can be reduced in new designs by the provision of positive guiding of axles by means of telescopic or other guides, together with roller bearing boxes and wheels having a minimum of coning, to avoid running against one rail. Frictional effects of laminated springs and suspension links transmit shock vertically and laterally from the track, and the elimination of such friction is desirable and beneficial. Suspension link length is important, and an increase in length will diminish the transmitted shock. A relationship has been established between track shape and vehicle response, which may be applied by a special application to an analog.

040199
THE RIDING QUALITY OF A TRAIN PASSING A CURVE AS DETERMINED BY SUPERELEVATION AND CENTRIFUGAL FORCE

Koyama, M, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg 18-7, Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo-110, Japan)

Vol. 11 N, Jan. 1963, pp 19-25, 6 Fig

The relationship is clarified between the riding quality and a lateral acceleration on a curved track. The opinions were polled of 50 persons who took part in the test by riding a test train and the findings were correlated with different degrees of lateral acceleration. Thus, the limit of excessive acceleration on curved tracks was examined from the standpoint of riding quality.

040214
RAILROAD AXLE DESIGN FACTORS

Byrne, R, Association of American Railroads

ASME Journal of Engineering For Industry (American Society of

Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

PAPER NO 67-RR-3, Apr. 1967, 10 pp, 8 Ref

Railroad axle designs have been developed from an application of theoretical principles of Reuleaux combined with extensive laboratory fatigue studies supplemented to some extent by road service tests. The designer is presented with data on the effects of the complex forces acting on axles operating in railroad service. Criteria for wheel seat and axle body stresses established from fatigue tests and modified by practical considerations are discussed. The paper gives elaborate reference material for use by future investigators of axle properties and designs.

040216
BRITISH RAILWAYS INVESTIGATIONS INTO THE PROBLEM OF AXLE FATIGUE FAILURES UNDER THE WHEEL HUB

Burdon, ES

British Railways, Research Department, Derby, England

Conf Paper, Apr. 1963, pp 27, 13 Fig, 12 Ref

This paper discusses the problem of the fatigue failure of railway axles and points out the main factors contributing to failures of this type. The reasons behind the investigation currently in progress are described and the results obtained to date are given. Future work is detailed and it is shown how the results of these experiments should enable a more satisfactory axle service performance to be obtained. A certain amount of increase in axle fatigue strength has been obtained by the straightforward application of metallurgically better materials—as happened when wrought iron was replaced by steel. However, because of the overriding importance of shape in a component subjected to fatigue loading, as an axle is, it can be predicted that the use of even higher strength steels will not produce proportionate increases in axle fatigue strength unless allied to a shape of axle which excludes, as far as possible, all notch and stress concentration effects.

040218
WHEEL MILEAGE PERFORMANCE ON ORE CARS OPERATING OVER THE QUEBEC NORTH SHORE AND LABRADOR RAILWAY

Tyler, HA, Quebec North Shore and Labrador Railway

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

64-WA/RR-6, Conf Paper, Dec. 1964, 12 pp, 14 Fig, 4 Tab, 8 Phot

The content of this paper reports the mileage performance between wheel reprofiling that is associated with both nonheat-treated and rim heat-treated wheels applied to 3000 high-capacity ore cars. Train operating speed is in the 35-mph range. Data are presented which compare the performance of the two wheel classes and demonstrate the life-range characteristic relative to a series of wheels. Incidence of wheel defects is given. Discussion is included of the effect that track condition and rail lubrication have on wheel wear.

040219
STUDY OF THE DEFECTS THAT ORIGINATE AND DEVELOP IN THE TREADS OF RAILROAD WHEELS DURING SERVICE

Wandrisco, JM, United States Steel Corporation
Dewez, FJ, Jr, United States Steel Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

60-RR-1, Conf Paper, Apr. 1960, 12 pp, 2 Fig, 2 Tab, 14 Phot, 8 Ref

Mechanism theories for the formation of defects that originate and develop in the treads of railroad wheels during service are presented. These defects were classified after a study of wheels that developed these defects during service and of wheels that were subjected to simulated service tests on a wheel-testing dynamometer. At least two general types of defects were found to occur during service-defects caused by stresses developed by braking and defects caused by stresses imposed by rolling loads.

040220
RESEARCH ON THE OPERATING STRESSES IN PATH RAILCAR AXLES, DRIVE SYSTEMS, WHEELS, AND RAIL JOINTS

Yontar, M, New York Port Authority :

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-RR-6, Conf Paper, May 1966, 21 pp, 33 Fig, 2 Phot, 36 Ref

This paper identifies the cause of premature cracking of axles with inboard bearings as being the bending-mode oscillation of the axle. It points out the importance of gear-tooth separation produced by torsional oscillations in the drive motor system in both right angle and parallel drive gear failures. A unique technique of simultaneous measurement of impulse and thermal loads on the wheel tread is explained and the test data are presented. The relation between the wheel impact loads and the dynamic behavior of rail joints is shown.

040222
WHEEL, AXLE, AND RAIL STRESS PROBLEMS RELATED TO HIGHER CAPACITY CARS–WHEEL PROBLEMS

Johnsen, AM, Armco Steel Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Conf Paper, Nov. 1963, 5 pp, 2 Tab

Panel Symposium, the ASME Railroad Division

November 21,1963

Factors to consider in selecting a wheel for high capacity cars—aside from dimensional compatibility with the rail and truck, are wheel class, wheel diameter, and rim thickness. Rim thickness determines replacement period and is primarily a function of car utilization. Wheel diameter determines stress in the contact area of the wheel tread and rail. Wheel class determines relative resistance of wheels to wear and service damage, principally shelling and thermal cracking. Safety and economy of the operation depends largely on freedom from excessive shelling, thermal cracking, and rapid wear, all commensurate with the cost of new wheels, reconditioning, and maintenance.

040223
A THREE-DIMENSIONAL FINITE DIFFERENCE SOLUTION FOR THE THERMAL STRESSES IN RAILCAR WHEELS

Novak, GE, Materials Research Laboratory, Incorporated
Eck, BJ, Griffin Wheel Company

ASME Journal of Engineering For Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

69-RR-4, Apr. 1969, pp 891-896, 13 Fig, 2 Phot, 12 Ref

A numerical solution is presented for both the transient temperature and three-dimensional stress distribution in a railcar wheel resulting from a simulated emergency brake application. A computer program has been written for generating thermoelastic solutions applicable to wheels of arbitrary contour with temperature variations in both axial and radial directions. The results include the effect of shear stresses caused by the axial-radial temperature gradients and the high degree of boundary irregularity associated with this type of problem. The program has been validated by computing thermoelastic solutions for thin disks and long cylinders; the computed values being in good agreement with the closed form solutions. Currently, the computer program is being extended to general stress solutions corresponding to the transient temperature distributions obtained by simulated drag brake applications. When this work is completed, it will be possible to synthesize the thermal history of a railcar wheel and investigate the effects of wheel geometry in relation to thermal fatigue.

040224
ANALYSIS OF RESIDUAL, THERMAL, AND LOADING STRESSES IN A B33 WHEEL AND THEIR RELATIONSHIP TO FATIGUE DAMAGE

Bruner, JP, Armco Steel Corporation
Benjamin, GN, Armco Steel Corporation
Bench, DM, Armco Steel Company

ASME Journal of Engineering For Industry (American Society of Mechanical Engineer, 345 East 47th Street, New York, New York, 10017)

Paper No 66-WA/, RR-3, Aug. 1966, pp 10, 14 Fig, 9 Tab, 5 Phot, 1 Ref

This investigation involves the problem of service loading conditions that produce the highest stresses and the possibility of fatigue damage. Static loading, rim heating, residual stress measurements, and fatigue tests were made in the laboratory on representative b33 wheels. A series of simulated loading conditions was studied and the resulting stresses combined by simple superposition principles. The resultant stress patterns were compared with fatigue test results using the modified Goodman relationship. In this way the service loading conditions that produce fatigue damage may be predicted.

040225
A COMPUTER PROGRAM FOR DETERMINING THE EFFECT OF DESIGN VARIATION ON SERVICE STRESSES IN RAILROAD WHEELS

Riegel, MS, American Iron And Steel Institute
Levy, S, General Electric Company
Sliter, JA, General Electric Company

ASME Journal of Engineering For Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Paper No 65-WA/, RR-1, Nov. 1965, pp 16, 8 Fig, 22 Ref

Two computer analyses have been prepared relating service stresses in railroad wheels to wheel shape and dimensions. One program computes the temperature distribution and stresses due to heat input by brake shoe friction at the wheel tread. The other computes stresses due to lateral, vertical, and tractional forces between the wheel and rail. Both programs have been validated for certain known conditions using theoretical solutions and are in agreement with available design and experimental stress data to the degree that differences in wheel geometry and loading conditions permit a comparison with experimental stress data. The next step contemplated is better experimental confirmation by computations for specific wheels and loadings for which test results are available and use of the programs to study trends resulting from changes in wheel geometry and dimensions. This work is directed toward optimization of wheel design, and elucidation of the nature and specific effects of excessive service loads.

040226
EFFECT OF DESIGN VARIATION ON SERVICE STRESSES IN RAILROAD WHEELS

Bruner, JP, Armco Steel Corporation
Levy, S
Jones, RD, Canadian Steel Wheel Limited
Wandrisco, JM, United States Steel Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-WA/RR-6, Paper, Nov. 1967, 16 pp, 12 Fig, 1 Tab, 10 Ref

Contributed by Railroad Division of the ASME for

presentation at the Winter Annual Meeting Energy

Systems Exposition, Pittsburge, Pennsylvania, November 12-17, 1967.

The continuing trend of present railroad operating practices toward higher wheel loads and speeds has created the need for better design criteria to insure that wheel configurations are the best attainable. Computer programs to simulate service braking and loading conditions have been applied to various wheel designs and the braking and loading stresses computed. The results indicate that cyclic stresses of significant magnitude may occur under different operating conditions, so fatigue concepts are important in wheel design considerations. There was no one optimum wheel design for all possible service conditions, although several configurations showed promise. A method was proposed for optimizing design for specific service conditions to safeguard against fatigue damage.

040238
AAR SPECIFICATIONS FOR CAST WHEELS—M-208-69

Abex Corporation, Valley Road, Mahwah, New Jersey, 07430

This reprint of AAR Specifications M-208-69 together with the consolidation of the individual cast steel wheel designs appearing in the AAR Manual of Standards and Recommended Practices is prepared for railroad personnel with a direct interest in wheels. The manufacturing procedures, chemical analysis, physical properties, mating, finishing, marking and inspection techniques are given. Several designs are shown.

040239
ABEX BLUE ADAPTER—LABORATORY AND FIELD TEST RESULTS

Abex Corporation, Valley Road, Mahwah, New Jersey, 07430

Test Rpt, Feb. 1971, 27 pp, 10 Fig, 8 Phot, 1 App

An extensive research program was initiated to improve the crown wear resistance of the Abex ductile iron adapter. Materials tested included versalloy, medium pearlitic iron, high pearlitic iron, malleable iron, ductile iron, manganese steel and alloys of these materials with tin, magnesium and nickel. Many types of heat treatment were investigated. Surface coating with tungsten carbide plasma spray was also tried. Of all the materials tested except for manganese steel which could not be economically applied high pearlitic ductile iron with flame hardened crowns proved superior. Adapters made of this material exhibited the longest life without being detrimental to side frame ceiling life. Refrigerator cars were equipped with various experimental adapters for road test. Six of these cars were equipped with experimental high pearlitic ductile iron adapters with flame hardened crowns. The longest life was obtained with these adapters. The life averaged two to one over the best of the other adapter materials. Eleven Flexivan cars were similarly equipped. Four of these cars have been inspected and life of the flame hardened adapters was increased by factors of two to three over competitive malleable adapters.

040242
INVESTIGATION OF STRESSES IN AXLE JOURNAL AREA

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

AAR-MR-116, Dec. 1951, 1 p

Only summary page present.

This report covers tests that were made to determine stresses in the journal area of car axles. The test machine used did not simulate track impacts normally encountered and the stresses, therefore, represent only the static load on a rotation journal. The static load was increased 50 percent above the normal maximum load that a 5 1/2-inch journal carries. Low stresses were obtained under these extreme laboratory test conditions, there is no indication that the dynamic blows encountered in normal road service would increase the stress in the journals in sufficient degree to cause stresses that would lead to axle failures in the journal area.

040243
EFFECT OF THROW OR RUN-OUT OF AXLES

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

AAR MR-117, Jan. 1952, 1 p

Summary page of report only.

The objective of the program was to determine the dynamic augment (or centrifugal force) in axles having throw from 1/4-in. to 1/2-in. Twenty-one freight axles were obtained for this investigation, twelve of which are of the present standard design having black collars, and the other nine are of a proposed design, identical to passenger car axles except as-forged between the raised wheel seats. The procedure used to obtain data on throw and unbalance was to mount each axle in a balancing machine, rotate the axle at 360 rpm and counterbalance each end, and then obtain ten equally-spaced dial gage readings of the axle surfare at each of three locations along the length of the axle. It was found that two-thirds of the axles tested have throw of 1/4-in. or less; the remainder have throw not exceeding 3/8-in. Where throw is significant it is a satisfactory indication of eccentricity. Dynamic augment or centrifugal force varies within a range of plus minus 100% from the average for a given value of throw. Values of dynamic augment were found, at 100 mph, from 57 to 1346 lb. Unbalance of 1.6 ft.-lb., average, is caused by each 1/8-in. of throw. A change in the allowable limit of throw from 1/4-in. to 3/8-in. would have no appreciable effect on lading damage.

040244
COOPERATIVE FREIGHT CAR TRUCK AND SNUBBER RESEARCH PROGRAM

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

AAR MR-114, June 1951, 13 pp, 1 Fig, 5 Tab

First 12 pages of report missing.

This item consists of the conclusions and four appended reports to MR114. It was found that in trucks with all-coil springs without snubbers, the best performance was obtained with 1 5/8" spring travel. All snubbing devices tested provided definite improvement in riding quality over that provided by unsnubbed springs. None of the fifteen Unit Snubbers tested provides performance considered satisfactory to a speed of 65 mph. Five of the eleven Package Snubbers tested provide performance considered satisfactory ("fair") to a speed of 90 mph. Two of the three Modified Conventional Trucks tested provide performance considered satisfactory ("fair") to a speed of 90 mph. These two trucks are as follows: HOLLAND RS-8 with 2 1/2" springs and HOLLAND RS-8 with CESD springs. Twenty-eight of the thirty-five High-Speed Trucks tested provided performance considered satisfactory to a speed of 90 mph. The appendices includes reports of studies on the performance of solid-type journal bearings, roller bearing research, lateral action of freight car trucks and accelerometer performance and side frame stress.

040245
LABORATORY STUDIES OF RAILWAY EQUIPMENT 5 1/2 TIMES 10-IN. JOURNAL BEARING ASSEMBLIES ROLLER VS SOLID TYPE BEARINGS

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

AAR MR-69, Aug. 1949, 1 p

Only conclusions page present.

The exploratory data made available through the limited tests completed to date, indicate, that with both types of bearings lubricated with car oil: (1) Lower starting (Static) friction or resistance for the roller over the solid type bearings under all conditions. (2) No advantage in running (dynamic) friction or resistance for the roller type bearing over the solid type bearing under fairly stabilized conditions. (3) The roller type bearing is capable of metal to metal operation at starting and relatively low speeds whereas the solid type bearing requires more power and is more susceptible to failure under these conditions. (4) The principle problem relating to the improvement of the solid type railway equipment journal bearing appears to be a matter of providing for a greater margin to take care of boundary lubrication during the relatively rapid changing oil film conditions attending abrupted speed reductions.

040246
TESTS OF TRUCKS AND TRUCK SPRINGS DESIGNED TO PRODUCE EASIER RIDING AND REDUCE HARMONIC ACTION

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

AAR MR-66, Prog Rpt, Mar. 1934, 1 pp

Only conclusion page present.

The tests made in this investigation show that freight cars equipped with 1933 Standard A.R.A. or old Standard A.R.A. coil springs developed vertical oscillation at critical speeds, which is more pronounced at half load than at full load. This vertical oscillation or bouncing can be reduced or practically eliminated by the use of various stabilizing devices in conventional trucks or by special trucks, when true wheels are used. The use of these devices should effect savings by the reduction of lading and equipment damage in cars which operate at speeds above 40 miles per hour.

040297
LETTER ON PERFORMANCE OF HYDRAULIC "A" SNUBBERS

Magee, GW

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

July 1968, 5 pp, 3 Fig

Unpublished Data.

Hydraulic "A" snubbers were tested on the AAR test track. Charts show the measured roll angle and lateral acceleration at the center of gravity with respect to speed. Wheel lift was observed on a number of runs and on two runs the flange climbed up on top of the high rail. Charts of several other runs without the Hydraulic "A" snubbers are included for comparison.

040298
SPECIFICATIONS FOR TESTING SPECIAL DEVICES TO CONTROL STABILITY OF FREIGHT CARS

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

Specs, 1969, 4 pp

These specifications cover testing and performance requirements for trucks or other special devices to control car stability for application to freight cars with 4-wheel trucks having 6.5" times 12" journals or larger with loaded center of gravity 84" or higher above top of rail. The tests shall be conducted using a 100-ton high center of gravity hopper car on 4-wheel trucks. This test will be run over a track section with a superelevated curvature especially prepared with low joints. Instrumentation for the test car is described.

040299
CHARTS OF SELECTED TEST RUNS ON AAR TEST CURVE ON LOUISVILLE AND NASHVILLE RR

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

Unpublished Data.

Lateral acceleration and roll angle are shown for test runs on the AAR test track. Three and six inch elevations, and 0.5, 0.25, and 0.34 inch shims were used. The vehicles had 2.5 or 3.7 inch springs, and in one test, volute snubbers and widened gibs. Wheel lifts were recorded.

040300
ROLLER BEARINGS FREIGHT CAR SERVICE

Horger, OJ, Timken Roller Bearing Company, Incorporated

Car Foremen's Association, Chicago, Illinois

Conf Paper, Mar. 1949, 13 pp, 4 Phot

The use of roller bearings on freight cars is justified on the basis of reduced maintenance and inspection time and derailment expense. The fitting of roller bearings to cars already in service is discussed. The coasting characteristics of roller bearing cars in hump yards and the rolling resistance of these cars in train starting are compared to plain-bearing cars.

040301
ANALYSIS OF TAPERED ROLLER BEARING DAMAGE

Widner, RL, Timken Roller Bearing Company, Incorporated
Wolfe, JO, Timken Roller Bearing Company, Incorporated

American Society for Metals, Metals Park, Ohio, 44703

C 7-11.1, Oct. 1967, 32 pp, 1 Fig, 2 Tab, 37 Phot, 21 Ref

Tapered roller bearings, damaged in field applications or laboratory tests have been subjected to a systematic analysis of such damage to prevent its recurrence in the field or to gain knowledge of its control in the laboratory. A method of analysis is described which has been developed for examining such bearing damage. The essential steps of the analysis are described with emphasis on the visual classification and metallographic examination of the damage. Bearing damage is classified in two major categories, that resulting from contact fatigue, and that due to other mechanisms. Damage which is related to material, surface finish, geometry, local asperities (grooves and bruises), the lubricant viscosity is usually due to contact fatigue. Damage due to other mechanisms is that which results from obvious mechanical, chemical, or electrical factors in the application which either change bearing geometry or eventually cause contact fatigue.

040305
ELASTOMERIC REQUIREMENTS FOR RAILWAY JOURNAL ROLLER BEARING SEALS

Otto, DL, Timken Roller Bearing Company, Incorporated

American Chemical Society, Southern Rubber Group, St. Petersburg, Florida

June 1967, 8 pp

The railroad journal roller bearing seal consists of two "sealing" lips. The external lip is designed to exclude dust, dirt, and moisture from the bearing in addition to providing a reservoir for prelubrication adjacent to the primary lip. The primary or internal lip is a "fluid" sealing lip and functions to retain lubricant in the bearing assembly. Operating conditions which cause ruptures and wear in seals are described. The seals must have an operating range from minus 60 degrees F to plus 375 degrees F without curtailing the service life of the seal. Relubrication is at four-year intervals with mileage extending to over 75,000 miles per year. The seals must have low compression set and high abrasion resistance. The compounds which have been used for railroad journal roller bearing seals are a copolymer of butadiene and acrylonitrile, or nitrile rubber. As operating speeds approach the 160 mph presently contemplated, bearing will need to be redesigned to lower the maximum operating temperatures.

040307
DEVELOPMENT OF GREASE-LUBRICATED TAPERED ROLLER BEARINGS FOR HIGH-SPEED RAIL TRANSPORTATION

Lieser, JE
West, CH, Timken Roller Bearing Company, Incorporated

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

69-Lub-31, Oct. 1969, 12 pp, 8 Fig, 4 Tab, 2 Phot

An extensive development program has demonstrated that grease-lubricated self-contained tapered roller bearings are suitable for rail applications to speeds of 160 mph. Rubbing lip seals generate excessive heat at speeds above 100 mph and must be replaced with clearance seals. A highly stable soap-thickened grease with extreme pressure additives was found suitable for 200,000 miles of operation without relubrication. Overcharges of lubricant, either initially or at relubrication periods, produce excessive temperature that leads to grease deterioration and a reduced ability to lubricate.

040310
INVESTIGATION OF NEW DESIGN ALUMINUM TRIPLE COVERED HOPPER CAR

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois

MR-416, Test Rpt, Aug. 1961, 35 pp, 13 Fig, 7 Tab, 6 Phot

A research program is described during which an extensive series of tests was conducted on a new design aluminum triple covered hopper car. These tests included a complete experimental stress analysis of the car under high static loads and impact forces. Because this car was of a design using materials and construction which differed from conventional designs, it was considered advisable to make the tests at loads and forces exceeding those generally applied to freight cars. Test results indicated that some method of relieving the point of stress concentration at the side sill adjacent to the bolster was needed. Additional weldments should be added between the compartment partitions and the roof to provide greater resistance to lading surges during heavy impacts. Provision should be made for jacking pads at the bolster location to distribute the load and avoid possible deformation when car jacking is required.

040311
FATIGUE TESTS OF FREIGHT CAR AXLES 5 1/2 TIMES 10 INCH JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois

MR-242, Prog Rpt, June 1955, 59 pp, 23 Fig, 16 Tab, 6 Phot

The series of fatigue tests was concluded on a proposed design of raised wheel seat freight car axle with "as forged" (unmachined) body between wheel seats. The proposed design has a considerably greater fatigue strength in the wheel fit than the Standard Freight Car Axle (Black Collar Design). One group of Standard Freight Car Axles had an abnormally low fatigue resistance of 13,000 psi in the body portion between the wheel seats. This value was raised to the normal value of 17,500 psi by stress relieving at 1150 degrees F for six hours. One group of axles of the proposed freight car design had a similarly low body fatigue resistance of 13,000 psi. Machining the axle body was found to be beneficial in improving the fatigue resistance. This finding may mean that unfavorable residual stresses due to straightening were removed by machining.

040316
HOT BOX RESEARCH–A STUDY OF REFRIGERATOR CAR JOURNAL BOX PACKING

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60616

MR-201, Res Rpt, July 1953, 16 pp, 4 Tab, 43 Phot

The data presented in this report show that drippings from the bunker drains are entering the journal boxes of refrigerator cars. The amount of this moisture and brine is sufficient to change the incidence of hot boxes to a pattern which differs from that existing in other types of cars in that the end boxes nearest the drains run hot more frequently. The drain design is under study with the object of improving this condition. Two methods of sampling were employed. The first method consisted of a laboratory analysis of 50 samples of the entire packing content from two adjacent journal boxes removed from 25 refrigerator cars. The second method consisted of the extraction of oil samples from the bottom of two adjacent journal boxes of 25 refrigerator cars.

040317
STUDY OF FREIGHT CAR AXLE DESIGN TO WITHSTAND LOADINGS UP TO 10 RO 20 PERCENT IN EXCESS OF PRESENT AXLE LOAD LIMITS AND SUMMARY OF DATA ON AXLES FOUND DEFECTIVE BY MAGNETIC PARTICLE AND ULTRASONIC TESTING OVER A FIVE-YEAR PERIOD

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-404, Res Rpt, 8 pp, 6 Fig, 1 Tab

This report covers the engineering study of recommeded axle dimensions for a load rating of 10 and 20 percent in excess of present axle load limits. This study covers the nominal 5-1/2" times 10", 6" times 11" and 6-1/2" times 12" axle sizes or respectively, 40,000, 50,000 and 60,000 pound per axle load ratings. This report also covers the results of a questionnaire sent to Member Roads to develop summary data on axles found defective when tested by magnetic particle and ultrasonic equipment with a projected estimate of the increase in expected failures when overloading beyond present axle rated capacities.

040318
INVESTIGATION OF NEW DESIGN ALUMINUM TRIPLE COVERED HOPPER CAR

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60616

MR-416, Res Rpt, 2 pp

Only two pages of original Document are available.

An extensive series of tests was conducted on a new design aluminum triple covered hopper car. This car was built by the Magor Car Corporation with aluminum manufactured by the Reynolds Metals Company. These tests included a complete experimental stress analysis of the car under high static loads and impact forces.

040319
CONSIDERATIONS FOR THE DESIGN OF LONG CARS FOR IMPROVING CURVE NEGOTIABILITY

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60616

MR-435, Res Rpt, Nov. 1966, 20 pp, 13 Fig, 1 Tab

Graphs derived from theoretical considerations are presented in this report to show the effects of applying 60-in. couplers to long cars and to indicate the extent to which truck centers require increased dimensions to provide acceptable flange forces. For purposes of illustration, calculations are based on an 85-ft. car coupled to two 31-ft. cars with all cars operating on a curve of uniform degree and with variously applied drawbar forces. The following is recommended: whenever possible, cars of 85 ft. and over should be equipped with 60-in. couplers; when cars cannot be equipped with 60-in. couplers truck centers should be spaced to produce a reduction in lateral forces.

040321
DEVELOPMENT AND TEST OF THE GENERAL 70-E TRUCK FOR BARTD

Burdick, WE, General Steel Industries, Incorporated
Jackson, KL, General Steel Industries, Incorporated

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

May 1966, 11 pp, 7 Fig, 2 Tab, 4 Phot, 1 App

A new transit truck, the General 70-E, has recently undergone extensive testing on the San Francisco Bay Area Rapid Transit District's 4-1/2 mile test track. This paper outlines the basic design principles to be considered in the development of a truck; describes how these principles were incorporated in the General 70-E design; and presents the results of laboratory and road tests. A logical procedure for the complete development of a transit truck, from concept through service testing is presented. Evaluation of the General 70-E truck is that it will provide a completely satisfactory ride for the San Francisco operation. The maximum vertical and lateral accelerations recorded during the test program fall well within any of the commonly accepted comfort criteria. Longitudinal vibration is negligible. The truck shows exeptional lateral stability. The trucks accumulated 15,000 miles in the test program without the need to replace any parts. The wheels were turned once at 12,000 miles.

040322
ROLLER BEARING ADAPTER MOUNTINGS FOR RAILROAD CARS

Sherrick, JW, Lord Manufacturing Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

68-WA/RR-5, Dec. 1968, 8 pp, 4 Fig, 3 Tab, 5 Phot

This paper deals with the development of an elastomeric mounting for installation between the roller bearing adapters and truck side frames of railroad cars. This mounting will provide for a controlled lateral motion between the adapter and side frame of a nominal plus minus 5/16 in. Test installations and the results of these preliminary tests are discussed and the advantages of a roller bearing adapter mounting are pointed out. Most of the purported advantages are supported with test results while others are predicted as a result of the test data.

040325
STUDY OF VIBRATION FREQUENCIES UNDER IMPACT CONDITIONS

Newcomer, GH, Association of American Railroads

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

59-A-250, Dec. 1959, 8 pp, 1 Fig, 2 Tab, 10 Phot, 2 Ref

A study is presented of vibration frequency characterisitcs under impact conditions for typical friction type draft gears used on railroad freight cars of a comparison of typical instrumentation records showing force-closure clutch action of typical and of representative electronic equipment used to measure these vibration forces. When determining the reaction-force characteristics of draft gears during closure, careful selection of instrumentation must be made. Instrumentation having a flat frequency response of 0 to 600 cycles is prefereed in order to attenuate the higher frequencies encountered in friction-draft-gear characterisitcs. Instrumentation having higher frequency response can be used but this usually results in confusion in interpreting the records to determine the fundamental force measurements.

040329
CORRELATION BETWEEN LOSS-DAMAGE AND AGE OF EQUIPMENT

Guins, SG

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

64-WA/RR-8, Conf Paper, 14 pp, 5 Fig, 4 Ref

Contributed by the Railroad Division of the ASME for

presentation at the Winter Annual Meeting, New York,

New York, November 29-December 4, 1964.

Two studies have been conducted to determine if correlation between age of equipment and loss and damage existed. Results of the study definitely showed existence of such correlation, indicating that both frequency of damage occurrence and their dollar value increase with age of equipment. It was also concluded that the major cause of damage was the drop of efficiency of the impact-protection gear, consisting of the coupler, draft gear, and draft gear-pocket geometry.

040331
THE DEVELOPMENT OF CONCEPTS IN FREIGHT CAR CUSHIONING

Byrne, R, Association of American Railroads
Britton, JG, Association of American Railroads

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

68-WA/RR-7, Conf Paper, Dec. 1968, 18 pp, 8 Fig, 2 Tab, 8 Ref

Contributed by the Railroad Division of the ASME for

presentation at the ASME Winter Annual Meeting and Energy Systems Exposition, New York, New York, December 1-5, 1968.

This paper covers a brief history of draft gears, testing techniques of draft gears, and the development of the present-day freight cushioning system. It further discusses the variation and the transmission of accelerations to lading in cars equipped with end-of-car cushioning devices and sliding center sill devices. The development of test techniques is covered for draft gears and special cushioning devices and data obtained in impact test programs are discussed. More exact methods are needed to evaluate cushioning systems, and additional data are required to accurately define the freight car vibration environment.

040346
STRESSES IMPOSED BY PROCESSING

Horger, OJ, Timken Roller Bearing Company, Incorporated

SAE Quarterly Transactions (Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10001)

Vol. 5, No. 3, July 1951, pp 393-403, 19 Fig, 1 Tab, 1 Phot, 27 Ref

Types of residual stress, measurement and formation are discussed. Residual stresses were measured on two different sizes of truck axle shafts of 1 11/16-in. and 2 1/8-in. diameter. Two specimens were taken for residual stress investigation from each shaft, one toward the flange end and the other from the splined end. Metallurgical examination was made. Results of completely reversed torsional fatigue tests made on 1 11/16-in. diameter shafts are presented. Fatigue tests were made in rotating bending on full-size large-diameter shafts of two different designs. Fatigue results are summarized. Residual stresses were measured in these large shafts. Favorable surface compressive stresses were determined for these shafts water-quenched from the tempering temperature as compared with nil stresses in those aircooled. It was concluded that favorable thermal stresses were a very important consideration in improving fatigue strength.

040347
WHEEL, AXLE, AND RAIL STRESS PROBLEMS RELATED TO HIGHER CAPACITY CARS, PART 1. AXLE PROBLEMS

Horger, OJ, Timken Roller Bearing Company, Incorporated

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Conf Paper, Nov. 1963, 7 Fig, 1 Tab, 24 Ref

Some fundamental considerations are made in the design of axles and two new axle designs of 72,000 and 80,000 pounds capacity are proposed. Larger axle design standarization must satisfy a wide range of car geometry factors such as center of gravity height from 72 to 94 in. and wheel diameter ranging up through 40 in. The effect of these factors on axle capacity is shown by curves derived from the Reuleaux formula; serious deficiencies in this formula are also discussed. Other primary axle design factors presented are wheel seat design kind of steel and heat treatment and effect of curved track effect of switches, frogs, and crossings effect of speed and effect of flat spots and shellouts of wheel treads.

040348
FATIGUE OF LARGE SHAFTS BY FRETTING CORROSION

Horger, OJ, Timken Roller Bearing Company, Incorporated

Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England

Conf Paper, Sept. 1956, 11 pp, 5 Fig, 6 Tab, 4 Phot, 9 Ref

Rotating bending fatigue tests were made for the AAR on sixty-six shafts of 9 1/2 inches diameter. A press-fitted member was mounted on each shaft. Fatigue failure initiated in the shaft under the fitted member. Six different engineering steels were used for the shaft forgings. Some steels were normalized and tempered while others were quenched and tempered. Two groups of specimens were quenched below the critical temperature to develop residual compressive stresses in the surface zone. All shafts were run 85 million stress reversals unless breakage developed earlier. The maximum allowable bending stress of endurance limit to prevent the shaft breaking off under the fitted member for all normalized and tempered or quenched and tempered shafts ranged from 9,500 to 12,500 lb. per sq. in. The two groups of shafts given a subcritical quench gave endurance values of 18,000 and 19,000 lb. per sq. in.

040349
FATIGUE STRENGTH OF NORMALIZED AND TEMPERED VERSUS AS-FORGED FULL SIZE RAILROAD CAR AXLES

Horger, OJ, Timken Roller Bearing Company, Incorporated
Buckwalter, TV, Timken Roller Bearing Company, Incorporated

American Society for Metals, Metals Park, Ohio, 44703

Sept. 1943, pp 559-581, 2 Fig, 5 Tab, 12 Phot, 9 Ref

Rotating cantilever fatigue tests were made on 48 full size railroad car axles to determine the fatigue strength of the axle wheel seat on which is pressed-on. Plain carbon steel of 0.39 to 0.53 per cent carbon content in both the as-forged and normalized and tempered condition was investigated. As-forged axles had 1/3 greater fatigue resistance in the wheel seat to the initiation of fatigue cracks than normalized and tempered axles of practically same carbon content. Of two groups of as-forged axles the one having about 10 points higher carbon showed 1/3 greater fatigue resistance in the wheel seat to the initiation of fatigue cracks than the lower carbon content axles.

040350
STRESSING AXLES AND OTHER RAILROAD EQUIPMENT BY COLD ROLLING

Horger, OJ, Timken Roller Bearing Company, Incorporated

American Society for Metals, Metals Park, Ohio, 44703

Reprinted from "SURFACE STRESSING OF METALS"

The history associated with the development of surface pressing is discussed, followed by examples of tests and practical applications. A discussion of the reasons and theory for the improvement in fatigue resistance is presented.

040351
PLAIN OR ROLLER BEARINGS?

Pearce, ES
Horger, OJ, Timken Roller Bearing Company, Incorporated

Abstracts of two papers presented at the meeting of the New York Railroad Club on October 20, 1949, are presented. E.S. Pearce, representing the solid journal bearing manufacturers' group, presents statistics on the number of bearing failures per journal bearings in service. He stresses the need for hot box alarms, especially of the recording pyrometer type, which could eliminate hot boxes occurring en route. He advocates increased research into improved lubrication and maintenance techniques and metallurgical improvements for backing and lining materials. Dr. O.J. Horger, representing the roller bearing manufacturers, stresses the savings in maintenance and inspection costs reduced accident hazards, and reduction in cars needed due to reduced maintenance, as advantages for equipped cars with roller bearings. He discusses operation of roller bearing equipped cars in hump yards.

040356
SATURATION OF NEW WASTE

Keller, WM

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-203, Prog Rpt, Aug. 1953, 4 pp, 2 Phot

The object of the investigation is to determine the adequacy of present methods of saturating new waste for journal box packing and determine the best method and procedure. No pattern of results is yet evident, except that the packing soaked at 200 degrees F, runs considerably hotter in the waste-oil machine than that packing soaked at 90 degrees F.

040358
LABORATORY INVESTIGATION OF THE EFFECT OF COLLAPSED SPRINGS OF LONG TRAVEL DESIGN ON CAR CLEARANCES

Keller, WM

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-211, Test Rpt, Jan. 1954, 10 pp, 1 Fig, 2 Tab, 2 Phot, 1 App

This investigation was made as a result of concern that serious trouble might be experienced with car clearances especially on gondola and flat cars equipped with springs of long travel design particularly when springs are in a collapsed condition. A seventy-ton drop end gondola, equipped with 3-11/16 inch travel springs in A.S.F. design A-3 Ride Control trucks, was furnished for this investigation. Using the measured car lean of 8-1/4 inches for empty car on 6 inch superelevated track with all springs in place as a base line, the static lean increased for the different conditions tested as follows: car empty—4 springs removed 5/8 increase; car loaded—all springs in place 3/4 inch increase; and car loaded—4 springs removed 1 inch increase. These data indicate that the effect of broken springs with this type truck and spring arrangement may increase car lean up to 1 inch with the type load we were able to place in the car.

040359
EFFECT OF OVERHEATING ON THE FATIGUE RESISTANCE OF PLAIN BEARING AXLE JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-212, Prog Rpt, 1952, 1 p

A laboratory test of axles was authorized in which axle journals would be overheated under load in the laboratory and subsequently fatigue tested to determine the effect of overheating. It was decided to carefully evaluate all axles which had failed in the test to determine whether or not copper penetration was present. Tentative conclusions based on the data obtained to date are: 1. Damage to the steel structure of axles due to severe journal overheating can occur without being caused by copper penetration. 2. No traces of copper penetration have been found in the overheated specimens.

040361
JOINT LUBRICATION TESTS CONDUCTED BY THE PENNSYLVANIA RAILROAD TEST DEPARTMENT AND THE MECHANICAL RESEARCH DEPARTMENT OF THE ASSOCIATION OF AMERICAN RAILROADS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-218, 2 pp

This report covers a series of road tests on the Middle Division of the Pennsylvania Railroad made to determine what improvement in journal bearing operation could be made. Conclusions based on these tests are: 1. Cooling journal bearings by passing air between wedge and bearing can be accomplished by a slight modification in the wedge and drilling the box when a modified journal bearing is used. 2. No appreciable effect on bearing operating temperatures was caused by built-up tread to simulate flat spots on wheels in the limited data obtained in these tests. The slightly higher bearing temperatures encountered with these wheels may have represented only the normal temperature variations experienced in these tests. 3. The waste pack is disturbed by the pounding effect of built-up tread on wheels which may cause a waste grab hazard.

040362
EFFECT OF PERIODIC NORMALIZING OF TRUCK SIDE FRAMES

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-219, Res Rpt, May 1954, p 1

The two series of tests on eight side frames covered by this report are the basis for the following conclusions: 1. Heat treatment of second hand truck side frames did not increase their fatigue life expectancy. 2. The reconditioning of worn column areas by welding when subsequently heat treated does not impair fatigue life expectancy. 3. The normalizing heat treatment process (heating to 1550 degrees F and cooling in still air) did not result in improved fatigue test performance in comparison with the stress relieving heat treatment as given the first four frames.

040363
FATIGUE TESTS OF FREIGHT CAR AXLES 5 1/2 TIMES 10 INCH JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-221, Prog Rpt, Apr. 1954, 1 p

This is the first Progress Report on a series of tests made at the Canton Laboratory on a proposed design of raised wheel seat freight car axle with "as forged" body between wheel seats. These tests are part of the program undertaken with the object of providing an improved freight car axle. The indications at this time are that: the proposed design "as forged" raised wheel seat axle appears to have a slightly greater fatigue life than the present standard AAR black collar design axle. Machining the axle body between wheel seats is beneficial to the fatigue life of the axle.

040365
FATIGUE TESTS OF FREIGHT CAR AXLES 5 1/2 TIMES 10 INCH JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-242, Prog Rpt, June 1955, 1 p

This report concludes the series of fatigue tests made at the Canton Laboratory on a proposed design of raised wheel seat freight car axle with "as forged" (unmachined) body between wheel seats. These tests constitute a part of the program undertaken to develop an improved freight car axle. The conclusions drawn from this investigation are as follows: 1. The proposed design "as forged" raised wheel seat freight car axle has a considerably greater fatigue strength in the wheel fit than the Standard Freight Car Axle (Black Collar Design) due to two factors: (a) The removal of the black collar and use of the raised wheel seat design gives an improved shape, resulting in at least 13% greater fatigue resistance to breaking off in the wheel fit. (b) The increased diameter at the wheel seat decreases the stress at that location by 21%.

040366
ECONOMIC ANALYSIS OF OVERHEATED JOURNALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-290, Res Rpt, July 1957, 4 pp

The following conclusions were drawn from this study: 1. The adoption of a rule to scrap all axles having overheated journals, or any other modification to scrap certain axles having overheated journals will not be completely effective in the elimination of broken journals, or have appreciable effect on the reduction of hot boxes. 2. Axles which are severely overheated are more likely to have inherent thermal damage than those which have been slightly overheated. 3. The primary cause of the majority of all broken journals results from burn-offs during overheating. The most effective remedy is the reduction of the incidence of hot boxes. 4. The annual cost of arbitrarily scrapping all axles having overheated journals would be $5,181,903. 5. The annual cost of compliance with a rule which would require that 1/8 inch additional service metal be arbitrarily turned off each overheated journal would be $2,647,165. 6. Ultrasonic testing of car journals during periodic lubrication attention would remove from service journals with cracks or related defects. Annual cost: $874,667.

040367
INVESTIGATION OF COATINGS TO PROTECT TRUCK SIDE FRAMES FROM CORROSION

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-299, Sept. 1957, 1 pp

The relative performance of coatings for the corrosion protection of truck side frames on railroad equipment was investigated. Copper steel was evaluated relative to low carbon steel for the possibility of reducing the effects of corrosion. Laboratory tests were designed to simulate various corrosive conditions found in service. The effects of brine corrosion and of atmospheric corrosion on the coating systems were studied extensively. The test data indicates the superiority of zinc coatings for corrosion protection of truck side frames. Certain vinyl coatings have also demonstrated excellent corrosion resistance.

040368
INVESTIGATION OF LOAD DISTRIBUTION ON JOURNAL BEARINGS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-310, Res Rpt, Nov. 1957, 2 pp

This investigation was initiated when it was found that many bearings are improperly loaded on the journal. The tendency is for the load to be concentrated at one or both ends of the bearing, which results in an undesirable bearing operating condition. In addition to laboratory tests, this investigation included data obtained from several railways as well as an inspection of bearings made by the Magnus Metal Corporation. Based on these data, the following conclusion was reached: The present wedge and bearing back design does not provide optimum loading of the bearing on the journal. Significant improvement can be made in the load distribution by two relatively minor changes, which are: 1. Change radius of the bearing wedge back from 78 inches to 50 inches. 2. Change shape of bearing back.

040369
THERMAL CHECKING OF WROUGHT-STEEL RAILWAY WHEEL MATERIAL

Wetenkamp, HR, Illinois University

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Paper No. 53-A-72, Dec. 1953, 9 pp, 5 Fig, 1 Tab, 5 Ref

Laboratory investigations were undertaken to study thermal checking in railway-car wheel steel. Five compositions of steel were investigated. Tests were designed to (a) give a measure of check sensitivity of wheel steels; (b) study microscopically the area in which the check initiates: (c) determine the critical hardness range of the material in which the check initiated; (d) determine the amount of contraction of martensite upon tempering fully hardened specimens of wheel steel; and (e) determine the sign and magnitude of the residual stresses resulting from the test procedure. The thermal-check sensitivity was found to increase with increase in carbon content within the range of carbon content considered. Hardness surveys showed that for a given class of steel the thermal checks initiated within a hardness range which was reasonably constant. The data obtained from residual-stress determination were qualitative in nature. Determination of the contraction of martensite upon tempering resulted in data that were in good agreement with previously reported works. Microscopic examinations seemed to indicate that the checks were intergranular. The microstructure varied from tempered martensite to nodular pearlite.

040370
IMPACT TESTS OF HOPPER CAR LOADED WITH FERROMANGANESE ORE

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-321, Res Rpt, Aug. 1958, 1 p

This report describes impact tests made on a four pocket hopper car loaded with ferromanganese ore in order to determine whether or not it is safe to ship such a product in hopper cars. Tests were made on both the A and B ends of the hopper car at speeds up to 11.3 miles per hour, and measurements and observations were made to check for any permanent deformation in major structural members of the car and for adequacy of the experimental wood bracing arrangement. It was included that hopper cars can be employed safely for the transportation of ferromanganese ore if adequate bracing is applied to the doors of the loaded hoppers. Only approved methods of bracing should be used and wood wedges should be used to secure the locking pawls of the door latches.

040371
INVESTIGATION OF AXLE JOURNAL FILLETS AND DUST GUARD SURFACES RESULTING FROM CONTACT WITH JOURNAL BOX DUST GUARD FLANGES

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-324, Res Rpt, Aug. 1958, 4 pp

In order to determine the extent to which damage was occurring with the dust guard opening in its present configuration, the Research Department made a field survey of axles coming into the wheel shop for attention. A total of 126 dust guard seats and fillets of axles were examined. During this examination it was observed that the following damage was occurring: 1. Pounding at the fillet, 2. Wear at the juncture of the fillet and dust guard seat diameter, 3. Grooving at the fillet caused by pressure on the dust guard seat diameter cold working the metal. As a result of damage to axle fillets by contact with dust guard wall surfaces, the Car Construction Committee reviewed the matter and decided that the dust guard wall projection should be modified to prevent damage to journals and also to provide better retention of oil in the journal box.

040372
A LABORATORY INVESTIGATION OF THE JOURNAL BEARING FILLET RADIUS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-349, Res Rpt, May 1959, 2 pp

With the objective of improving bearing life by means of better performance at the fillet, some preliminary experimental tests have been conducted in the AAR Mechanical Laboratory. The laboratory tests were conducted to determine if a smaller area of initial fillet contact would result in less bearing lining disturbance at the fillet, and if this might be accomplished by a variation of the original fillet radius to either a larger or smaller radius dimension. Conclusions and suggestions based upon the test results and observations are as follows: 1. Any reduction of the present standard bearing fillet radius dimension appears to create a worse condition. 2. A moderate increase in the present standard bearing fillet radius dimension of 3/4 inch plus 1/16 inch, minus zero, to 13/16 inch, plus 1/16 inch, minus zero, if testing in service now in progress confirms the laboratory findings.

040373
IMPACT TESTS OF BALTIMORE AND OHIO RAILROAD TWO-POCKET FIFTY-TON HOPPER CAR LOADED WITH FERROMANGANESE

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-350, Res Rpt, Apr. 1959, 1 p

See also AAR MR-321 for similar studies.

This report covers the results of a series of impact tests with a two-pocket fifty-ton hopper car loaded with ferromanganese. The purpose of this series of impact tests was to determine the safety of shipping this dense commodity in a standard hopper car that has auxiliary bracing between the hopper doors and also to determine the extent of the damage that can normally be expected on the hopper pockets and door equipment when the car is subjected to over-solid impacts. The following conclusions were made. The Baltimore and Ohio two-pocket hopper car, Class N-44, is representative of equipment that can be safely used to transport ferromanganese if the hopper doors are properly braced in the same manner used in this series of tests. The results of this test show that it is reasonable to expect a certain amount of bulging and distortion to the hopper doors, frames, and the hopper sheets adjacent to the door when ferromanganese is transported in this type car when the car is subjected to impacts at speeds of 6 mph or greater. The impacts in this series of tests were as high as 10.9 mph, which is higher than would be expected in normal service.

040374
HOT BOX RESEARCH–FIELD SURVEY ON CAUSES OF HOT BOXES

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-360, Res Rpt, July 1959, 3 pp

In order to determine the causes of hot boxes and to direct further research on the journal box assembly and truck details for improvement of plain journal bearing operation, a task force was authorized to make a field survey of hot boxes. This survey was made on 131 repair tracks, in 15 shops, and in 61 transportation yards of 51 representative railroads. The geographical distribution of the railroads was selected to represent all of the regional territories of the United States, and to embrace operations under all of the climatic conditions encountered. Data were collected through the following methods: 1. By examination of 295 cars which had developed 341 hot boxes. 2. By examination of 17,256 journal boxes in transportation yards after switching, both hump and flat, and before servicing. 3. By examination of 2,422 journal boxes at terminals after inspection and servicing by the regular yard forces. 4. By examination of 3,628 journal boxes at intermediate points where no journal box attention is given. 5. By observations of general maintenance practices on repair tracks. 6. By measurement of 1,588 journal temperatures on 10 trains. 7. By examination of 32 journal boxes which had indication of above normal temperature as recorded by fixed trackside hot box detectors. 8. By examination of 158 journal finishes through the use of a profilometer. In this study, primary attention was given to the journal bearing and its immediately related mechanical parts. However, the scope was extended sufficiently to include determination of the condition of such items as springs, center plates, side bearings, truck sides, and bolsters.

040384
DYNAMICS OF "SHIMMY" IN PASSENGER CAR TRUCKS

Guins, SG, Chesapeake and Ohio Railway

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

50-SA-21, Paper, June 1950, 13 pp, 9 Fig, 1 Phot

Contributed by the Railroad Division of the ASME at the

Semi-Annual Meeting, St. Louis, Missouri, June 29-23, 1950.

This paper was concerned with only one phase of passenger truck dynamics and therefore the solutions developed won't necessarily be valid when one encounters severe lateral oscillations in a passenger car. Tests were conducted to investigate the causes and the solutions of "Shimmy" motion. It was found that this type of truck motion can be not only controlled but prevented if a proper angular damping is introduced between the truck frame and the car body.

040385
INVESTIGATION OF THE TRUCK HUNTING INSTABILITY PROBLEM OF HIGH-SPEED TRAINS

Clark, JW, United Aircraft Research Laboratories
Law, EH, United Aircraft Research Laboratories

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-TRAN-17, Paper, Aug. 1967, pp 12, 6 Fig, 2 Tab, 14 Ref, 1 App

Prepared for presentation at the Sesquicentennial Form on

Transportation Engineering, New York, New York,

August 28-30, 1969.

The problem of trucking hunting instability and the design implications for high-speed trains were investigated. Linearized theoretical analyses were made to identify the most important design parameters for speeds of 125 to 200 mph. Truck wheelbase, truck mass, wheel coning ratio, and springs to oppose yaw and transverse motions of the truck relative to the car body—all have large effects on the critical speed for secondary hunting instability. It appears probable that lightweight passenger cars could be designed for stable operation of speeds considerably in excess of 200 mph.

040386
STEERING A FLEXIBLE RAILWAY TRUCK ON CURVED TRACK

Newland, DE, Sheffield University

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Aug. 1969, pp 908-918, 13 Fig, 7 Ref

Contributed by the Railroad Division of the ASME at the

Joint Railroad Conference, Montreal, Quebec,

Canada, April 15-16, 1969.

This paper gives a linear analysis for the steady motion of a flexible two-axle railway truck on curved track. Most existing truck designs are too rigid to be self-steering, but provided that the primary suspension is sufficiently flexible, it is shown that a truck can negotiate main line curves without slipping or flange contact. Results are obtained for the minimum radius of curvature for no slipping, expressed as a function of the suspension stiffness. It is shown that lateral loads due to superelevation deficiency have only a small effect on the motion of the track, which is mainly determined by creep forces arising from the geometric inability of the four wheels to roll freely on curved track. Results are obtained for the maximum rolling displacement of the wheelsets (the tracking error).

040388
THE EFFECTS OF THE LATERAL INSTABILITY OF HIGH CENTER OF GRAVITY FREIGHT CARS

Wiebe, D, Stucki (A) Company

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 727-736, 16 Fig, 3 Ref, 3 App

High center of gravity freight cars experience extreme weight shift from side to side as a result of lateral resonance on track with cross-level differences from alternately staggered joints, as well as soft or other local variations in either rail. Dynamic measurements from tests made on test track with controlled 3/4-inch cross-level difference changes illustrate the force and motion magnitudes resulting from resonant and near resonant operating speeds; side bearing loads of 138,000 lb and spring group loads of 100,000 lb, accompanied by center plates separating and wheels lifting. The rotational energy input to the car body can be approximated for a given motion cycle and is preportional to the product of the amplitudes of the track profile and the car body motion. The high lateral (horizontal) forces on the track at the side bearing and center plate make the truck unstable and cause wheels to lift off the rail on one side. This lateral force at a given end of the car is proportional to the corresponding vertical side bearing load. Freight cars traveling at resonant speed are especially prone to derail on curved track under high wheel-rail friction conditions. Forces and motion generated between the car body, truck, and the track, cause high cyclical stresses and severe wear between components that can shorten equipment life and cause severe track maintenance problems. The purpose of this paper is to describe the resonance environment, the forces and motion, that result when high center of gravity cars traverse track with cross-level difference changes, and to illustrate how this environment relates to the car body, the truck, and the truck structure.

040391
A CRITERION FOR THE CONTROL OF 100 TON HOPPER CAR ROLL MOTION

Henderson, KA, Canadian National Railways
Johnson, J, Canadian National Railways

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 717-726, 18 Fig, 4 Tab

A program of experimental investigation was undertaken by the Canadian National Railways with the object of preventing 100 ton hopper cars from derailing. It has been realized for several years that 100 ton hopper cars have a tendency to derail at low speeds and that the derailments are associated with excessive car rolling. The control

which is needed to limit the roll motion can be achieved by appropriate modifications to the suspension system. This paper discusses data derived from this experimental work and presents a criterion for the control of the roll motion. The moment ratio is presented as being a realistic yardstick which can easily be calculated from measurements which are reasonably simple to make. The moment ratio, as a criterion, can be used for the following purposes. 1. The highest value of the moment ratio can be used as a basis for making the effectiveness of various suspension modifications and can also be used to judge the sufficiency of any modification. 2. The speed range over which wheel lift can occur can be determined by examining the relation between train speed and moment ratio. The number of consecutive track irregularities needed to cause wheel lift can be found by analyzing the buildup of moment ratio throughout the test track. Examination of the composition of the stabilizing and overturning moments used to calculate moment ratio can provide information concerning how an improvement was achieved.

040396
COMPRESSION TESTS OF A C&O ARTICULATED HOPPER CAR

Dyrne, R

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

MR-452, Test Rpt, July 1969, 27 pp, 10 Fig, 6 Tab, 4 Phot

This report covers the compression testing of an articulated hopper car designed for 308,500 lb. gross weight on rails. The car was tested in a lightweight condition and also in a fully loaded condition. Car empty—compression force maximum 935,000 lb.; car empty—center truck offset; compression force maximum 518,000 lb; and car loaded with 150,000 lb. of ballast and 91,200 lb. of concrete blocks—compression tested to 906,000 lb. The car did not experience any excessive vertical deflections due to bending in either the empty or loaded conditions. The data from the offset truck test indicated that the car had a tendency to align as the compression load was applied. The maximum compressive force of 935,000 lb. in the empty car test and 906,000 lb. in the loaded car test did not produce any failures in the car and did not cause any visible deformation in structural members of the car.

040397
REPORT ON A STUDY OF TANK CARS INVOLVED IN A COLLISION AT CRETE, NEBRASKA

Byrne, R

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

MR-454, Test Rpt, July 1969, 83 pp, 15 Fig, 10 Tab, 37 Phot, 1 App

On February 18, 1969, a Chicago, Burlington & Quincy eastbound freight train derailed cars and freight cars standing on an adjacent double-end siding. The group of standing cars included three tank cars loaded with anhydrous ammonia. The center car of this standing group of tank cars was a stub-sill, non-insulated tank with a nominal capacity of 33,500 gal. In the collision, the tank ruptured, permitting contents to escape. Temperature-impact energy transition curves from the Charpy tests are shown. The fracture of the Crete tank car was almost entirely of a brittle nature. The metallurgical processing of the tank led to a microstructure conducive to low toughness and a high NDTT.

040407
ROLLER BEARING AXLEBOXES-PASSAGE OF ELECTRIC CURRENT THROUGH AXLE ROLLER BEARINGS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

June 1965, 7 pp, 1 Tab, 3 Ref

Partial Copy of Special Enquiry Rpt. Question B95

One organization found a large number of axle roller bearings damaged by grooves which were formed on both the rollers and the inner ring. The damage was subsequently found to be due to the passage of electric current which flows from the locomotive down the main heating lead through the heaters and then across the roller bearings on its way to the rails and back to the locomotive. Quite small currents can cause this damage particularly if the grease used has unfavorable electrical properties. The only reliable solution is to fit flexible copper connections between the coach body and truck and at least one sliding contact which connects the truck electrically to the wheelset and thereby provides a low resistance circuit so that the bearings are effectively shunted.

040408
ROLLER BEARING AXLEBOXES–REPORT OF ENQUIRY

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 1, Oct. 1966, 4 pp, 1 Fig

Partial Copy. Question B95

All the railway administrations are using, to a varying extent, roller bearing axleboxes. This report of enquiry gives a survey of the various techniques applied, the different conceptions concerning the maintenance of these axleboxes and the problems regarding the cleaning, storing and stabling to which the bearings give rise.

040409
GENERAL PROBLEMS CONNECTED WITH WHEELS AND THEIR ASSEMBLY: SOLID CAST-STEEL WHEELS, WHEELS OF DIFFERENT DIAMETER AND SHAPE–A FIRST CONTRIBUTION TO THE STUDY OF SOLID CAST-STEEL WHEELS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 3, Apr. 1968, 15 pp

Question B98

This report concerning "solid cast-steel wheels" manufactured in the United States using different casting processes, describes: the laboratory investigation; the service tests, undertaken by various Administrations represented on the Committee; and, the braking tests on the test-bench. The first results have shown that, in the case of wheels with a running-tread diameter of 920 mm, the cast-steel wheels manufactured using the Griffin process as well as those cast using the Abex process, both of which are identical to BV 1 in chemical composition and in mechanical characteristics, did not, on the whole, perform so well as the BV 1 rolled-steel wheels. The report also mentions the encouraging initial results obtained from the tests using cast wheels with heat-treated treads fitted to nonbraked cars.

040410
DEVELOPMENT OF AN ACOUSTIC DEVICE FOR THE DETECTION OF WHEEL-FLATS OF A CERTAIN SIZE–ENQUIRY REPORT–DEFINITIONS OF WHEEL DEFORMATION: CAUSE OF WHEEL DEFORMATIONS; EFFECTS OF DEFORMED WHEELS: AUTOMATIC DETECTION OF DEFORMED WHEELS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 1, Oct. 1968, 1 pp

Partial Copy - Summary and Conclusions only. Question B110

On the basis of the facts and opinions obtained, the following can be concluded: wheel deformation is a natural though avoidable attendant phenomenon of railway traffic with high speeds and considerable tractive effort; and wheels that are damaged place a great strain on rolling stock and track. Owing to the additional bending moments and acceleration peaks the stresses to which rails and individual parts of vehicles are subjected can ready prohibitive values.

040411
RUNNING SAFETY OF VEHICLES FITTED WITH THE AUTOMATIC COUPLER–PROBLEMS OF RUNNING SAFETY FOR VEHICLES FITTED WITH THE AUTOMATIC COUPLER AND POSSIBLE SOLUTIONS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Rpt 1, Oct. 1970, 9 pp

Partial Copy - Summary. Question B125

Formulation of a derailment theory applicable to the problem of vehicles fitted with automatic couplers is outlined. The following are braking at slow speeds, pushing from the rear, and incorporation of unloaded cars in heavy trains. A study is to be instituted to enable comparisons between the situation with side buffers and the situation with the automatic couplers.

040412
GENERAL PROBLEMS CONNECTED WITH WHEELS AND THEIR ASSEMBLY: SOLID CAST-STEEL WHEELS, WHEELS OF DIFFERENT DIAMETER AND SHAPE–THIRD CONTRIBUTION TO THE STUDY OF SOLID CAST-STEEL WHEELS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands)

Report No. 8, Oct. 1970, 29 pp, 4 Tab

Question B98

In this report an account is given of the running tests, the braking tests on the wheel testing machine and the test runs on steep falling gradients. The running tests employed wheels of 730 mm diameter with treated wheel-rim of non-alloyed steel with a carbon content of either 0.61% or lower than 0.5% with an ultimate tensile strength of 115 to 130 hbar and 84 to 101 hbar respectively. Other tests were made with solid wheels of 920 mm diameter made of Wt steel (carbon and manganese content lower than or equal to 0.52% and 0.80% respectively. These tests consisted of falling-gradient runs on the St. Gothard line and of runs on flat sections under loaded wagons. Some wheels were also submitted to tests on the test rigs at MINDEN, VITRE-sur-SEINE and DERBY, in order to determine their behavior under the effect of heat generated by braking (liability to thermal cracks and deformations of the wheel-rim). Finally, one wheel of 730 mm diameter and wheels of 920 mm diameter of Wt steel were submitted to investigations in the laboratory and the latter wheels were in addition, studied with a view to the stresses developed. The braking tests carried on the rig with 730 mm diameter ABEX wheels have given unfavorable results. The running tests in commercial service have also given unfavorable results (spalling of running-tread). Concerning the GRIFFIN wheels of the same diameter, the running tests have also supplied disappointing results, there wheels displaying spalling or even perhaps flaking. The ABEX and GRIFFIN wheels of 970 mm diameter with treated wheel-rim and somewhat high carbon content showed a good behavior in SWEDEN during tests under high load (25 t/axle) but very mild braking conditions, the climatic conditions however being very severe. The 920 mm ABEX wheels, ordered in Wt steel have shown a good behavior during the running tests and during the braking-tests on the MINDEN, VITRY and DERBY rigs (resistance to thermal cracks). However, during the falling-gradient runs on the St. Gothard line, they had given rise to deformations reducing the play of the axle.

040437
BEHAVIOUR OF THE METAL OF THE RAILS AND WHEELS IN THE CONTACT ZONE–ENQUIRY INTO THE PROBLEM OF SMALL DIAMETER WHEELS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 3, Oct. 1966, 6 pp

Partial Copy--Appendix 3 Abstracted Separately, Question C53.

This report summarizes the responses to an enquiry into the effect that a reduction in the diameter of wheels would have on the behavior in service of the rails and wheels. Information was collected on the subject of P/D ratios (P = load per wheel in tons, D = diameter in meters) and includes an analysis of tests carried out by the U.S., Russia, Germany, the British and the French. Very different values of P/D were found, depending on the railway and especially on the type of steel in the rails.

040480
EXPERIENCE WITH THE NEW ROLLING STOCK ON LONDON TRANSPORT RAILWAYS

Bingham, GS Bruce, JG

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 307, Part 5, 65-66, pp 480-551, 10 Fig, 24 Phot

Features of the new cars which are designed to maintain high reliability are stressed. The high reliability has lead to the maintenance cost savings anticipated by the design characteristics.

040483
NEGLECTED CONVENTIONAL BEARINGS

Tandon, NN, Indian Government Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 4, Paper No. 673, 65-66, pp 396-411, 9 Fig

It has become evident in the course of present investigations that the major single cause of Indian Railways' very high incidence of hot boxes is the badly designed and poorly maintained bronze babbit bearing. But even an ideally designed and properly maintained bearing can perform satisfactorily only when so many other allied features of the axlebox assembly are of sound design and well maintained. This paper, while mainly focusing attention on the weaknesses of and the desired improvements to the bearing, will also briefly deal with other allied features which considerably influence the performance of solid bearings.

040496
THE DUAL ROLES OF DESIGN AND SURFACE TREATMENT IN COMBATING FATIGUE FAILURES

Wise, S, British Railways Board
Burdon, ES, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 298, Part 2, 64-65, pp 142-215, 23 Fig, 8 Tab, 1 Phot, 27 Ref

The problem of producing components which will have satisfactory lives under repeated stress conditions requires a twofold approach. In the first instance the design must take account of any stress concentration effects in the component by geometrically distributing the material in the most efficient way so as to reduce such stress concentration effects to a minimum. The second approach is based on the fact that fatigue failures in the vast majority of cases are initiated on the surfaces of components. The designer must consider what deleterious surface effects occur on the component being designed, and counter these with the use of a surface treatment applicable to the particular case being studied. The present-day incidence of fatigue failures in all branches of engineering 90 percent of all service failures, is intolerably high. The importance of the twofold approach in designing for fatigue loading conditions is extremely important.

040498
PRACTICAL ASPECTS OF PRIMARY SUSPENSION DESIGN

Botham, GJM, Metropolitan-Cammell Limited

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 313, Part 5, 66-67, pp 495-535, 22 Fig, 1 Tab, 3 Phot, 4 Ref

The most common primary suspension systems on car trucks are: leaf spring and horn guide; coil spring, equaliser beam and horn guide; coil spring and cylindrical guides; and chevron rubber. The design characteristics of these systems are discussed. Damping characteristics, stress loads, and spring rates are given for suspension systems. To fit coil springs to 4-wheeled trucks, the following factors must be considered: satisfactory ride performance can be obtained with laterally rigid suspension on 15 ft. wheelbase cars; particular attention has to be given to providing sufficient damping force to control vertical, and in particular pitching movements; and, such damping need not necessarily be variable between tare and load for the majority of applications but is of advantage to be so.

040499
DESIGN FOR COMFORT

Koffman, JL, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 319, Part 5, 67-68, pp 428-508, 35 Fig, 12 Tab, 12 Phot, 52 Ref

The work done during the last ten years to improve passenger comfort has resulted in marked advances as far as riding, noise levels, heating and ventilation are concerned. Increasing speeds combined with road and air competition make it essential to ensure the development of still more effective coaches. The coaches should be lighter and they must be strong and energy-absorbing in accidents. Riding qualities have become less of a problem and running-gear maintenance requirements will be reduced, particularly by the use of rational tire profiles, but effective braking from high speeds will demand considerable attention. Heating and noise insulation will also demand further attention.

040505
TANK WAGONS FOR OVERSEA RAILWAYS

Barrow, TAW Smith, AD

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 303, Part 1, 65-66, pp 60-128, 20 Fig, 24 Phot, 4 Ref, 1 App

Railways served by British designed cars vary in gauge between 2.5 ft. and 5.5 ft. and some maintain single line traffic in tropical or sub-tropical climates. Designing to compensate for environment changes are discussed. Truck, tank, underframe, and fittings designed are illustrated and described for African railways.

040530
THE STANLEY HERBERT WHITELEGG MEMORIAL FUND TRAVEL SCHOLARSHIP–1965 AWARD ROLLING STOCK MAINTENANCE ON THE NETHERLANDS RAILWAYS

Reid, GJC

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 6, 65-66, pp 573-584, 2 Phot

Brief details of rolling stock maintenance on Netherlands Railways are given. The regular pattern of the Dutch timetable lends itself to standard time intervals between maintenance examinations, and this enables a considerably degree of forward planning of maintenance and of budgetary control. It is suggested that time interval rather than mileage or engine hours provides a better basis for planned maintenance, and is certainly worth further investigation.

040535
AUXILIARY SERVICES ON ELECTRIC ROLLING STOCK

Arthurton, RID, London Transport Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 297, Part 1, 64-65, pp 15-71, 4 Fig, 22 Phot

The advantages and selection of a low tension d.c. lighting, control and battery system are discussed and a description of generating and regulating apparatus is given. Also briefly described are low tension wiring and fusing; inter-car and inter-unit coupling equipment; supply, storage and distribution of compressed air; heating and ventilation; door control systems; speedometers and mileage recorders; communication systems; and windscreen wipers.

040541
RUBBER AS AN AID TO SUSPENSION DESIGN

Koffman, JL, British Railways Board
Fairweather, DMS, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 312, Part 4, 66-67, pp 331-423, 48 Fig, 12 Tab, 33 Phot, 27 Ref

The main object of this paper is to indicate how, where and why some earlier B.R. applications did not succeed, to suggest a more rational approach and to make a plea for a more ready availability of essential information. The dynamic characteristics of rubber springs which are discussed include: shore hardness, elasticity, load versus deflection, creep, effect of temperature, damping and spring stiffness are discussed. Further information is needed on load-deflection characteristics, life expectancy, creep, damping, and ageing characteristics.

040551
DESIGN CONSIDERATIONS FOR NEW ROLLING STOCK FOR THE VICTORIA LINE, LONDON TRANSPORT RAILWAYS

Webster, E, London Transport Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 326, Part 6, 68-69, pp 516-563, 9 Fig, 8 Phot, 7 Ref

The 1967 Tube Stock incorporates many new features, some arising directly from the fact that the trains will only carry a single operator. The background to the development of many of the new items is traced and reference made to prototype testing which was carried out on a very extensive scale. The rolling stock, which is suitable for operation in 12 ft. diameter tunnels, is made up into 4-car units each consisting of two driving motor cars and two trailer cars. Two units will normally be coupled together to form an 8-car train. The trains are arranged for automatic operation and are controlled by a single operator, situated in the front cab, who controls the door operation and the starting of the train. The station to station run is normally performed entirely automatically, but manual control can be substituted in the event of failure of the automatic equipment.

040552
HYDRAULIC DAMPERS AND DAMPING

Batchelor, GH Stride, RCT

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 326, Part 6, pp 563-628, 26 Fig, 7 Tab, 6 Phot, 8 Ref

After brief review of the influence of viscous damping on free and forced oscillations of mass-spring systems, and its effect on response to impulses, suitable damping factors are quoted for control of body and truck oscillations on the suspension. This is followed by discussion of the most suitable forms of force-velocity characteristics for railway applications, and a section dealing with damping calculations. The influence of damper flexible mountings is then examined, with particular reference to impulsive suspension response and response to sinusoidal in deal with excitation. Experimental work relating to vehicle damping requirements and the recently issued B.R. specification with stipulates the requirements for dampers for use on British Railways' vehicles is discussed. Difficulties in the manufacture of dampers with linear symmetrical force-velocity characteristics are then pointed out with special reference to the tendency for current damper designs to result in S-shaped characteristics.

040554
EVALUATION OF CLEANING PROCESSES IN RAILWAY VEHICLE REPAIR ACTIVITIES

Cook, BE Ward, RJ

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Part 11970, pp 62-91, 3 Tab, 18 Phot

Cost and effectiveness comparisons between processes are made and conclusions produced in the form of recommended procedures for the range of components on locomotives and carriages. Factors covering the choice of cleaning material, their effects on safety precautions and contamination of works effluent and discussed. Certain experimental work on developments of cleaning equipment in workshops are detailed. Perhaps unexpectedly, cleaning by hand still has a place among modern cleaning methods and the reasons for this are explained.

040778
SUMMARY OF FATIGUE TESTS OF FREIGHT CAR AXLES AND ESTIMATED EFFECT OF OVERLOADING

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-390 Res Rpt, July 1960, 18 pp, 2 Fig, 6 Tab

This report was prepared to accumulate and consolidate all data now available for consideration on the problem of overloading of cars in order to resolve the question as to whether the strength of axles and other car conditions justify changes in the present rules which would permit or restrict heavier loading. With a 10 percent overload, the estimated number of axles which will fail before running their full life expectancy is 72 percent. With a 20 percent overload, the estimated number of axles which will fail before running their full life expectancy is 100 percent.

040782
REPORT ON COMMITTEE ON WHEELS

Garin, PV, Southern Pacific Company

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

Circular D.V.-1368, May 1956, 65 pp, 39 Fig, 7 Tab

As a result of two meetings in 1955 and 1956 and Committee action this report is submitted on the following subjects: wheels—cast steel. Progress reports on two experimental designs, AARX-2 and AARX-3 were analyzed and approval of both as AAR standards was recommended. Wheels-wrought steel. Ultrasonic testing was recommended on new diesel locomotive wheels for a two year period to provide additional data for correlation of size of discontinuity with indication. A dimensional study of design F-36 was completed and no changes were recommended. Wheels and Axles. A ballot to discontinue mandatory magnetic particle inspection of freight car axles between wheel seats was submitted. Wheel and Axle Manual. Complete revision of the Wheel and Axle Manual will be made after decision is reached on the adoption of new designs of cast steel wheels. Changes in specifications and designs for axle dimensions for passenger cars, spun multiple wear cast steel wheels, cast iron wheel defects and boring mill practice were also made.

040783
FATIGUE COMPARISON OF 7-IN. DIAMETER SOLID AND TUBULAR AXLES

Horger, OJ, Timken Roller Bearing Company, Incorporated
Buckwalter, TV, Timken Roller Bearing Company, Incorporated

American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania, 19103

Vol. 41, Proceeding1941, 12 pp, 6 Fig, 3 Tab, 6 Phot, 9 Ref

The object of this experimental investigation was to determine the fatigue resistance of solid versus tubular type axles for railroad car service. Solid axles tested represented conditions consistent with existing railroad specifications. The tubular axles investigated were of two types; one of which was tested with permission of A.A.R. and the results reported by the manufacturer, the other was tested as a separate project in order to contribute information on certain questions pertaining to the fatigue strength of axles. Rotating cantilever beam fatigue tests were made on axles about 7 in. in diameter using steel of about S.A.E. 1045 analysis. Comparison of axle fatigue resistance due to a press-fitted wheel was made between "as-forged" solid members and seamless tubes in "hot-rolled" and several conditions of heat treatment. Results showed that tubular axles having high tensile strength values may or may not exhibit greater fatigue strength than those having lower physical properties. Observations on the effect of residual stresses are given. Some tubular axles showed greater fatigue strength than the solid ones.

040799
PASSENGER RIDE COMFORT ON CURVED TRACK

Magee, GM Keller, WM

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Bulletin 516, 5406-5407, pp 125-214, 42 Fig, 4 Tab, 13 Phot, 10 Ref

Reprinted by AAR, 3140 South Federal Street, Chicago, Illinois 60616.

Tests were carried out to obtain data for making recommendations for the permissible speed on curves and the length of transition curves for passenger comfort, and for establishing clearance requirements on curved track. The first test was run on the Louisville and Nashville, May 10, 1950, using the Chesapeake and Ohio track inspection car and making use of 20 observers. Results of this test indicated the importance of the roll of the car body in reducing the effective elevation of the track insofar as passenger comfort was concerned. A second test on the Kansas City Southern developed gyroscope and recorder techniques to show the angle of the car body from the vertical. From the results of these tests it was possible to establish a very satisfactory relationship between passenger reaction and the amount of lateral acceleration so that in subsequent tests it was not necessary to use passenger observers. To obtain data on the various types of modern passenger cars being used, running tests were subsequently made on 7 railroads. The tests have indicated that for types of modern equipment having soft springs and no provision for restricting the roll of the car body on curves the present AREA limitation of 3-in. unbalance should be continued. For cars having stiffer springs, outside swing hangers (and springs) or roll stabilizers reducing the amount of roll with unbalanced elevation, the tests in. can be tolerated by the more favorable types of equipment. A new and different procedure is recommended for determining the length of transition curves, based on the rate of change of lateral acceleration entering and leaving the curve rather than on the rate of change of elevation. With respect to clearance the test data gives displacement characteristics due to roll of the car body on the springs of the various types of passenger cars. The records indicated that an allowance of plus or minus 1 deg in car body roll will provide for irregularities in line and surface for representative main-line track for speeds up to 90 mph.

040800
WHAT CAUSES WHEEL TREAD DEFECTS? PART 1: SHELLING

Wandrisco, JM, United States Steel Corporation
Dewez, FJ, Jr, United States Steel Corporation

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

July 1960, pp 30-32, 10 Phot

Studies were made of wheels that shelled in service after being subjected to the usual on-tread braking as well as a wheel equipped with disc-type brakes. These studies have indicated that shelling is essentially a fatigue failure that is caused by rolling loads. The formation of structurally weakened metal as the result of the heat of braking friction is believed to accelerate the formation of shelling cracks. Macroscopic examinations of radial-tangential sections from shelled areas have indicated that shelling is caused by cracks that form at angles of 30 to 50 deg to the tread surface. Because shelling cracks are oriented at 30 to 50 deg to the tread surface they are assumed to be caused by high shear stresses developed by rolling loads.

040812
WHAT CAUSES WHEEL TREAD DEFECTS? PART 2: THERMAL CRACKING

Wandrisco, JM, United States Steel Corporation
Dewez, FJ, Jr, United States Steel Corporation

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Aug. 1960, 4 pp, 5 Phot

United States Steel undertook an investigation of wheel-tread defects. Shelling was shown to be the result of repeated stress application to the rolling wheel, which apparently caused the tread metal to fail in shear. Cracks propagate from below to the tread surface. When two of these cracks of opposed orientation meet beneath the tread, metal between them is loosened and finally expelled. This is the typical shelling type of failure. While shelling apparently is not caused by braking, there are wheel defects which can be caused by stresses that develop in the wheel rim as a result of thermal gradients generated by friction between the tread and brake shoe during braking. Shelling and thermal cracking of railroad wheels shorten wheel life, and checking brought on by severe braking may occasionally result in a complete wheel failure.

033080
SOME STATISTICAL ANALYSIS OF ADHESION COEFFICIENT MEASURED BY BRAKE TESTING CAR

Idemura, K, Japanese National Railways
Araki, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 7, No. 4, Quart Rpt, Dec. 1966, pp38-39

Adhesion between wheel and rail is a stochastic variable depending on numerous variable factors, therefore it needs to be dealt with statistical analysis on adhesion coefficient. Report presents a statistical investigation on the data of adhesion coefficient which has been examined in friction braking of a brake testing car on a grade section in 1960.

033083
WHEEL-RAIL ADHESION

Marta, HA, General Motors Corporation
Mels, KD, General Motors Corporation

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)
68-WA/RR-1, Aug. 1969, pp839-854, 69 Ref

The subject of adhesion between locomotive wheels and rails has been an area of vital interest to locomotive manufactures and to the railroads. Horsepower of internally powered locomotives has continued to increase significantly, thereby providing more power for traction. The trend of increasing horsepower has been the product of progress in technology and engineering development. Wheel-to-rail adhesion within the lower speed range has been a limiting factor in tonnage ratings for locomotives in drag service on U.S. railroads. Factors Affecting Adhesion are: (1) Vehicle Factors, (2) Track Factors, and (3) Contact-Area Common Factors. Additional discussion of the conclusions follows.

033084
FRICTION CREEP PHENOMENON OF ADHESION BETWEEN STEEL WHEELS AND RAILS

Marta, HA, General Motors Corporation
Mels, KD, General Motors Corporation
Itami, GS, General Motors Corporation

ASME/IEEE Railroad Conference (American Society of Mechanical Engineers,
Institute of Electrical and Electronics Engineers, 345 East 47th Street New York, New York, 10017
1971, 35pp, 31 Ref
Conference sponsored by the American Society of Mechanical Engineers and the Institute of Electrical and Electronics Engineers.

The purpose of this article is to present a summary of the laboratory and field tests which have been conducted by EMD to evaluate the friction and creep phenomenon of adhesion between steel wheels and rails. The available adhesion coefficient between the driven wheels and rail is a primary factor in determining the amount of power that can be converted to tractive force by the locomotive. For this reason, experimental investigations into rolling contact friction-creep phenomenon were conducted on model equipment in 1968 along with full scale field tests on an SD-45 model locomotive.

033088
COMPARISON OF LIGHT INTENSITIES OF VARIOUS LOCOMOTIVE HEADLAMPS AND VISUAL RANGE BY HEADLAMP ILLUMINATION

Masaki, H, Japanese National Railways
Suzuki, S, Japanese National Railways
Tanaka, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 1, No. 2, Quart Rpt, June 1960, pp65-66

With the increasing train speed more powerful headlamps are demanded to prevent accidents especially at highway crossings. The light intensity distributions of the various headlamps installed in the actual locomotives were measured at the neighborhood of the Shinmachi Station of the Takasaki Line. The photometric property of the sealed beam headlamps is superior to that of the ordinary type. To secure good illumination, two or more headlamps are to be installed in a locomotive.

033110
CONSTRUCTION OF THE NEW ALTERNATING LOAD TYPE ADHESION TESTING MACHINE

Maruyama, H, Japanese National Railways
Ohyama, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 11, No. 3, Quart Rpt, Sept. 1970, pp174-175

In the field of adhesion phenomena of the railway, oscillation takes part in friction in the form of alternating load of the wheel. The adhesion problems have been hardly investigated from this point particularly by experiments. We made a new type testing machine by which adhesion force (friction force) under alternating load could be measured. The followings are the construction and the results of preliminary experiments with this machine.

033114
MAGNETIC RUN-CURVE RECORDER

Ohishi, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 12, No. 1, Mar. 1971, pp58-59

Train speed recorders are used in a part of the trains in JNR, but on accuracy, maintenance and recording items, they have not fully content performance the use of roll chart is troublesome and recording item is almost only the train running speed. The recording performance, after preliminary adjustment, was found stable. Accuracy of time and distance recording was satisfactory, that is accuracy of time was about 1 percent and distance about 2 percent at most. It became clear that the prototype Magnetic Run-Curve Recorder was excellent for usual train speed recorders, especially in points of accuracy, maintenance and handling.

033123
ADHESION CHARACTERISTICS OF LOCOMOTIVE AND A FEW FACTORS AFFECTING THEM

Sekikawa, Y, Japanese National Railways
Kogawa, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 12, No. 1, Quart Rpt, Mar. 1961, pp21-29

There is no difference in adhesion coefficient due to the type of rolling stock used. However, the fact that the adhesion coefficient practically available varies according to the type of locomotive, is caused by the difference in the amount of axle-load shifting due to the different constructions of truck and also by the difference in the difficulties in recovering the adhesion after slipping. The present authors analyze the effect of various constants of locomotive on the adhesion recovering phenomenon after slipping and describe a method of improving the adhesion characteristics, intending to contribute to the design of locomotive and also to the planning of locomotive utilization.

033150
TEST FOR WHEEL BURNS OF RAILS BY D-TYPE AC LOCOMOTIVES

Shiba, S, Japanese National Railways
Kimura, S, Japanese National Railways
Ito, A, Japanese National Railways
Ueda, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp48-50, 1 Ref

This test was intended to analyse the process of wheel burn formation. In the gradient traction test of an ED 75 AC locomotive, on the Kagoshima line, wheel slip was forced to occur by various operating conditions, and the wheel burns of rails were examined. It is the object of this test to find an optimum operation method for heavy trains and to improve the practical adhesive capacity as a preventive measure of wheel slip, by the analysis of adhesion on various rail conditions.

033172
EXPERIMENT ON ADHESION IN BRAKING BY ADHESION TESTING MACHINE

Idemura, K, Japanese National Railways
Wada, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968

Adhesion between the rail and wheel of rolling stock is known as a complex phenomenon influenced by many factors. In order to increase available adhesion value, it is necessary to study the factors. Modeling procedure on an adhesion testing machine is suitable for the purpose at it simplifies the conditional factors. The experiment reported here is aimed to have insight for fundamental factors, through qualitative analysis of the sliding and re-adhesion process in braking.

033176
MEASUREMENT OF RAIL SURFACE CONDITIONS (REPORT 2)–FRICTION OF RAIL SURFACE

Ueda, T, Japanese National Railways
Shiba, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 1, Quart Rpt, Mar. 1968, pp38-40, 1 Ref

Measuring methods of rail surface conditions and of friction of rail surface in the field developed, and applied to measurements in a performance test of ED75S AC locomotive. The friction varied during the measurement and was affected by the weight of the slider. The friction of the rail on the definite position varied with time, and values ranging 0.29 to approximately 0.53 were obtained. Friction variation in the direction of the rail was small. Effect of wetting on the friction was also small, whereas oiling of the rail produced extraordinarily reduced friction, which recovered the original values by the passage of several trains.

033179
SLIDING FRICTION OF METALS IN CONTACT UNDER HIGH PRESSURE

Miyairi, M, Japanese National Railways
Tomizawa, M, Japanese National Railways
Miura, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968, pp117-119

In order to make clear the mechanism of adhesive force in train operation, friction coefficients between metals contacting with high pressure exceeding the yield point of the metal were studied. As an important factor affecting the friction coefficient of metal, the effects of the holding time of specimens in dry air (in a desiccator) were discussed. A sliding process is divided into three stages, namely initial, transient and final stage. In the initial stage, the friction coefficient is generally small and reaches only 1/2-1/3 times of that in the final stage. This fact would make possible an explanation that the adhesive force obtained from a running test on the rails is rather lower than that obtained from an adhesion test device in laboratory.

033272
SAFETY AND AUTOMATION ON ELECTRIC AND DIESEL MOTOR POWER UNITS

Neruez, J, Belgian National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

1962, pp37-63

Application of automation techniques in the driving of power units (locomotives and motorcoaches), automatic starting, control of the spinning and skidding of the wheels, automatic transmission of the signal indications and automatic stopping: vigilance and deadman's devices; application of electronics.

033364
THE FRENCH HIGH SPEED MOTOR UNITS

Nouvion, F, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21968, pp79-95

Article discusses the problems of high speed operation in locomotive design. These factors include: high power to weight ratios; reduced resistance to forward movement; good adhesion; stability at high speed. The factors are further examined in detail and conclusions are that for efficient operation, units must be designed to operate at increased maximum speeds. Design of units must be tailored to achieve this goal.

033367
DETAILS OF SOME RECENT TEST WORK ON THE S.N.C.F. 1. RAILWAY DYNAMICS SECTION (R.D.S.) 2. BRAKE TEST SECTION (B.T.S.) 3. ROLLING STOCK SOUND AND HEAT PROOFING SECTION. 4. VITRY TESTS STATION

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 11969, pp60-70

Report of test work by the various sections of the S.N.C.F. including tests of stability of gas turbine unit at high speeds, and study of unit on straight and curved track. Tests of braking systems-The Capitale, test vehicles with anti-locking systems, disc and shoe brakes and electro-magnetic brake. Finally, tests of noise levels in coaches with different bogies, and spring test bed for determining vehicle spring rate.

033371
PROSPECTS FOR 300 KM/H WITH 25 KV 50 HZ OVERHEAD LINE EQUIPMENT

Boissonnade, P, French National Railways
Dupont, R, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 41970, pp140-152, 7 Ref

Discusses the modifications necessary to overhead line equipment to obtain a speed of 300 km/h. Tests and modifications of pantograph are discussed as well as modifications to overhead power lines. A report of high speed tests in 1969 and 1970 are included with the results which include a maximum speed of 281 km/h.

033373
THE DEVELOPMENT OF THE LOCOMOTIVES OF THE BB 16500 SERIES

Nouvion, F, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21970, pp43-53

Discusses the development of BB 16500 series locomotive. Includes discussion of the mechanical parts including the suspension system, development of the electrical equipment and the performance of the unit under varying conditions. A discussion of maintenance and costs is included.

033386
RAIL SURFACES AND LOCOMOTIVE WHEEL SLIPPING

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Feb. 1961, pp146-147

A study of locomotive wheel slipping was undertaken to find a correlation between slippage and rainfall. Slipping was measured by recording the beat of the locomotive exhaust while weather conditions were noted. Colloidial materials which accumulates on rail surfaces was collected and identified. This material contained Fe(sub 3)0(sub 4), silica and possibly a hydrated form of iron oxide Organic matter in the form of lubricating oils could not be determined by the method employed. Chemical cleaning of the rails was examined and sodium metasilicate was considered an effective compound for this purpose.

033403
THE DYNAMIC BEHAVIOUR OF THE CATENARY AT HIGH SPEEDS

Berard, A, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21966, pp97-101

At present maximum speed of 160 km/h (100 mph), current collecting from the catenary system does not present any difficulties. At speeds over 160 km/h this problem becomes more complicated, as the oscillatory phenomena considerably amplify the vertical movements of the contact wire at certain speeds, with risk of excessive degradation of the quality of contact. Contact can be regular only when the difference of level of the contact wire is neither too sudden nor too considerable. For the necessary improvement of the quality of current collection at high speeds, the modifications of the catenary suspension described herein are significant.

033404
THE BEHAVIOUR OF WHEEL SETS ON S.N.C.F. MOTIVE POWER UNITS (THE EFFECTS OF CERTAIN TYPES OF STRESSES)

Gauthier, P, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 41969, pp188-201

Discusses stresses of wheels. These are residual and fretting. The second section deals with the causes of fretting and its relation to tensile and compressive stresses. These are caused by overheating of axlebox and its adjacent wheel box. The frequency of overheating increases because of roller bearing systems. The destruction of wheels because of horizontal rail reaction, wheel loading, wheel skid and localized thermal damage is also considered. The use of surface treated wheels is suggested containing different steels for safety, regularity and economics.

033405
THE DYNAMIC BEHAVIOUR OF THE PANTOGRAPH AT HIGH SPEEDS

Dupont, R, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31966, pp102-106

At high speeds the quality of current collecting depends on the dynamic behavior of both the catenary and the pantograph. The measurements of the dynamic behavior of the pantograph through these tests, made possible the choice of design of the best system suited for high speed operation, which was the AM type of pantograph (an open two arm design instead of the closed parallelogram), that proved the most satisfactory in maintaining good quality of contact at speeds of 225 to 250 km/h.

033406
TOWARDS A NEW DIESEL-ELECTRIC LOCOMOTIVE: THE CC 7200

Tessier, M, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31966, pp107-116

Details development and construction of a diesel-electric locomotive with a single unit power plant of 2650 KW (3600 HP) to 2950 KW (4000 HP) with a weight of 110 tons on 6 axles. Uses electrical transmission of 3 phase alternator and 2 traction motors. Body weight supported by rubber block suspension and all weight including the traction motors is spring, excluding wheels, axles of mounted axle gear. Wiring design includes assemblies with connectors for quick replacement.

033434
MEASUREMENT OF RAIL SURFACE CONDITIONS

Ueda, T, Japanese National Railways
Shiba, S, Japanese National Railways
Kobayashi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 3, Quart Rpt, pp45-46, 2 Ref

The coefficient of adhesion is a major factor affecting the performance characteristics of railcars and locomotives. Adhesion characteristics of the locomotives themselves have been improved by modification of the truck structure, main circuit in electric locomotives, etc. Various methods were developed and examined in laboratory to determine the most dominating factors in rail surface conditions, wetness and contamination, and these methods were applied to the measurement of rail conditions in the field test of an electric locomotive.

033449
GAS TURBINE LOCOMOTIVES OF THE UNION PACIFIC RAILROAD

Chisman, JI

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 2, Mar. 1971, pp189-203

Until recently, there was only one place in the world where gas turbine locomotives could be seen regularly at work and this was in the U.S.A. The author took the opportunity to look at one of the 8500 h.p. locomotives at the U.P.R.R. Maintenance Depot, Council Bluffs, Iowa and was privileged to discuss their performance with the U.P. Engineering Staff at their Headquarters in Omaha, Nebraska. Thirty of these locomotives were introduced in 1958 and were specially built for heavy Trans-Continential freight trains. Thie paper is not a technical appraisal of these units as time was very limited, but rather an account of some of the more practical aspects of the locomotive of interest.

033450
BRITISH RAILWAYS' EXPERIENCE WITH PANTOGRAPHS FOR HIGH-SPEED RUNNING

Taylor, K

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 41971, pp349-373

The paper outlines the requirements with which a pantograph must comply if it is to collect current satisfactorily from an overhead contact system at high speed. Reference is made to the factors which govern the design of the pantograph and the need to relate its performance to the dynamic behaviour of the overhead line equipment and locomotive or electric multiple unit set body throughout the speed range. Some difficulties which have been experienced in operating at speeds up to 100 miles/h and the measures taken to overcome these are described. The paper suggests some lines of further development which are worthy of consideration to make the pantograph suitable for operation at higher speed.

033451
PANTOGRAPHS FOR HIGH-SPEED RUNNING

Graziano, MC

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 41971, pp374-406

A—Simplified method for the analysis of dynamic stresses and movements occurring in collection by a pantograph under the contact wire. B—Design of an FD Mini-Pantograph (40 cm. lift). C—Theoretical study of a double panograph with dual damping. D—1.5 kV pantograph for high-speed collection under a 63 m. span 1500 V. contact wire.

033452
THE DEVELOPMENT OF THE PANTOGRAPH FOR HIGH-SPEED COLLECTION

Souch, DJW Taylor, G

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 41971, pp374-466

After a brief illustrated account of the main types of pantograph available, the paper deals with the basic factors that influence design. Some preliminary considerations including dimensional limitations, transverse rigidity, contact pressure, system voltage, current rating and pan profiles are dealt with and the relative merits of frame and roof-mounted air motors considered. The paper then discusses aerodynamic behaviour and its effect on the quality of contact together with the problems that arise due to snow and ice formation. Factors affecting contact strip wear are mentioned and an analysis of strip life obtained on various railway systems using different materials is given. The merits of contact surface lubrication are also noted. Comment is made regarding the maintenance aspect, with particular reference to contact strip and pan head renewal. Reviews present trends in collector head development, including leaf springs, rubber suspension elements and pan head damping. The prospects of materials such as carbon reinforced plastics for articulated frames, and resin bonded glass fibre insulators are discussed. Protective devices to safeguard both pantograph and overhead are mentioned and details of the constant wire height scheme to be developed by the French Railways are included. In conclusion, a brief description is given of the slewing technique being tested by Swedish Railways for the pantographs of vehicles with automatic tilting suspensions.

033743
JACKKNIFING OF DIESEL ELECTRIC LOCOMOTIVES REPORT OF THE JOINT COMMITTEE ON RELATION BETWEEN TRACK AND EQUIPMENT

Magee, GM, Association of American Railroads
Keller, WM, Association of American Railroads
Ferguson, R, Association of American Railroads

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

Rept. 10838, Jan. 1955, 21pp, 2 Ref

A number of railroad companies had been reporting difficulties with diesel electric locomotives under buffing or pusher operation. This action was evidenced by lateral instability between the several units, especially those under the largest buffing forces and resulted in lateral displacements and lateral forces of such magnitude that the rails were turned over and derailments caused in some cases. To obtain as complete an understanding of the jackknifing action as possible it was decided to make measurements on both the locomotive and the track. A test location was picked on a right curve of 8 deg. 6'. The grade was 1.72 percent at the curve but within a mile became 2.20 and 2.40 percent so that part of the train on the steeper grade when the recordings were made. The rail was 131 lb. RE Section laid in 1946 and rather badly curve worn. The test locomotives were GP-7 Electro Motive general purpose road switchers. The following conclusions were drawn: Jackknifing is the result of lateral instability of the several units and its severity is dependent on the magnitude of the buffing force and the eccentricity of the force. It is evident the eccentricity of the force will depend on the amount of overhang and the clearance available for lateral movement. Reduction of

the bolster clearance to a small amount improves the conditions sufficiently that operation is not excessively difficult. Lateral forces are reduced about 50 percent. Operation of the general purpose units with full bolster clearance and standard couplers under buffing forces is not practicable with four units and probably undesirable with three units. Forces of almost 25,000 lb were measured at 10 mph and 140,000 to 175,000 lb tractive force and higher forces can be developed at lower speeds or under impact conditions. These laterals applied continuously will be very detrimental to rail and wheels, cause journals to run hot, and may cause derailment. The use of the alignment control coupler attachments reduced the forces to a normal amount for the curvature of the test location. The lateral forces under full regenerative braking with alinement control couplers for an undetermined reason were a little higher in the few tests made than in the pusher operation which had twice the tractive force. However, they are still quite moderate. The jacknife position, once assumed, remains until the train is stretched out.

037220
TRACK LOADING FUNDAMENTALS–5 EFFECT OF WHEELBASE ON TRACK STRESSES

Clarke, CW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, Mar. 1957, pp 274-278, 9 Fig, 6 Tab, 2 Ref

Axle loads are tabulated for various steam and diesel locomotives, and the effect of wheelbase on track stresses is analyzed. Three different designs of diesel-electric locomotives were selected to illustrate the effect of wheelbase arrangement on rail stress. It was found that the 2-Do-2 type produced 10 percent lower rail stress values than either of the A1A-A1A types, despite its higher power rating.

037236
GLASS BANDING OF ARMATURES

Hyett, WG

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Nov. 1964, p 906, 1 Fig, 1 Tab, 1 Phot

The use of fibre-glass reinforced plastics instead of steel to band traction-motor armature windings which extend from the core has several advantages: (1) no insulation is required, (2) burning from the coil seldom causes band failure, (3) permanent stretching due to accidental overspeeding is not encountered. In general, the plastic system resists centrifugal forces and provides better mechanical support than steel. The glass tape consisting of fibers and semi-curved resin is applied through a tensioning device into a warm (120 C) armature rotating on a lathe at 75,000 lb/in (super 2) or 45,000 lb/in (super 2) pressure for used or new armatures respectively. The number of turns required is supplied in a table from the tape manufacturer, P.P. Payne and Sons Ltd. The plastic system is cured by baking at 150 deg C for five hours.

037260
UNIT BEARING PRESSURES FOR LOCOMOTIVE DETAILS

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1941, pp 497-498, 2 Fig, 2 Tab

Data are compiled and reported for unit bearing pressures for locomotives which are giving satisfactory service. The pressure or load curve and the bending moment diagram are shown for the outside cylinder slidebars of some express passenger engines built for the Central Argentine Railway. British and U.S. design standards for axlebox bearing pressures for passenger, freight, and shunting engines are given. The pressure curve for one revolution of the driving wheel of an engine having two outside cylinders, 19 in. diameter by 26 in. stroke, coupled wheels 6 feet 2.5 in. diameter and a boiler pressure of 225 lb/sq. in.

037283
A COAL-BURNING GAS TURBINE LOCOMOTIVE DESIGN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 89, Dec. 1948, p 635

Principal details of the open-cycle layout, using electric drive are given. Thermodynamic considerations, together with the physical properties of the materials of construction, suggested an intial gas temperature of 1,300 deg F, at the turbine inlet, and a pressure ratio of 4-8/1. The turbine will deliver 4,120 h.p. to the reduction-gear pinion at 24 percent shaft thermal efficiency, when the combustion efficiency is taken to be 96 percent. The chief components of the gas turbine: an axial-flow compressor; a reaction turbine, a direct-current generator with two shafts; reduction gears (a pinion between two low-speed gears, which drive the two main generator shafts); a regenerator; a combustor and, fly-ash separator.

037297
GAS TURBINE LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Nov. 1946, p 572

A comparison is made between the gas turbine and diesel electric locomotives available in 1946. An overall efficiency of 18 to 20 percent should be realized with the gas turbine locomotive. Cost of maintenance comparisons could not be made. The high-speed diesel engine is limited to a power output of 1500 to 2000 b.h.p.; the maximum power output of a single unit of the gas turbine should be much greater.

037438
PLASMA TORCH PROVED FOR LOW SPEED APPLICATIONS

Dobbs, DJ, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Nov. 1969, pp 812-814, 5 Fig, 1 Phot, 3 Ref

The article discusses research results of the British Railways attempts to improve adhesion of rail vehicles by using a plasma torch to remove materials from rail surfaces. Laboratory tests confirmed the feasibility of using such a device, in two areas: low speed operation for freight trains and high speed operation for passenger trains. A test vehicle was made up to field test the plasma rail vehicle. Results of the testing show that mechanical condition of the rail head is important; old rail with large areas of contact required higher output than new rail. The tests show conclusively that starting and low speed operation of freight vehicles with low adhesion can be resolved by the application of the plasma torch.

037473
INFLUENCE OF GLAZED FROST AND HOAR FROST ON OVERHEAD CONTACT SYSTEMS AND THE PANTOGRAPHS OF ELECTRIC MOTIVE POWER UNITS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE No. 26, Comm Rpt, Jan. 1968, pp 20-22, 1 Fig

Question A-59.

Although all known feasible methods of combating hoar frost or glazed frost on overhead contact systems were investigated, the selection of one single method valid in all circumstances and for the most severe meteorological conditions, was impossible. Immobilization of the pantograph was never caused by icing of the joints but always by the weight of the deposited ice. One method used to remove light hoar frost is to heat the contact wire with the traction current. For severe icing thawing is accomplished by passing a high current, about 2500A, through the contact wires.

037592
METHODS OF TESTING AND EVALUATING LOCOMOTIVE RUNNING QUALITIES

Schwanck, U Minden, IW

Eisenbahntechnische Rundschau (Hestra-Verlag, Darnstadt, West Germany)

Vol. 13, No. 4, Apr. 1964, pp 149-165, 23 Fig, 2 Tab, 2 Phot, 30 Ref

The German Railways initiated a thorough research into the question whether the new developments in locomotive and car construction assured safety in relation to the new developments in rail and track structures. Present day techniques are described in the ongoing studies and tests of the vehicle dynamics and wheel to rail interaction of locomotives. Among the data cited were measurements of an electric locomotive that indicated that the trailing axle wheel set of the two wheel truck imposed about double the lateral load against the rail as the leading axle wheel set on straight track. The discussion concluded that more research and testing would be continued, using more sophisticated measuring means that are available.

037607
THE FIRST GERMAN LOCOMOTIVE FOR 200 KM/H SCHEDULED SPEED

Gierth, E

Eisenbahtechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 10, Oct. 1965, pp 433-448, 19 Fig, 12 Ref

The author describes this first locomotive designed by the German Federal Railways and built by Henschel and Siemens-Schuckert for scheduled speeds of 200 km/h. This locomotive is the result of developments from previous extensive tests and is designed for a maximum speed of 210 km/h. The locomotive power rating is 6420 KW for one hour and 5340 KW continuous. The starting tractive effort is 70,400 lbs. for 5 minutes, 26,000 lbs. for one hour, and 24,000 lbs. continuous. A complete description of all the important mechanical details and components is given, as is also done for the electrical equipment from the current collecting pantograph, the transformer with the thyristor switch apparatus, to the truck-mounted motors and the unique drive to the wheels. The operation of the continuous train control system as actuated from a communication line laid along the track is described, which permits the safe control of this high speed locomotive.

037611
SWITCH LOCOMOTIVE V 90 OF THE GERMAN FEDERATED RAILWAYS

Schmuecker, H

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 3, 6503, pp 91-92, 7 Fig

Only a portion of the article describes this locomotive. One portion deals with the latest design of cardan shafts having ball joints made of plastic that eliminate the need for periodic lubrication servicing. The other describes the truck design, which includes springs made of rubber "sandwiched" with steel plates that are used at the journal boxes and over the coil springs between the truck and the locomotive frame. The truck is simple, with cast members welded together, and with the traction transfer points below the axle center line. The composite design has effectively reduced lateral and vertical accelerations.

037612
TESTS WITH THE E 10 CLASS LOCOMOTIVES FOR THE DEVELOPMENT OF THE HIGH SPEED LOCOMOTIVES CLASS E 03

Nebelung, HR

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 5, May 1965, pp 159-166, 11 Fig

The author describes a research program on the testing of the locomotive design and components for the development of the high speed (200 km/h) electric locomotive, Class E 03 on the German Railways. One of the test locomotives was equipped with trucks having leaf springs over the journal boxes in addition to coil springs between the truck frames and the body; the other was equipped with trucks having coil springs throughout. The former gave a very hard ride at the lower speeds, with much body vibration up to 100 km/h, and over 140 km/h there was excessive fore and aft vibration longitudinally. The locomotive with coil spring suspension gave a very satisfactory ride up to the desired 200 km/h. Since, at the speed of 200 km/h, 1 km is traversed in 18 seconds, the enginemen's controls were designed semiautomatic, an electronic system of controls was built in to take over the control of the acceleration of speed from 30 km/h to 200 km/h. Conversely, reduction in speed is also automatically controlled. Thyristors are used with the high voltage transformer, which eliminate the troublesome high voltage switch gear with contacts.

037639
TRAINING DIESEL-ELECTRIC MAINTENANCE STAFF

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Sept. 1957, pp 304-305, 4 Phot

A 14-week training course used by the Southern Region of British Railways is described. On the engine side, the aim is to present the fundamentals, and to go into considerable detail on the parts and operation of the engine fitted in the Southern Region diesel-electric multiple-unit trains. On the electrical side, lecture room experiments are carried out to prove various laws and demonstrate the use of instruments for circuit checking and fault finding. An operation simulator is pictured and its use is described. This unit simulates the complex action of load control equipment on the diesel-electric sets.

037697
AXLE STRESSES–IV

Mcard, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 74, June 1941, pp 676-679, 5 Fig

Motored axles driven by spur gears are peculiar to electric and diesel electric traction. The bending and twisting moments in an axle driven through single spur gears by a nose-suspended motor of a freight locomotive, and a diagram of bending moments from static loads and overturning force in axle driven by spur gears from a traction motor are shown. Bending moment diagrams and a summary of stress calculations for the gear-driven axle of an express diesel-electric locomoitve, 5 feet 6 inches gauge are also illustrated. The mechanical properties for carbon and intermediate alloy steels, which conform to British Standards for axle fabrication, are given.

037704
VERTICAL OSCILLATIONS OF LOCOMOTIVE BODIES

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Sept. 1959, pp 140-142, 4 Fig, 24 Ref

This review article discusses the effect of spring stiffness and damping factors on bouncing. The effect of static deflection and viscous damping factors on body acceleration of 100-ton Co-Co locomotive is illustrated.

037708
BOGIE DESIGNS FOR RUSSIAN DIESEL LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 110, Feb. 1959, pp 242-244, 3 Fig, 1 Tab, 4 Ref

Road tests of the Russian TE.3 Co-Co diesel-electric locomotives, which contain primary, half-elliptic spring systems only, concluded that bogie design problems limit speeds to 60-75 mph. A modified TE.3, designated TE.7, was built for speeds up to 88 mph. Because of lateral forces between the bogie frame and the leading axles, ride quality was considered unsatisfactory above 60 mph. A new, yet untest, design for a six-wheel bogie with Alsthom type axlebox suspension and helical spring bolster supports is described and illustrated.

037753
ORE REGULATIONS FOR THE 360 HOURS TEST ON THE TEST BENCH OF DIESEL ENGINES LIABLE TO BE FITTED TO RAILWAY VEHICLES

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, Brussels, Belgium)

June 1971, pp 563-565, 1 Fig

The importance of testing, under international regulations, diesel engines liable to be fitted to railway vehicles has been recognized by the railway administrations as well as by industry. The diesel engines are subjected to a type-test to ascertain the thermal balance, the fuel and oil consumption, the working diagrams, the rated power of the engine, etc. When the engine has successfully passed it is subjected to operating tests on three locomotives in main line or shunting service.

037768
WHEEL PROFILE TRUEING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, June 1955, pp 623-624, 2 Fig, 3 Phot

A single-purpose machine for reprofiling locomotive tires has been designed to machine tires without removing the axles from the vehicles. The machine is not intended to replace wheel-turning lathes in main workshops. The machine is operated by electrohydraulic power, and reprofiling is carried out with two built-in cutters operating simultaneously, and on the climbing miller principle. The truing machine can be supplied for 4-ft. 8-1/2 in. gauge and arrangements are being made for its manufacture to suit other gauges.

037775
ELECTRONIC CONTROL OF SPIN AND SLIDE

Crawford, KDE, Westinghouse Brake & Signal Co. Ltd.

Railway Gazette International (IPC Transport Press, Dorset House, Stamford Street, London SE1, England)

Apr. 1971, pp 140-142, 2 Fig, 1 Phot

Viewed as control problems wheel-spin and wheel-slide are identical. Therefore a common electronic detection circuit can be used to trigger electrical and mechanical corrective devices such as air-brake dump valves. Rapid restoration of traction or braking torque as the wheel recovers can be achieved electronically by a flywheel circuit which anticipates slightly the return to full adhesion. A block diagram of the system is shown.

037793
ADHESION RESEARCH

Kelly, JC, Birmingham University
Scott, BF, Birmingham University

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Jan. 1968, pp 7, 1 Tab

The use of an arc plasma generator (apg) to improve wheel to rail adhesion is examined in a letter to the editor. It is pointed out that rail contaminants affecting adhesion adversely fall into two groups: oil and water films and emulsions not bonded to the rail, and metallic soaps produced by chemical reaction between fatty acids and steel which are integral with the rail surface. Both contaminants must be treated. The gross films can be removed mechanically, but the chemical structure of the soaps must be broken down by heating to about 30 deg C. The second task is most demanding and forms a basis for performance predictions. The maximum power requirement occurs at high speed, say 240 km/h, when both traction and "steering" rely upon enhanced adhesion. A graph shows the variation of power with the penetration depth of the 300 deg C isotherm in a steel rail. Power decreases with plasma length, but the power intensity increase outside the attainable range. The variation of power with length (and consequently with speed) is strongley non-linear. The authors of this letter believe that each fast train must carry an a.p.g. module.

037800
BR CLASS 40 LOCOMOTIVE SUSPENSIONS MODIFIED

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Feb. 1970, pp 142-144, 4 Fig, 1 Phot, 7 Ref

The article discusses the suspension design of the British Railways class 40 locomotive, which was modified to minimize the maintenance and repair of the laminated springs. The suspension system also subjected the truck frame to high vertical and lateral stresses. The modification replaced the laminated springs by helical springs. Result was improvement in the vertical riding qualities especially over 50 mph. A reduction of dynamic forces was also achieved, which will result in longer suspensions and track frame life.

037807
4,000 HP LOCOMOTIVE UNITS FOR U.S.A.

Diesel Railway Traction (Voith Getriebe KG, Heidenheim, West Germany)

Aug. 1961, pp 295-325, 12 Fig, 16 Phot

European design forming the most powerful single locomotive-unit in the world was delivered to the States for heavy drag-freight service. The six large diesel-hydraulic locomoitves are powered by two Maybach engines of 2,000 b.h.p. each U.I.C. rating, driving through the special Voith L.830 transmission, to each set of which has been added a fluid coupling to deal with resistance braking, which is a leading feature of these locomotives.

037808
SOME ASPECTS OF DIESEL HYDRAULICS

Diesel Railway Traction (Voith Getriebe KG, Heidenheim, West Germany)

Sept. 1959, pp 3-8, 3 Tab, 8 Phot

Present trends, and features are described of the 270 large diesel-hydraulic locomotives now at work or under construction in Western Europe. Growing experience has demonstrated the superior traction characteristics of hydraulic transmission in the heaviest drag freight working in handling heavy passenger and freight trains without any damage or strain to engine or transmission components, and with less danger to drawgear components down the train. Efficiencies of electric and hydraulic transmissions vary very little over the whole speed and power range. The effect of the inefficiency in a electric transmission builds up a cumulative heat effect so that a diesel-electric locomotive cannot sustain high tractive efforts at low track speeds for long periods. A diesel-electric locomotive does not show a continuous rated tractive effort of more than 16 to 17 percent at the drawbar; the speed at which that tractive effort is exerted is commonly 20 to 32 percent of top track speed. Diesel-hydraulic line-service locomotives commonly have continuous rated tractive efforts at the drawbar equal to 22 to 27 percent adhesion, and at no more than 13 to 16 percent of top speed.

037809
THE OPERATIONAL EFFICIENCY OF THE V200 DIESEL LOCOMOTIVES OF THE GERMAN FEDERAL RAILWAYS

Glasers Annalen ZEV

Verlagsbuchhandlung (Georg Siemens), Luetzowstrasse 6, 1 Berlin 39, West Germany

No. 41958, pp 3-15, 7 Fig, 6 Tab, 3 Phot, 33 Ref

The article describes briefly the development of the V 200 starting from the first prototypes and deals more comprehensively with the experience gained in actual operation. Consumption figures and particulars of the running performance of locomotives which have not suffered any damage are given.

037810
2,200 HP LOCOMOTIVES IN YUGOSLAVIA

Dimitrijeuic, M, Yugoslav Railways

Diesel Railway Traction (33 Tothill Street, London, England)

Vol. 12, No. 308, Jan. 1958, pp 2-8, 4 Fig, 3 Tab, 3 Phot

The problems in design of a 2,200 HP locomotive for dieselization of Yugoslavia is detailed. The specifications, features, layout, superstructure, power transmission maintenance and results of trial runs and steep grade tests are included, as well as fuel consumption and economy.

037811
THE 2,000 HP DIESEL LOCOMOTIVE OF THE GERMAN FEDERAL RAILWAYS

Lampe, C Gossl, N

Railway Technical Review (Carl Rohrig Verlag, Darmstadt, West Germany)

Oct. 1955, pp 2-16, 13 Fig, 2 Tab, 6 Phot, 6 Ref

This document discusses the advantages of the design of the 2,000 HP diesel locomotive as used by the German Federal Railways. The power transmission unit, cooling system, and engine are described and illustrated. The maintenance requirements are given.

037815
ADHESION RESEARCH ON B.R.

Coates, PJ, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Oct. 1967, pp 741-742, 2 Phot

The British Railways has conducted research into means to increase rail adhesion. The means used fall into 4 categories: mechanical; chemical; thermal; and quantal. The mechanical methods include scrubbing, abrading and sanding rails which tend to foul points and to be detrimental to the rail surface. Chemicals to remove contaminants in the rail surface have also been evaluated, but results are difficult to evaluate. Thermal and quantal methods include the use of an electric ore between the vehicle and rail head and the plasma jet. This device produces thermal, quantal and chemical effects, as well as increasing adhesion coefficient from 0.1 to 0.5 in laboratory tests.

037823
ITALIAN DIESELS OF 2,000 HP

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, No. 7, July 1967, pp 529-537, 4 Fig, 2 Tab, 3 Phot

Italian diesels of 2,000 hp of advanced four-axle design are 33 percent greater in output than the 75 locomotives of Gr. D343 being built. Many parts are standard and interchangeable. In particular, the gear-drive systems for the monomotor bogies and also the traction motors are interchangeable. Driving cabs and contents are the same, as are such details as air compressors, filters, radiator elements and so forth. The systems and components of each engine are described and illustrated.

037825
ENGLISH ELECTRIC 2,700 HP DIESEL-ELECTRICS FOR B.R.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Aug. 1967, pp 625-628, 1 Fig, 1 Tab, 2 Phot

First of a fleet of 50 Co-Co Type 4 locomotives with charge-air cooled 16-cylinder engines will be put in service by British Railways. The D400 class will be the first diesel-electric locomotives to incorporate automatic control of tractive effort, slow-speed running and integrated braking; this latter provides the correct dynamic brake application for the degree of train brake applied. The cast steel bogies and the traction motors have the provision for the fitting of weight transfer compensation equipment if required. The maximum axle-load is 19-1/2 tons and the bogie wheel-base 13 ft. 6 in.

037826
CHEMICALS TO IMPROVE RAIL ADHESION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Nov. 1967, pp 831-832, 3 Phot

The chemical spraying method developed by British Railways offers a promising solution to the wheel slip problem, and it is significant that there is now a proprietary spraying device known as the P and M Maxi-mu. An important and essential feature in the application of the chemical spray method is the making of adhesion surveys, using the tribometer, of portions of the track where wheel slip is serious prior to the installation of distributors. This enables the most effective positions for distributors to be determined. Spreading of the chemical fluid is actually performed by the train wheels. During 1964-65 extensive tests of ethyl caprillate were made, and it is now established that this is the most generally satisfactory of all the chemicals which have been so far tried.

037829
UNIVERSAL BOGIE DESIGNS FOR HUNGARIAN BUILT LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Feb. 1967, pp 112-113, 5 Fig, 1 Phot

Multi-gauge twin-axle truck designs are described for locomotive power from 600 to 2,000 hp and axleloads up to 20 tons. An important aspect was to design with three principal objects: to keep down the unsprung weight; increase the wheelbase, and provide suitable spring characteristics and adequate damping. Riding properties of locomotives equipped with this basic type of bogie have been found to be very good. Effectiveness of the non-linear primary suspension has fulfilled expectations and even without damping at this stage, no tendency to resonance conditions has been encountered.

037843
SPECTROGRAPHIC EXAMINATION OF DIESEL ENGINE SUMP OILS

Corbyn, PT, British Railways
Haines, AF, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, June 1965, pp 478-82, 3 Fig, 8 Tab, 5 Phot, 6 Ref

Concentrations of metallic elements in diesel engine sump oils, as measured by emission spectrographic chemical analysis, were correlated with internal wear of specific engine parts: iron-liners, piston rings, aluminum-piston seizure, chromium-chromium plated rings, liners, copper and lead-bearings, sodium-radiator leakage. It is very difficult to make reasonable predictions of the internal wear from such spectrographic results without a considerable background of information for normal engines of the same time and extensive data on oil changes or additions, filter changes, etc. This technique gives its best returns when regarded as complementary to the perceptions and judgment of an experienced engineer.

037844
OVERCOMING FREEZING IN DIESEL FUEL FILTERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Oct. 1961, p 464, 2 Fig

The most common trouble reported was the blockage of the fuel feed at the primary filter between the vehicle fuel tank and feed pump. Blockage was due to wax formation. Solution to the problem was to substitute a small SS sedimenter unit for the gauge primary filter. Details are provided concerning failure analysis, primary filter requirements and the principal components of the sedimenter unit.

037848
TEST INSTRUMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 119, July 1963, p 76, 1 Phot

The Hoyt Ultrasonic Bondmeter has been developed to check for proper bonds between the lining and the shell of a plain bearing. It should be especially useful in the examination of diesel engine bearings. Tests made with the unit are completely non-destructive. It can be used on newly-lined bearings, or for the routine inspection of bearings in service. The instrument will operate successfully with any white-metal, and with any shell material except cast-iron.

037856
LOCOMOTIVE ADHESION TESTS IN THE U.S.A.

Railway Gazette

Temple Press Limited, 161-166 Fleet Street, London EC4, England

Vol. 121, Feb. 1965, p 120, 1 Phot

Use of strain gauges on a traction motor pinion to measure transient torque loadings is described. The locomotive used for the tests was a 3-ft. 6-in. gauge diesel-electric equipped with GE 761 traction motors. To produce maximum loads on the pinion the tests were made at low speed or while stationary. Eight loaded coal wagons were coupled to the locomotive and the brakes were applied. Current to the motors was increased until wheel slip occurred on clean and rusty rails. The train was then accelerated with power supplied to one bogie only up to 18 mile/h so that wheel slip took place at various speeds. Readings of the strains produced were also taken for coasting down a gradient, and when an impact took place between the locomotive and train. Several of the torque readings are given.

037887
RELATIVE MERITS OF STEAM, ELECTRIC, AND DIESEL TRACTION

Rudgard, H

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Oct. 1949, p 458

Comments by Mr. Harold Rudgard in a recent paper on railway motive power are summarized. The paper traces the history of mechanical traction from the latter half of the eighteenth century. There is reference to various major developments, with mention of steam-turbine locomotives, electric, diesel and diesel-electric traction, as well as light units and railcars, and the gas-turbine locomotive. Comment is made on the merits of the various forms of traction and conclusion is reached that looking at the problem of rail traction from a long term point of view the overall tendency is leading to nation-wide electrification in years to come.

037888
WELDING AS APPLIED TO LOCOMOTIVES AND ROLLING STOCK

Bulleid, OVS, Institute of Welding

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Nov. 1949, p 525

The development of the application and technique of welding particularly as applied to railways, locomotives, rolling stock, and wagons is traced. An early development was the application of welding to a carriage underframe the result being so satisfactory that it led to the general introduction of this method of construction. The result was a lighter underframe and more rigid construction which required less camber. The next development was the application of welding to wagon underframes. The need was cited for paying attention to design as visualized from the point of view of welding to obtain the best results from fabricating of various materials which had contributed so much to the solving of some of the problems in regard to the weight of rolling stock.

037890
MOTIVE POWER OF THE FUTURE

Missenoen, E

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, Nov. 1949, 2 pp

An abstract is given of a paper that discusses railway motive power. Emphasis is placed on electrification of the railways coupled with the judicious use of diesel traction as being prime factors for rehabilitation of the British Railways. A strong case is made for electrification based on revised economic data, projections of future passenger and freight traffic, and the need for a properly intergrated system of inland transportation.

037895
REPAIR OF LOCOMOTIVE PLATE FRAMES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, Feb. 1950, 5 pp, 14 Fig, 4 Phot

Recent developments in welding technique are described. The first step in the investigation was a satistical analysis of the defects for each of the main classes of locomotive, and among the trends noted were the following three points: frame cracks are of the progressive type due to fatigue, the number of frame cracks in any engine class is related to the age of a frame, and there is a marked tendency for cracks to recur where previous fractures had been made good by welding. Preliminary x-ray investigations showed where weld defects typically appear. These areas are described.

037897
NOVEL AXLEBOXES FOR EXPRESS LOCOMOTIVES

Harrison, FC

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, May 1950, pp 539-545, 2 Fig, 1 Phot

The axleboxes are of the Athermos mechanically-lubricated type. All the accepted components of an Isothermos axlebox are incorporated, namely: a bearing ensuring copious fluid film lubrication over the whole journal, an oilflinger conveying a large volume of oil to the bush; an oil sealing ring shrunk on the axle; and a safety pad which effectively protects the oil flinger from damage. The special features peculiar to this new axlebox are; a novel guiding system consisting of forked links mounted in Silenblocs which permit the axlebox to move vertically without fore and aft deviation; and a novel device allowing a controlled lateral play of 20 mm which has a marked effect in easing the running on sharp curves.

037905
GAS TURBINE ELECTRIC LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, Jan. 1947, p 92

Short descriptions of the locomotive to be built by Brown-Boveri and the Metropolitan-Vickers locomotive are noted. Each of the two new locomotives is to have a continuous rating of 2,500 hp, and the overall dimensions and total weight are approximately the same in each case. The gas turbine in each case will be of the well-known open-circuit type. In the Brown-Boveri locomotive there will be one turbine. In the Metropolitan-Vickers design, however, there are two separate turbines.

037932
MANGANESE-STEEL AXLEBOX LINERS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Apr. 1948, pp 514-516, 4 Fig

Wear of axleboxes, more than any other single feature, is responsible for requiring locomotives to be returned to the workshop for repairs, and the mileage between shoppings is directly connected with the wear-resisting properties of the materials of which the axlebox rubbing surfaces are composed. It became clear that any considerable improvement in shopping mileage would require different material for the flat surfaces of the axleboxes, and the practice of fitting manganese steel liners to roller bearing axleboxes suggested a line of attack. Details for fitting axleboxes with new liners are presented. The leading features which were observed during examination in the shops and sheds following mileage runs average 80,000 miles shows. 1. The surfaces of the liners which are in contact with one another become work hardened in service and take on a high polish. 2. A very interesting feature has been that reduction of "knock" or wear in a longitudinal direction has had also a beneficial effect on lateral wear. 3. Bolts and rivets of the horn liners have remained tight. 4. Scoring of the liners has been negligible. The manganese steel liner has been adopted as standard and it has fitted to new construction of all types. Apart from the potential increase in shopping mileage, the liners already are proving of considerable value from an operating point of view in reducing development of rough riding.

037933
THE CHESAPEAKE AND OHIO RAILWAY TURBO-ELECTRIC LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Apr. 1948, pp 516-517, 1 Fig, 1 Phot

Design specifications are presented for a 1948 C40 turbo-electric steam locomotive. A schematic diagram accompanies the brief narration.

037936
DESIGN OF BOGIES FOR ELECTRIC LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, May 1948, pp 601-602, 2 Fig, 3 Phot

An improved bogie developed by the Swiss Locomotive and Machine Works of Winterthur incorporates transverse coupling together with a centering device to prevent hunting, and friction dampers on the axlebox guides. Experimental results showed that if two bogies are coupled by means of a transverse bar that there is a reduction in (a) the guiding pressure on the leading axles of both bogies, and (b) the angle of incidence of the leading axles. The two bogies are connected by a spring coupling at the end of a triangular yoke on each bogie. The coupling permits a degree of side play adjustable to any value between 20 and 500 mm. after which further relative movement is controlled by two helical springs, which may be adjusted to allow a maximum movement of 24 mm.

037939
THE DESIGN OF LOCOMOTIVE AXLEBOXES

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, June 1948, pp 654-658, 14 Fig

The function of the locomotive axlebox, principle features of its construction, and a comparison of the advantages from use of plain or roller bearings, are presented. Technical aspects of solid bronze, forged-steel cast-steel, and the isotherms axleboxes are given along with design characteristics for both inside and outside axleboxes. There is considerable comparative commentary throughout the article relative to good design practice.

037947
ROLLER-BEARING AXLEBOXES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Dec. 1945, p 616, 2 Fig

The design of an efficient seal for the retention of lubricants in axleboxes is described. In this design frictional resistance has, for the first time, been reduced to negligible proportions. The seal consists of an L-shaped packing member, the lip of which is maintained in contact with the revolving shaft by means of a light-tension spring; the whole arrangement is mounted in a neat metal housing, the outer diameter of which is a press fit into a recess provided in the bearing to be sealed. When compared with plain bearings, a saving of 85 percent or more may be expected in the cost of lubrication; refills are reduced to one every six months or so.

037985
AXLE-FATIGUE TESTING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Dec. 1960, p 714, 2 Phot

A testing machine, designed for investigating the fatigue strength of railway rolling-stock axles, has been installed in the new Central Research Laboratory of London Transport at Chriswick. The machine is of the resonant type driven by an electric motor through a slipping clutch which is incorporated to ease the starting and stopping conditions. The test specimen are of a typical axle size. The stress is measured by several resistance strain gauges, calibrated in position, and various protective devices are provided to enable the machine to be left running unattended

039311
REDUCING FLANGE-WEAR ON BOGIE LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Dec. 1959, p 559

The phenomenon of relatively rapid flange-wear on sharp curves with the bogies of Bo-Bo and Co-Co locomotives must be accepted pending the results of further research into the reduction of bogie weight and unsprung weight, the height of the bogie centre of gravity, different relative speeds of the axles and motors, weight transfer, etc. Flange or rail lubrication using a lubricant matched in viscosity to suit the ambient temperature lengthens the flange life from six to nine times, this factor varying according to the tire steel used. A change from tires of "D" steel to those of 70-ton tensile steel alone can increase flange life by as much as three times. A combination of lubrication, hard tires, and the fitting of a centralizer linking the movement of the two bogies and which is capable of drastically reducing flange forces on curves, will improve flange life by 12-15 times.

039313
MOTIVE POWER FOR HIGH SPEEDS

Kuckuck, R
Niekamp, K, Hauptverwaltung der Deutschen Bundesbahn

Die Bundesbahn (Hestra-Verlag, Darmstadt, West Germany)

No. 7/8, July 1971, pp 339-343, 5 Phot

This article traces the growth of high speed operation engineering and planning on the German Railways from 1903. Projected plans call for even heavier and higher speed units of motive power, with 25 ton axle load and capable of 300 km/h. Further developments are in progress in motive power elements, as the asynchronous motor drive. Similar progress is evidenced in the application of computer techniques to train control and operation. The demands for faster travel speeds are being constantly considered by the German Federal Railway.

039316
THE SIX-AXLE 3000 HP DIESEL LOCOMOTIVE MODEL ML 3000

Lampe, C

Franckh'sche Verlagshandlung, Stuttgart, West Germany

No. 217, June 1960, pp 3-17, 13 Fig, 3 Tab, 10 Phot, 14 Ref

Described is the development of a standard production line of four and six-axled Diesel-powered hydraulic-drive multiple-purpose swivel-truck locomotives with power capacities ranging from 2000 to 4000 hp. As a sample of this line of production the 3000 hp. Locomotive C C equipped with blower air-cooled engines is described in greater detail and its operational efficiency is demonstrated by means of the test-run results. The ML 3000 is produced by Krauss-Maffei' AG.

039317
SCIENTIFIC INVESTIGAIONS OF DIESEL-POWERED TRACK VEHICLES

Roehrs, F

Krauss-Maffei News (Franckh'sche Verlagshandlung, Stuttgart, West Germany)

No. 217, June 1960, pp 17-22, 4 Fig, 2 Phot

The diesel-powered vehicles of the German Federal Railroads are investigated by a specialized testing institute, the Research Center for Internal Combustion Engineering, under similarized service conditions on the route by means of test cars for their performances and the proper operation of their mechanical equipment, and the grade of their energy transforming efficiency is determined. The modern electronic testing methods are described and several test results are presented. An efficiency field diagram of a 1100 HP diesel locomotive, a temperature and pressure diagram recorded from a 3000 HP diesel, and a torsional vibration oscillogram recorded from the articulated shaft of a diesel, are shown.

039318
A HYDRAULIC POWER TRANSMISSION FOR HIGH ENGINE PERFORMANCES

Schuttel, F

Krauss-Maffei News (Franckh'sche Verlagshandlung, Stuttgart, West Germany)

No. 217, June 1960, pp 23-26, 7 Fig, 1 Phot, 6 Ref

The Maybach Mekydro Power Transmission intended for Diesel locomotives with power outputs ranging up to 1800 hp which transmission consists of a hydraulic disconnecting converter combined with a four-speed geared transmission and has been tested in many applications, is described in its basic features. Such transmissions for high power inputs form, together with suitable engines, the basis for the construction of powerful diesel-hydraulic locomotives for main route work.

039319
FIRST MAIN-LINE DIESEL-HYDRAULIC LOCOMOTIVE FOR BRITISH RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Feb. 1958, pp 221-223, 1 Fig, 2 Phot

The first diesel-hydraulic main-line locomotive ordered under the British Railways modernization plan has been completed. The power rating is 2,000 hp and the wheel arrangement A1A-A1A incorporates two 12 cylinder diesel engines each set to 1,100 hp. The engines, transmissions, trucks, brake system, and drive controls are described. Exterior dimensions ares hown. Safety features include warning lights provided at each engine position and a general warning light which shows the driver if a fault has developed. Failure of air pressure or vacuum prevents the engine being used to drive the locomotive.

039320
WHEEL AND RAIL LUBRICATION

Birmann, F, German Federal Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Oct. 1957, p 413

Remarkable increases in life of rails and wheel flanges through lubrication, by as much as 700 percent, are quoted by Dr. Fritz Birmann, in his paper "Lubrication of Rails and Wheels." The requirements of a lubricating system to reduce wear of rails and tires, are that the lubricant must be prevented from spreading to the running surface of the rail, thereby reducing traction; that the efficiency of the system must not be spoiled by dust, dirt or weather influences; that the lubricating devices and spray nozzles must be profile free on the rail and vehicle; and that lubrication must not start too late on the curve, so that it is preferable, where possible, to lubricate tires before entering the curve.

039404
IMPROVEMENT OF THE RIDING STABILITY OF EXISTING RIV WAGONS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-26,29, Report, 6801-6907, 6 pp, 1 Fig

Question B56.

The document discusses the testing of inexpensive modifications to two-axled freight cars for high speed operation. Several alternatives are described, which did not give satisfactory stability. The modification which gave satisfactory results were: the use of double link suspension plus adoption of worn wheel profile. A cost comparison of the various modifications is included.

039407
PROTECTION OF ELECTRIC TRACTION INSTALLATIONS AGAINST OVERVOLTAGES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

No. 23,25,28, ORE Pub-23,25,28, Report, 6607-6901, 6 pp, 2 Fig

Question A50.

This ORE report discusses sources of electrical overloads which may threaten overhead contact systems, substations and traction unites. The means to protect each of these areas is discussed in detail. Finally, field tests conducted in Belgium, the Netherlands and Poland with horn-type and linear-type lightning arrestors are discussed.

039409
ADHESION OF LOCOMOTIVES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

No. 21,25, ORE Pub-21,25, Report, 6507-6707, 4 pp, 1 Fig, 1 Phot

Question B44.

High frequency sparks were tested as a means to remove foreign matter from rail to improve the friction coefficient. The results showed an improvement in the coefficient for sparked rail. An unresolved problem is radio signal, interference caused by the sparking. No detrimental effect has yet been found on the steel of the wheel or rail by sparking and there has been no effect on the fatigue strength.

039411
TESTING THE PERFORMANCE OF PANTOGRAPHS AND OVERHEAD CONTACT SYSTEMS AT VERY HIGH SPEEDS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-25,28, 6707-6801, 12 pp, 7 Fig, 1 Tab, 3 Phot

Question A84.

The findings of various European railroads in the design of pantography and overhead lines, at high speeds of 160 to 200 KM/H, are summarized. The relationship between pantographs, overhead lines, and tunnel entry was studied. Conclusions resolve that present designs would not create serious problems in operations up to 200 km/h.

039441
STRESSES IN DIESEL LOCOMOTIVE WHEELS RESULTING FROM BRAKE SHOE HEATING

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-AAR-436, Tech Rpt, Feb. 1963, 2 pp

Test results show the following: temperature gradients of 250 degrees F from wheel tread to outside hub at the strain gage location will cause thermal stresses in the order of 40,000 psi or greater; machining the wheel plate resulted in increased stresses at the outside wheel hub ranging from 13 to 20 percent; and stress increase on the basis of speed at time of brake application showed an increase in stress at the outside hub of approximately 42 percent from 40 to 60 miles perhour, and an additional 25 percent from 60 to 80 miles per hour.

039457
ELIMINATING LOCOMOTIVE WHEEL SLIP

Fisher, FG, Reading Company
Allen, RK, General Electric Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 104, Apr. 1956, p 234

While factors connected with locomotive design, maintenance and operation may have some effect in producing slipping, with little doubt contamination of the rail surface is the principal cause due to the formation of a thin film of oil. The most promising method for film removal would appear to be chemical treatment, either by cleaning or conditioning the rails. A firm submitted a sample chemical material which has proved highly successful in rail conditioning. The maximum adhesion after use of this chemical was 24 percent, compared with the normal maximum of 20 percent expected with clean, dry rail.

039458
BENDING STRESSES IN A MOTORED AXLE ON ELECTRIC ROLLING STOCK–3

Broadbent, HR, London Transport Executive
Richards, J, London Transport Executive

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, June 1956, pp 579-581, 7 Fig, 2 Ref

This article presents formulae used in the determination of bending moment of axles of powered tracks. Also comments concerning track irregularities upon wheels are also discussed. Mention is made of the differences between calculated stresses and recorded stresses, which are usually small except in stress increase by press fitting of wheel brakes. Conclusions are that vertical track irregularities are unimportant in stress of axles and that the use of check rails can reduce axle stresses. Finally, a prediction of axle life and axles stress is close between calculated and test results.

039472
CAST-STEEL BOGIES FOR GOODS VEHICLES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 94, Mar. 1951, p 269, 1 Phot

Accurate bolster guides and a locking device on axlebox lids are features of a cast-steel spring plankless bogie with integral axleboxes and brake suspension brackets to the side frame. This design has been fitted to tank wagons with a 12-1/2-ton axle load, and 10 in. x 5 in. journals.

039475
ADHESION AND FRICTION IN RAIL TRACTION

Koffman, J

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 89, Oct. 1948, p 484

For dry rails, a coefficient of adhesion of 0.25 may be assumed for speeds up to 40-50 m.p.h. At higher speeds, however, there is less information to draw on. Above the 40-50 m.p.h. range, the dependence of adhesion on speed introduces a bend into the curve connecting speed and power output. For wet rails, the coefficient of adhesion is reduced to about 0.6 of the value determined for dry rails. Of the many variables encountered in brake-block friction, there is abundant evidence of the dependence of coefficient of friction on speed and brake-block pressure. Substances should be saught for blocks for which the coefficient of friction is less affected by speed than in the case of cast iron; the effect would be to allow acceptable braking distances without having to use high braking ratios, so that a reduction in the weight of brake gear could be contemplated.

039476
CARRIAGE-BOGIE DESIGN

Koffman, J

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Mar. 1948, p 297

Factors involved in determining the riding characteristics of coaching stock are numerous. By means of suitable formulae, the path of a wheel set, will be a sine curve. It is influenced by the profile of the rail head. The characteristics of springs are carefully considered as suggested that helical springs might be used to deal with both vertical and lateral forces or by arranging for bogie center to bear against large rubber pads disposed at an oblique angle, so as always to be in shear.

039493
BO-BO LINE SERVICE UNITS FOR S.N.C.B.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Jan. 1964, p 60, 1 Tab, 1 Phot

Design specifications and details for a 1400 bph diesel-electric locomotive are cited. The vehicle described was built by La Brugeoise et Nivelles S.A. for the Belgian National Railways.

039523
MOTIVE POWER LIFE CYCLE COSTING

Brittell, CW, Alco Products, Incorporated

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp 49-53, 1 Fig

Included in "Engineering Economic Analysis in Railroad Planning and Operations."

The design changes to trucks and locomotive components needed to upgrade a four-motor diesel locomotive to 3000 horsepower are described. More horsepower per traction motor increases the tendency of the locomotive to lose adhesion. ALCO has a new high adhesion, four-wheel truck designed to reduce weight transfer to a minimum. Cash flow analysis for making decisions on replacement of locomotives is illustrated.

039526
WELDING IN LOCOMOTIVE CONSTRUCTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Oct. 1940, p 437, 1 Phot

A new automatic flash-butt welding machine at Doncaster Works, L.N.E.R. is described and illustrated. The machine has a welding capacity of 12-1/4 sq. in. cross section area. The clamps are operated by pneumatic clamping cylinders through heavy steel levers. Incorporated in the butting cylinder is the A1 patent automatic dash-pot control gear which gives a wholly automatic action to the welding operation.

039532
TRENDS IN ELECTRIC LOCOMOTIVE DESIGN

Davy, GV, English Electric Company, Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 102, Jan. 1955, p 37

It is perhaps too early to say whether there will be any general trend towards one particular type of single-phase locomotive; existing types have certain advantages and disadvantages, and only extensive running will determine which, if any, type shows marked advantages over the others. The paper is confined mainly to the postwar developments in the design of Western European electric locomotives and their performances, and city services such as exist in France. The 50-cycle commutator, the three-phase squirrel cage and the d.c. motors are discussed.

039535
ELECTRIC LOCOMOTIVES FOR HIGH-SPEED TRAINS

Dalton, GA, South African Railways
Meyer, E, Swiss Federal Railways
Sthioul, MCH, Swiss Federal Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 90, June 1949, pp 667-668

Some of the conclusions reached following consideration of the use of electric locomotives for high-speed trains were: maximum service speed is set by economic rather than technical factors; the present tendency in all countries was towards locomotives with two-axle or three-axle driving bogies, and in general with all weight available for adhesion; the nose-suspended motor was still in use and even being adopted in certain countries for new stock under design.

039549
THE ULTRASONEL FLAW DETECTOR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, July 1953, pp 17-18, 3 Phot

The Ultrasonel instrument of Trevor-Johnstone Company for detection of flaws in locomotive frames and thin plates by measuring the intensity of ultrasonic waves is described. The Ultrasonel will detect either internal or surface defects. The internal defects may be revealed by either transparency or echo methods as may be convenient, whereas the surface flaws are detected by inclining the feelers at an angle to the surface. The feelers are set at an angle to the surface so that the ultrasonic waves move along the surface without penetrating the test material.

039552
COAL-FIRED GAS TURBINE FOR LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, July 1953, p 68

A 750 hr. test of an Allis-Chalmers gas turbine fitted with a multi-tube fly-ash separator to minimize turbine blade erosion at power levels above 3000 hp. was undertaken. It is evident from this test that there must be complete removal of all fly-ash particles larger than 20 microns, or roughly 0.001 in. dia. The two coal pumps stood up well to their work, and showed relatively little abrasion after 575 hr. continuous service; control of the rate of feed also was satisfactory. Ring-supported combustors came through the test in good conditions after 140 hr. of oil-burning and 698 hr. of coal-burning, showing a combustion efficiency consistently about 95 percent.

039556
REMOTE-DRIVE SPEED MEASURING INSTRUMENTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Oct. 1953, pp 433-435, 2 Fig, 7 Phot

This article describes the Hasler remote electric drive speed recorders which are especially suited to dual driving cabs of electric and diesel-electric powered trains. The equipment has been designed for fitting a speed indicator and recorder in the normal leading cab, and a speed indicator only in the trailing cab. Incidents are record by means of cinematic measuring mechanism the recording being effected by a steel ball on specially prepared paper, from which copies can be easily taken; no ink is required.

039569
THE FRENCH RAILWAY SPEED RECORD

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Mar. 1954, p 352, 1 Fig

As part of a study of the technical and economic aspects of high-speed operation, the SNCF conducted four days of trial runs at progressively higher speeds. The purpose of the tests was to investigate the margin of safety allowed by the speeds now regularly scheduled with normal types of locomotives and rolling stock. They were also regarded as a contribution to research into methods of improving the productivity of transport and reducing its cost, by showing how the building of vehicles able to run at ever-increasing maximum speeds can reduce maintenance expenditure on locomotives and track when operating at the speeds now normally scheduled. The test train consisted of three coaches of a recent design. Continuous records were made on all the runs by means of piezo-electric apparatus of the lateral forces exerted on the track by the first and third axles of the locomotive bogies. It was found that these did not exceed 4.2 tons.

039574
PRODUCTION OF ANTI-FRICTION BEARINGS

McNicoll, D

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, July 1954, pp 125-126, 4 Phot

British Timken Limited established at their Birmingham works a department expecially equipped for large-scale production of axleboxes of the common-type. The first group of operations for which a special machine was evolved was for the boring and facing of both ends. To obtain maximum concentricity of bores at each end of the housing it was desirable to carry out the operation on a machine in which the housing would rotate. The problem was resolved by the installation of a large double-ended, hollow spindle, boring and facing machine, the bore of the head being such that it would accommodate the largest housing. Considerable economy in machining time resulted by the installation of a Cincinnati duplex horizontal miller with the heads designed to feed vertically thereby eliminating the new setting required for each end of the axlebox. A multi-spindle horizontal drilling machine was installed to improve economy of drilling, specially on split-type designs.

039578
TOWARDS ATOMIC POWER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Oct. 1954, p 369

Any plan for widespread railway electrification today must take a long-term view of sources of power. Schemes have been published for turbo-electric locomotives that would carry their own reactors for steam generation, but the advantages to economic development of electricity widely distributed from central stations are so great that it would be hard to justify the use of individual power units. In future it is more likely that the transmission system will be established for common use by industry and transport, the railways taking their supplies from convenient points like any other large consumer, and using them at the industrial frequency after transformation of voltage. An output of electricity from atomic plants at the end of a decade equivalent to that produced today by a million tons of coal is foreseen. Subsequent expansion would be rapid. The years ahead should be a period of planning by the railway industry so that when atomic power is available the decisions as to where and to what extent it is to be used will have been taken already.

039584
RECENT DEVELOPMENTS IN TRAIN SPEED RECORDING

Axworthy, FR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 94, Feb. 1951, pp 152-154, 3 Fig, 4 Phot, 1 Ref

The best way to record the speed of a train at the side of a track in a remote location is to measure the time required for the train to travel a fixed distance. Recent developments of this type of instrument have centered around methods of improving scale shape; however a different approach to the problem of producing a linear scale when measuring the time to travel a known distance, is made in a new recorder designed by Everett Edgcumbe and Co. Ltd., of Hendon. This contains a simple analogue computer, the output of which is a current directly proportional to speed. The present instrument operates on a timing distance which may be varied between 100 and 200 yards or between 75 and 150 yards. However, the same computer system could be used for a speed recorder operating on a base length of from 1 to 3 ft. although this would make the instrument somewhat more expensive.

039588
GAS-TURBINE LOCOMOTIVE PROGRESS IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Aug. 1951, p 144

This article summarizes the results of three gas turbine locomotive demonstration/evaluation programs in the U.S. An experimental G.E. locomotive handled about 350,000 million gross ton-miles of traffic on 1.4 million gallons of 95 percent bunker "C" crude oil. Subsequently, 10 more locomotives were ordered. An experimental Bladwin-Westinghouse gas-turbine-electric locomotive with two 2,000 bhp turbines handled train loads up to 2,200 tons, but experienced blading failure in one unit when a temperature limiting control failed. Another Bituminous Coal Research Inc., experiment with a 4200 bhp gas turbine fired with pulverized coal has operated for 1000 hr. has overcome many problems, the greatest of which was fly ash erosion of the turbine blades.

039598
BRITISH-BUILT GAS-TURBINE LOCOMOTIVE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Feb. 1952, pp 125-130, 3 Fig, 4 Tab, 6 Phot

The design features of a gas-turbine locomotive for use on the British Railways are presented. The design includes a 3000 hp power plant, an open-cycle gas turbine without a heat exchanger, a maximum service speed of 90 mph and a tractive force of 60,000 lbs. Considerable detail is provided.

039601
GAS TURBINE LOCOMOTIVE TESTS ON HEMERDON BANK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Mar. 1952, p 354, 1 Fig, 1 Phot

A series of trials carried out recently with the Metrovick gas turbine locomotive of the Western Region on Hemerdon Bank, near Plymouth, has demonstrated the capacity of the equipment for dealing with the exceptional conditions imposed by stopping and restarting heavy loads on a gradient of 1 in 42. Five trials were carried out. The results confirm the adequacy of design both of the gas turbine and of the electrical equipment of the locomotive.

039604
EFFICIENCY OF DIESEL LOCOMOTIVES

Koffman, JL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Apr. 1952, pp 402-406, 12 Fig, 7 Ref

The efficiency of the steam locomotive has been given as 11 percent and that of the electric locomotive as about 20 percent. Neither value compares favorably with the 28 percent estimated for diesel locomotives, the ratios being 1.82 for electric/steam, 1.4 for diesel/electric, and 2.55 for diesel steam traction. On the score of fuel comsumption the diesel engines are not so much better than electric locomotives. For example, when pulling a 350-ton train at 70 mph on the level, the electric locomotive must develop some 900 hp at the wheels, compared with 1,100 hp required from the heaviest diesel-electric locomotive, so that the ratios of efficiencies will be only 1.145 whilst parity will be attained at 70 mph with a trailing load of about 175 t. also on the level.

039609
GAS TURBINE LOCOMOTIVE TESTS

Railway Gazette (Temple Press Limited, 161-166 Fleet treet, London EC4, England)

Vol. 96, May 1952, pp 572-573, 2 Fig, 1 Tab, 1 Phot

This article described dynamometer car trials on Western Region of the British Railways to check fuel consumption and thermal efficiency. Also checked was the designed tractive effort-speed characteristics, the most notable feature of which is the restriction of the starting tractive effort to 31,500 lb. and its maintenance up to a speed of 21 mph. Curves presented in Fig. 1 show that speed could not be checked properly on the dynamometer car runs. Another feature brought out by Fig. 1 is that thermal efficiency of gas-turbine locomotives rises with increase of load, though of course on the drawbar value it falls with increasing speed on any given controller notch. The curves shown in Fig. 1 and 2 refer to drawbar outputs and consumptions.

039613
DETECTION OF FLAWS INFORGINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Aug. 1952, p 122, 1 Fig, 1 Phot

Increasing use is being made of ultrasonic equipment for the detection of hidden flaws in forgings, slag inclusion in welding, and so on. Apart from the value of such methods of inspection as a safety precaution, the detection of hidden flaws during the early stages of manufacture can contribute considerably to savings in machining costs, since flaws are not always apparent by visual inspection until machining reaches an advanced state. A diagrammatic representation of the testing of a steel bar with a discontinuity, using a Solus-Schall ultrasonic flaw detector is shown.

039620
AMERICAN RAILWAY SPEED IN 1942

Allen, CJ

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Feb. 1943, pp 166-168, 2 Fig, 2 Tab

The speed records of American railroads are analyzed for the period 1935-42, in which steam, diesel and electric locomotive are compared.

039632
AXLE STRESSES–III

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 74, Jan. 1941, pp 115-117, 3 Fig, 1 Tab

The bending moments of locomotive crank axles are discussed. The computations and graphics for two, three, and four cylinder steam locomotives are included. Stresses in relation to crank angles for three cylinder locomotives are tabulated.

039633
AXLE STRESSES–II

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Oct. 1940, pp 410-411, 2 Fig

The article illustrates graphically and by mathematics the stresses which are present in the carrying and driving axles of locomotives and rolling stock. This is one part of a series on axle stresses of rail vehicles.

039641
INDICATION OF TRAIN SPEEDS BY RECTIFIED CURRENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, June 1955, p 650

The complete speed indicating equipment consists primarily of a heavy-duty single-phase alternator and a rectifier moving coil instrument. Interposed in the circuit is a wheel dia. adjustment box, by which correction can be made for changes in tire dia. when the wheels are returned, and facilitates the transfer of the equipment to other motive power units having different wheel diameters. The speed indicating equipment is shown to be unaffected by the vibration met in traction conditions or by extraneous electrical influences. A range of locomotive speed indicators of robust construction, designed to withstand the conditions normally encountered in railway traction service, with a minimum of maintenance, has been developed by Smiths Industrial Instruments Limited.

039645
DESIGN OF LOCOMOTIVE AND RAILCAR FRAMES–1

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 143, Aug. 1955, pp 214-217, 3 Fig, 2 Phot

In working out the design of a frame for any power-operated rail unit, provision must be made for it to function: as a rigid girder support for the main components it will be required to sustain; as a foundation upon which the power of traction may be developed and transmitted to the wheels; as a strut to resist buffing shocks; and as a transporting member in all lifting operations. Locomotive frame stresses and methods for calculating stresses are discussed. A diagram of stresses developed by a 1200-hp diesel-electric locomotive under service conditions is shown. Cast side frame and underframe designs are described.

039648
DESIGN OF LOCOMOTIVE AND RAILROAD FRAMES–2

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 281-282, 4 Phot

British cast-steel tender underframes are described and illustrated. In brief the design uses a pair of straight through plates running from front to rear buffer beams, with suitable openings for the carrying axles and their axleboxes. Most other countries use the double-truck tender which requires an entirely different underframe. Frame stressing and truck frame designs for British and U.S. locomotives are discussed.

039651
SPACE-INTERVAL DRIVER'S VIGILANCE DEVICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 333-334, 2 Fig

The Swiss-developed safety control apparatus operates on a distance interval, and therefore gives the same factor of safety irrespective of the locomotive speed, whereas the more common system based on a time interval does not achieve this feature. The effect of the new apparatus is basically the same as the previous systems, i.e., following the incapacity for duty of the driver, a warning is sounded in the cab and if no action is taken by the driver the traction motors are switched off and the brakes applied. A diagram showing the mechanical and electrical circuits of the safety device is given. Also shown is part of a diagram of the run-down on the safety apparatus expressed in locomotive miles travelled.

039662
A REVOLUTIONARY GAS-TURBINE DEVELOPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, Jan. 1956, p 36

Gas-turbine-electric locomotives for freight operation were constructed for the Union Pacific Railroad. The locomotive is of single-ended two-unit permanently close-coupled design, each unit having the Co-Co wheel arrangement. The rated 8,500 hp will develop a continuous tractive effort of 145,000 lb and a maximum speed of 65 mph. The gas-turbine is designed to burn Bunker C type fuel oil which, however, is not carried on the locomotive so that 100 percent of the weight available for adhesion remains practically constant. Under full load the gas-turbine will consume approximately 870 gal. of fuel per hr. Overall length of the locomotive and tender is 165 ft. height 16 ft.; and weight on driving wheels 815,000 lb.

039671
RUSSIAN 3,000 HP NATURAL-GAS LOCOMOTIVE

Aseev, EN Shebrovsky, AF

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, Mar. 1960, pp 305-306, 6 Fig, 2 Tab, 1 Ref

The main particulars of the locomotive are: bhp, 3000; weight, tons, 200; maximum speed, kmh, 100; specific weight, kg/hp, 66.6; average fuel consumption percent, 10; radius of action, km, 500; length overall, mm 29,970, number of units, 1; number of driving axles, 6; axleload, tons, 20; crew, 2.

039677
FIRST SOVIET GAS-TURBINE LOCOMOTIVE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, June 1960, pp 683-684, 3 Fig

The first Soviet gas turbine locomotive is designed to handle 3,000 ton trains on the level at the maximum design speed of 100 km per hour. The single unit weighs 140 tons has 3 feet 5-3/8 in. wheels and is capable of running through 820-feet radius curves. The gas turbine runs on heavy (Masut) oil and is an open-cycle single-shaft unit without a heat exchanger. The front compressor bearing is of the normal supporting type and the rear one deals with axial and thrust loads.

039682
MOTALA DIESEL-TURBINE LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Sept. 1960, 3 pp, 1 Fig, 1 Phot

Distinctive features are: (a) The traction characteristics are those of a gas turbine combined with mechanical change-speed transmission from a reciprocating oil engine. (b) A smooth and gradual start, with high effective adhesion values, is always possible. (c) Though there is some complexity in the control construction, the transmission is essentially simple, with interdependent and automatically operating constituents. (d) There is no short-time or continuous rating of the transmission. (e) The principal constituents are all machines well tested and proved in railway service. (f) The simplicity and lightness of all constituents gives an inherent favorable power: weight ratio for the locomotive. (g) As the system in a sense is the equivalent of a non-pressure-charged engine of four-stroke type working in a high-pressure atmosphere, and with the compressor tied to the charging and turbine systems, the operation at high altitudes can be very favorable. (h) Dynamic braking is inherent in the system and without the addition of any cooling or heat-dissipating elements.

039922
GAS-TURBINE LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Jan. 1953, pp 116-117

Further development of gas turbines could profit from an open appraisal of the technology and the benefits inherent in gas turbines. For instance the torque characteristics are suitable for a mechanical drive to be used without any change speed gearing, and the conventional electric transmission might be eliminated. Elimination of electrical equipment would reduce weight, bulk, and cost, very considerably. Centrifugal compressors, as opposed to the current axial type, offer the potential benefits of greater robustness, lower costs, and greater flexibility, and might be placed across the chassis or vertically. The two most important lines of development for gas-turbine locomotives apart from those aimed at utilization of cheaper fuels, are to increase maximum cycle temperatures, and to improve heat exchanger performance.

039923
SPEED INDICATING ON LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Feb. 1953, pp 157-158, 4 Phot

The speed indicating and recording equipment manufactured by Elliot Brothers consists of an a.c. tachometer generator mounted on the bogie axlebox and directly coupled to the axle shaft, supplying current proportional to train speed via a wheel diameter compensator to speed indicators in both driving cabs and a graphic speed recorder within the locomotive. Electrical impuses corresponding to distance travelled operate a mileage counter of the cyclometer type. Since all the connections between the various components of the system are electrical, there is complete flexibility in the layout of equipment.

039924
GAS TURBINE OPERATING ON BRITISH RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Feb. 1953, p 201

Some details of experience so far gained with the Brown-Boveri and Metropolitan-Vickers gas turbine locomotives are presented. The combined effect of poor part-load efficiency and considerable portion of operating time at low power settings gave a useful work-to-fuel ratio for a complete trip not very different from that of a good steam locomotive. The Brown-Boveri locomotive accumulated about 120,000 miles and 3,300 hours compared to 42,000 and 1,200 for the Metropolitan-Vickers.

039925
A LOCOMOTIVE RAIL-STRESS INDEX

Clarke, CW, Western Australian Government Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Feb. 1953, p 229

This article highlights a paper entitled "A Locomotive Rail-Stress Index". The author reviews the method of determining the stress produced in a rail in accordance with the elastic theory, and determines the heaviest equivalent isolated wheel load which may be permitted on a specific rail section at permissible service speed, in order that the stress produced in the rail will not exceed the allowable stress value. From this the author deduces a rail-stress index applicable for any given wheelbase and axle loading.

039927
LONG-WELDED CONDUCTOR RAILS ON THE SOUTHERN REGION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Mar. 1953, pp 371-372, 3 Phot

Improved methods have recently been introduced to enable the maximum length of conductor rail to be unloaded and renewed in the short possession times available, with the minimum amount of labour. Under the new system conductor rails are welded into 180 ft. lengths at the flash-butt welding depot and conveyed to the site on rakes of three 40-ton bogie rail wagons. Up to 26 conductor rails weighing 150 lb per yard are loaded on the rail wagons in four tiers of eight, seven, six and five rails. Using a tackle to pull-off the rail, a gang of six mean can unload 1-3/4 miles of conductor rail in a 4-1/2 hour track possession. Six lifting and traversing frames are used to transfer the rail from the four-foot way to the new insulators, and enable 16 men to complete the laying in, fishplating and bonding of 1/2-mile of 150-lb conductor rail in 4-1/2 hours.

039929
GAS-TURBINE SUCCESS ON U.S.A. RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Apr. 1953, pp 473-474, 1 Ref

Early test runs and experiences with the G.E. and Westinghouse gas-turbine-electric locomotives of the Bo-Bo-Bo-Bo design are briefly described. The G.E. design is rated at 4,500 hp the Westinghouse design at 4,000 hp. The article focuses on the Westinghouse design, its fuel consumption and performances.

039938
SOME ASPECTS OF BOGIE DESIGN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Jan. 1952, p 32

Normal design has proved its practicability over a long period and most efforts have been directed towards improvments in detail rather than to the production of something fundamentally different. Arduous conditions have led to efforts to eliminate or reduce wear so that a vehicle can run longer between less expensive overhauls. These and other problems were covered in a paper to the Institution of Mechanical Engineers.

039942
THE APPLICATION OF BEARING SPRINGS TO LOCOMOTIVES AND OTHER RAIL UNITS

McArd, GW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, Feb. 1942, pp 263-266, 4 Fig, 1 Tab

The design, maintenance and characteristics of suspension systems for locomotives and railcars are discussed. The design of a locomotive places restrictions upon suspension systems, which differ from railway cars. The characteristics of steam locomotives require different suspension systems than electrics. Stresses and dimensions for laminated springs for railway vehicle use are tabulated.

039957
SPEED AND BRAKE APPLICATION RECORDER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, June 1956, pp 475-476, 1 Fig, 2 Phot

A speed and brake application recorder, the R 1038 tachograph has been designed for records of speed and brake application against a distance base in the critical period immediately preceding any accident or incident in which locomotives or railcars may be involved. A self-erasing recording disc provides, on a large scale, records of speed and brake applications against a distance base of 1,820, 910, or 450 yd. only, all records previous to the selected distance being automatically erased. The disc may be removed to provide evidence and a spare disc fitted without upsetting the calibration in any way.

039961
BOGIE DESIGN FOR ELECTRIC LOCOMOTIVES–1

Croft, EH, General Electric Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Aug. 1956, pp 264-265, 3 Fig, 1 Phot

Methods are given for limiting transverse forces on the track, and stresses on the bogie and body. The design concepts are discussed from the aspects of both wheel diameter and bogie oscillations. The use of rubber as a cushioning medium is also described.

039963
BOGIE DESIGN FOR ELECTRIC LOCOMOTIVES–2

Croft, EH, General Electric Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Sept. 1956, pp 384-385, 4 Fig

Suspension, adhesion, and good riding requirements of general service locomotives are discussed. Attention is given to three-point suspension, weight transfer reduction, Bo-Bo characteristics, bogie behavior on curves, and the need for three-dimensional rigidity in the frame types.

039973
NEW INSULATING MATERIALS FOR OVERHEAD CONTACT SYSTEMS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publ No. 23, Rpt, July 1966, 2 pp, 2 Fig

Question E54.

The report is concerned with testing of synthetic materials which may be used as insulators for overhead contact systems of electrical railways. The use of such materials is especially of interest for rough environments such as tunnels, mixed traction systems and coastal areas. The duplication of these conditions is described for laboratory testing.

039974
ENERGY CONVERSION

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publ No. 21, Rpt, July 1965, 1 pp, 1 Fig

Question A89.

This document gives an overview of alternative forms of energy conversion which are of interest to electrified railways. The forms of energy conversion discussed include fuel cells, thermo-electric generators, thermionic generators, thermionic generators, magneto-plasma dynamic generators. The conclusions are that only thermionic generators are the only form which appears promising in the immediate future.

039975
GREASE FOR ROLLER BEARINGS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publ No. 21, Rpt, July 1965, 2 pp, 1 Fig

Question E18

This article reports the findings of Committee E18d to determine greases to be used for roller bearing lubrication. Factors to be considered include: vehicle speed, grease type, bearing and axle box design, axle load and ambient temperature. The test program resulted in a set of test criterion for lubricants.

039976
RUNNING PROPERTIES OF ELECTRIC AND DIESEL MOTIVE POWER UNITS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publ No. 21, Rpt, July 1965, pp 5-9, 6 Fig

Question B10.

This report contains a comprehensive description of the theoretical bases, used on the riding properties of an electric locomotive as well as of the methods of measurement and evaluation applied. In this connection, an account of the level which the development of these methods has attained is also given.

039996
LABORATORY STUDIES OF JOURNAL BOX LUBRICATION MATERIALS THIRD PROGRESS REPORT

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-MR-188, Aug. 1950, 1 pp

The purpose of the Research Program was to compare and evaluate different means for lubricating the conventional solid type bearing journal box assembly as applied to railway cars, with the ultimate objective of establishing a factual basis for recommendations covering possible revisions of practices and material specifications leading to increased safety and improved service performance. No final conclusions covering definite specification requirements could be made based on early finding in the program.

040004
SPECIFICATIONS M-101-68 AXLES, CARBON STEEL, NON-HEAT-TREATED AND HEAT TREATED

Association of American Railroads, 1920 L Street, NW, Washington, DC, 20036

Spec M-101-681969, 20 pp, 6 Fig, 6 Tab, 4 Phot

These specifications cover non-heat-treated axles up to and including those 6-1/2 inch nominal diameter at the center, and heat-treated axles of all sizes for passenger cars and freight cars to designs shown in the A.A.R. Manual of Standards and Recommended Practices. These specifications also cover heat-treated locomotive axles. Manufacturing processes, chemical composition requirements, mechanical properties, testing requirements, dimensional tolerances, markings, and inspection requirements are described in detail for axles designed to meet these specifications.

040016
WHAT'S AHEAD FOR GAS TURBINES FOR RAILWAY TRACTION

Tessier, M, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 2, 1967, pp 61-66, 7 Fig

The aircraft type turbine enables lighter weight construction and a cut in the maximum cross-section. Running at 250 km/h, a 3-body railcar set would require, fitted with a diesel engine, 2,820 kW, whereas the gas turbine engine of 1,700 kW would be adequate. The aircraft turbines were known for their short service-life; however, the fact of down-rating a 1,100 kW aircraft turbine to 810 kW leads to a cut in operating temperature of about 100 degree C. Such a fall would involve a big gain in the endurance of the turbine blades. Operating with diesel fuel might have the opposite effect. Concerning the type of the transmission system between turbine and axles, the turbine engine offers very favorable advantages; the torque speed characteristic of the drive turbine offers an adequate flexibility to enable direct-drive for the axles through a mechanical transmission system without any gearbox. The bench tests are described with a Turmo III C turbine engine. Plans for field testing are outlined.

040017
DETAILS OF AN INITIAL EXPERIMENTAL GAS TURBINE RAILCAR SET

Guillemard, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 2, 1967, pp 67-74, 9 Fig, 1 Tab

For the prototype gas turbine set, a 330 kw diesel-powered railcar set was selected for starting. The original trucks were satisfactory for operation to 150 kmh, but were replaced with Y-214 trucks for greater speed capability. The air intake and exhaust systems and the Soundproofing necessary for the installation of the 297 kg turbine motor are described. The transmission system is described and illustrated. The fire protection system, heating and air conditioning system, and the towing gear are briefly discussed.

040018
INITIAL TESTS OF THE TURMO III C TURBINE ENGINE

Senac, G, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 2, 1967, pp 75-90, 22 Fig, 2 Phot

Experiments began in July 1966, with a TURMO III C3 aircraft type turbine engine in a rail vehicle. The aim of the experiments is to determine the results as to soundproofing, operation with the fuels stocked by the S.N.C.F., the potentialities for traction, and the endurance with such a machine. From the initial tests, results are already satisfactory, both for soundproofing and for operating with the usual SNCF fuels. From the engine starting test results, it was decided to substitute an F3 type engine for the C3 type. The endurance test results are shown.

040019
OPERATING CONDITIONS OF TURBINE ENGINE: CONTROL, REGULATION, PROTECTION

Amet, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 2, 1967, pp 91-96, 6 Fig

Systems for adapting an aircraft-type turbine engine to the Very High Speed Set are discussed. The design of the regulating and driving assemblies are to be as simple as practicable. The regulating system for the gas turbine and the fuel supply system are illustrated. The fault indicator signals and the fire detection and extinction methods are described.

040020
DYNAMIC BEHAVIOR OF HIGH SPEED CURRENT COLLECTION

Ehara, N, Tokyo University

JSME Bulletin (Japan Society of Mechanical Engineers, 1-24 Akasaka, 4-Chome, Minato-ku, Tokyo 107, Japan)

Vol. 14, No. 69, Mar. 1971, pp 303-304

A mathematical model is formed on the basis of representing the overhead line by a multi-particle system and the pantograph by a concentrated mass. A new method is proposed to find the contact force between the pantograph and the overhead line making use of the future motion of the overhead line. By this method, the characteristic properties of the system are obtained more exactly and the theoretical results show a good agreement with the experimental results.

040021
APPLICATION OF GRINDING STONE BLOCK TO PREVENTION OF WHEEL-SKIDDING OF HIGH SPEED VEHICLES

Ishizawa, M, Japanese National Railways
Maruyama, H, Japanese National Railways
Ohyama, T, Japanese National Railways
Satoh, K, Japanese National Railways

JSME Bulletin (Japan Society of Mechanical Engineers, 1-24 Akasaka, 4-Chome, Minato-ku, Tokyo 10 Japan)

Vol. 14, No. 70, Apr. 1971, p 381

Resin-bonded grinding stone block was applied to the shoe of a special tire cleaning device mounted on the vehicle for the New Tokaido Line in order to improve the adhesion and prevent the wheel-skidding. The grinding stone shoe which was apt to be abraded and to grind the wheel-tread more or less had the tendency to remove undesirable adhesive material and produce a more active surface with improvement of adhesion. The abrasion of grinding stone block increased in the order of emery, single crystal aluminium oxide, regular aluminium oxide and silicon carbide as abrasive grain material and with grain percent and inversely with grain size. A running test with the vehicles has shown the tendency of the frequency of wheel-slips being reduced under use of the grinding stone shoe.

040024
WHEEL AND RAIL LOADING FROM DIESEL LOCOMOTIVES

Marta, HA, Electro-Motive
Koci, LF, Electro-Motive

Conf Paper, pp 146-177, 30 Fig, 2 Phot

This review is divided into the following areas: sample derailment data; basic curve negotiation mechanics; experimentally determined wheel-to-rail forces; rail profile data; the effect of dynamic brake levels; and mechanical considerations. Sample derailment data was taken from all six areas and well illustrated with examples. A summary of results is shown. There are a number of mechanical areas involved in the locomoitve which can and do affect the wheel-rail loading. Among these, although there are many others, are the alignment control draft gear, matching wheel sizes, and maintenance of truck bolster stops.

040030
DEVELOPMENT IN OVERHEAD LINE CONSTRUCTION

Merz, H, Bauabteilung Der Generaldirektion Der SBB

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19, No. 1,2, Feb. 1970, pp 71-77, 10 Fig, 3 Tab, 1 Phot, 6 Ref

Increase in traffic power requirements and speed prompted this study. Tests were made of the current carrying contact wire and current collection. Temperatures of 310 degrees were recorded on the contact line during a 20 minute period when the current load rose from 500 to 2000 Amp. at 1 minute intervals (line voltage being 15 KV). Different means of contact line suspension were tested. Data from these tests are given, as also graphs of the results. The results indicate the need for improved overhead line construction, enlarging the contact line diameter dynamic suppression and improvement of the pantograph, and further research into the heating of contact lines over a moderate current limit.

040045
DEVELOPING A HIGH-POWERED DIESEL ENGINE FOR RAILWAY TRACTION

Schur, T, Sulzer Brothers Limited

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-DGP10, Conf Paper, Apr. 1967, 12 pp, 12 Fig, 1 Tab, 6 Phot

The design criteria is discussed for the new Sulzer four-stroke locomotive engine being developed. How some of these derived from two experimental engines, which were operated on a four-stroke and two-stroke cycle is also discussed. Field research as well as elaborate bench-test facilities have been provided to perfect the new locomotive diesel engine. The work that has recently been carried out on some of the more important components of this engine is described. Some mention is made of the problems encountered with combustion and pressure charging at the high specific loads to which this engine type is being taken.

040046
SELF-PROPELLED GAS-TURBINE TEST CAR

Dean, AG, Budd Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-WA/RR-2, Conf Paper, Dec. 1966, 5 pp, 5 Fig

The Budd Company expected to complete the assembly of a gas-turbine self-propelled railway car in the summer of 1966 for a 9-month test on the Long Island Railroad. This vehicle is intended to demonstrate the compatibility of aircraft-developed turbines with railroad environment. To expedite the program and conserve on cost, production elements have been adapted for this application wherever possible. The car body is the Budd Pioneer III. The floor height, originally 39 inches in the passenger area, has been increased to 47 inches to provide adequate height for the turbine and other equipment. This provides an overall height slightly over 12 ft. The running gear is based on the Pioneer III truck developed for and tested by the BARTD. The air conditioning and propulsion systems are described.

040062
SPECTROGRAPHIC ANALYSIS OF DIESEL ENGINE LUBRICATING OILS BY THE ROTATING PLATFORM METHOD

Smith, JC, General Electric Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Paper No 60-RR-5, Paper1960, 4 pp, 2 Fig, 5 Tab, 2 Phot, 12 Ref

Contributed by the Railroad Division of the ASME for presentation at the ASME-AIEE Railroad Conference Pittsburgh Pennsylvania, April 20-21, 1960

The most promising of a number of methods for analyzing wear products in diesel-engine lubricating oils were examined. With certain modifications, the rotating-platform technique shows advantages over the others, in terms of accuracy, (plus or minus 10%) sensitivity (1 ppm lead), speed (20 min. per sample), cleanliness, little smoke, no residue and versatility (quickly installed).

040066
RUSSIAN MAINTENANCE PRACTICES FOR DIESEL LOCOMOTIVES

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

Mar. 1966, 6 pp, 4 Fig, 5 Tab, 1 Ref

Translation of Russian journal article prepared by S. G. Guins, Chesapeake & Ohio Railroad.

Russian railroads strongly follow the philosophy of preventive maintenance. The schedule of work is controlled both by mileage and time. In 1961 a program was put in operation by order of the Ministry of Railroad Transport, setting certain norms for the mileage between major overhauls. Tables show actual distance between locomotive overhauls as compared to prescribed norms; distribution of defects by component (of the locomotive); and the cost of major maintenance vs cost of overhaul for various locomotive component parts.

040068
REMOVAL OF OIL FROM THE RAIL

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

1, June 1966, pp 37-41, 8 Ref

Rail cleaning tests were conducted in the USSR using chemical, mechanical and thermal methods on a laboratory apparatus which was instrumented for contact pressure and friction. It was concluded that: 1. Basic cause of reduction of adhesion is the oil that is deposited on the rail from journal boxes, gear boxes and tank cars. 2. For better operating conditions cleaning of track with steam containing ML-2 compound is recommended.

040071
PLANNING OF LOCOMOTIVE ASSIGNMENT

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

Aug. 1967, pp 5, 2 Fig, 2 Tab

A computer program was developed in 1965 on the Sverdlov Railroad utilizing "Ural 2" computer for planning locomotive assignment. Analysis of the particular situation lead to consideration of several plans. 1. Assignment of locomotives to certain train schedules for the whole planning period and then defining the best plan for train formation, taking into consideration those schedules to which the engines have been assigned. 2. Planning of train consist, taking into consideration schedules, and then assigning locomotives to these consists. 3. From input data determine time when consists and their locomotives are available and then, by use of "Transportation problem match locomotives and consists to the schedules through use of feedback. The plan is corrected and improved and then the optimal plan is printed and issued. 4. A step-by-step solution. As the first step, optimum assignment of locomotives to train consists. Second step, assignment of consist to available schedules. This is done utilizing the feedback system. The first two methods do not guarantee an optimum solution; the last two methods do.

040073
RAILWAY TRANSPORT DURING 40 YEARS OF SOVIET REGIME FROM THE PLAN GOELRO–TO THE GENERAL PLAN OF THE ELECTRIFICATION OF RAILROADS

Tischenko, AI

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

1957, 13 pp

A historical review of the electrification of Soviet railroads is presented. The article begins with Plan GOELRO, around 1920 and includes highlights from six Five-Year Plans up to about 1957. Estimated cost of electrification of one kilometer of level two track line is given as 580,000 rubles.

040077
FLEXICOIL SECONDARY SUSPENSIONS IMPROVE HIGH SPEED RIDING

Clayton, GA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, June 1970, pp 460-464, 3 Fig, 1 Tab, 1 Phot, 19 Ref

Following successful experiments with flexicoil secondary suspension fitted to a Class 86 electric locomotive, British Railways intends to make further use of this type of springing. Faulty hydraulic dampers caused pitching oscillations of 2.42 c/s resonant at 100 mile/hr with 60 ft. rail joints and body nosing oscillations of 1.25 c/s on straight track. Design installation and evaluation of a flexicoil suspension system resulted in significant improvement in the riding characteristics at high speed.

040087
THE TRACTIVE RESISTANCE OF DIESEL LOCOMOTIVES

Koffman, JL, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Dec. 1961, pp 738-739, 2 Fig, 4 Ref

This report of tractive resistance data from a British Transport Commission bulletin in terms of lb. per ton yielded a dimensionless drag of 0.6 to 0.9 and rolling resistance values of 3.5 to 4 lb. per ton for various diesel locomotives. At speeds above 10 mph and particularly in the speed range of 20 to 80 mph the values of r or R are influenced by the component proportional to (V/10) and not by C(sub d) and the (V/10(super 2)) factor. This suggests that the effect of transmission and coupled axles action is of considerable influence.

040088
PERFORMANCE OF LOCOMOTIVE BOGIE BOLSTER SPRINGS–I

Koffman, JL, British Transport Commission
Batchelor, GH, British Transport Commission

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 116, Jan. 1962, pp 16-18, 2 Fig, 2 Tab, 15 Ref

The lateral rigidity of helical springs in bolster suspensions of truck vehicles is evaluated in terms of displacements between the top and bottom bolster planks. The effects of lateral flexibility on working stresses and lateral displacement and oscillation characteristics, particularly nosing, swaying and lateral oscillations are calculated.

040091
PROPULSION OF TRAINS AT SPEED

Pocklington, AR, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Apr. 1965, pp 317-329, 6 Fig, 2 Phot

Safety aspects on unrestricted main-line track were investigated by instrumenting axleboxes to measure lateral force on hauled vs propelled trains. It was found that it is the combination of sharp curves and high propulsive efforts, both demanding low speeds, which requires close examination.

040092
PREVENTING SLIPPING OF TRAIN WHEELS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, June 1965, pp 450-451, 1 Fig, 3 Phot

Experiments into the use of chemical sprays from wheel-actuated lineside distributors were conducted using ethyl caprylate, sodium metasilicate, and Syton W 20. There is already some evidence that an improvement in time lost due to slipping has occurred, but it would be premature to say how great this is, or to what extent it has been maintained.

040102
WEIGHT TRANSFER. A MATHEMATICAL ANALYSIS FOR BOGIE LOCOMOTIVES

Borgeaud, G, Swiss Locomotive and Machine Works

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London Ec4, England)

Vol. 120, Sept. 1964, pp 731-738, 26 Fig, 11 Tab

Three methods to represent changes in axle and bearing loads with respect to the tractive effort are discussed. The study is primarily mathematical in nature.

040104
PRACTICAL ADHESION FACTORS

Krishnemurti, R

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Oct. 1964, p 856, 1 Fig, 1 Phot, 1 Ref

An examination and comparison of the torque and slipping characteristics, and the starting performance of electric locomotives and diesel-hydraulics are made. The accepted adhesion value for rigid-frame coupled axle locomotives is 0.33 and for the truck locomotive is 0.30. This article suggests that a coefficient of 0.37, which is commonly adopted for the electric locomotive, might be more correct. Notchless control is suggested to improve the starting performance of the diesel hydraulic.

040109
BRITISH RAILWAYS CARRIAGE AND WAGON AXLE DESIGN

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Apr. 1966, pp 281-283, 2 Fig, 5 Tab, 7 Ref

Information is presented relating to the effect of shapes and stresses on the fatigue properties of components. The journal load, wheel load, and flange force are tabulated for a 74-ton car with 4.5-ton trucks. Fatigue strength of steel axles and bending moments for steel are shown. The ride quality and center of gravity for passenger trains are calculated.

040113
SOME ASPECTS OF BOGIE PITCHING

Koffman, JL, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, July 1966, pp 574-576, 2 Fig, 1 Phot, 5 Ref

The desire to increase passenger comfort makes it necessary to pay careful attention to the effects which bogie pitching can have on body oscillations. The general aim is to use dampers between axlebox and bogie frame which would be equally effective in compression and expansion because pitching takes place symmetrically and regularly about the lateral axis. Proprietary hydraulic dampers are theoretically the most suitable to deal with these oscillations provided the correct characteristic has been determined, produced, and maintained. Body and bogie primary suspension oscillations with and without auxiliary friction dampers are shown for a passenger coach travelling at 70 mph. The beneficial effect of the friction damper reducing the magnitude of the fore and aft accelerations is apparent.

040115
THE LIMITS OF ADHESION

Steiner, B, Oerlikon Engineering Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Apr. 1967, pp 268-273, 5 Fig, 1 Tab, 4 Phot, 10 Ref

A comparison of adhesive data for 15-types of electric locomotives shows that at least ten are overpowered. The adhesion coefficient is defined and the relationship between tractive effort and wheel slip is shown. Measures to prevent wheel slip are discussed. The fluctuations of wheel load and adhesion on dry, wet, and oily rail are illustrated. It is concluded that elaborate mechanical axle-load-equalizers which have been used to improve adhesion are not as important as carefully designed suspension and damping systems.

040119
SPARKING TO IMPROVE ADHESION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Sept. 1967, pp 663-664, 2 Fig

Development of the use of arc plasma as a means of improving adhesion between wheel and rail is discussed. For ordinary thin oil films energies of 50 J/cm2 or more are needed. The main factor involved in adhesion increase by sparking is the removal of the pollution from the rail surface, including moisture, and any effect on the actual surface itself. An example of the improvement in spark tests that can be achieved is shown in several slip risk probability graphs for a severely polluted rail. On unsparked rail the use of a tractive effect requiring 17 1/2 per cent adhesion would result in a 10 percent slip risk, but after the successive amounts of sparking used the same slip risk occurs at 26 1/2, 33 and 45 1/2 per cent respectively. The mobile test bed is an experimental device to measure the changes in adhesion; it is not a tool for the practical application of sparking in service.

040133
THE NEW ELECTRIC LOCOMOTIVE TYPE RE 4/4 OF THE SWISS FEDERAL RAILWAYS AND THE PROBLEMS RELATED TO THE DEVELOPMENT OF ITS MECHANICAL PART

Borgeaud, G, Swiss Locomotive and Machine Works
Loosli, H, Swiss Locomotive and Machine Works

ASME Journal of Engineering For Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

67-RR-11967, 15 pp, 24 Fig, 1 Tab, 12 Phot, 3 Ref

In 1964 the Swiss Federal Railways introduced the prototype of a very efficient, high-power electric locomotive type Re 4/4II of the wheel arrangement Bo'Bo'. The locomotive weighs 80 tons overall and has a 1-hr rating of 6340 hp, and it had to be especially designed for small lateral forces between wheel and rail and good adhesion properties. The basic theoretical problems related to the development of the mechanical part of the locomotive are outlined. The technical solutions of the various mechanical problems are described. A few remarks on the numerous tests carried out with the completed locomotive are included.

040135
THE EFFECTS OF MAINTENANCE POLICIES ON LOCOMOTIVE PERFORMANCE

Garin, PV, Southern Pacific Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-WA/RR-5, Conf Paper, Nov. 1967, 20 pp, 8 Fig, 6 Tab, 3 App

Some of the differences are discussed in maintenance policies with diesel locomotives as compared to their steam-driven predecessors based on experience that has evolved during several decades of dieselization on American railroads. An optimum economic relationship exists between maintenance practices and locomotive performance. Aspects involved in this relationship are presented, as are considerations for achieving the best balance between operating results and maintenance costs. A description of diesel-locomotive maintenance practices on Soviet railways is included, for comparative purposes.

040145
GAS TURBINES FOR RAIL VEHICLES

Kroschel, HU, Bundesbahn-Zentralamt, Munchen

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18, No. 5, May 1969, pp 186, 6 Fig, 1 Tab, 5 Ref

A comparison is made of the thermodynamics of the gas turbine with the diesel engine. While the diesel engine operates through a more efficient thermal cycle, with a lower specific fuel rate, the gas turbine makes possible a drastic reduction in weight per horsepower. The applications of gas turbines to locomotives as prime motive power units are described, including the combination of a gas turbine supplementary power unit to the main diesel engine. More recently there have been gas turbines applied with much success as the power unit on rail motor cars. Descriptions of various turbine propulsion units are given with a supporting table of data.

040156
THE EFFECT OF BRAKE SHOE ACTION ON THERMAL CRACKING AND ON FAILURE OF WROUGHT STEEL RAILWAY CAR WHEELS

Wetenkamp, HR Sidebottom, OM Schrader, HJ

Illinois University, Urbana, Illinois

No. 387, Bulletin Series 387, 101 pp, 18 Fig, 25 Tab, 24 Phot, 2 App

Laboratory test were made on 369 wrought steel railway car wheels. Two types of tests were performed: the wheels were stopped from high speed by using high brake shoe pressure, and the wheels were tested under long-continued applications of the brake shoes. The stop tests were intended to produce thermal cracks in the wheel treads. The long-continued brake shoe applications were intended to produce fractures through the rims and plates of the wheels. In both types of tests the conditions imposed on the wheels were more severe than the wheels should receive in normal railway operation. The studies of the effect of carbon content of the wheel material, various methods of heat treatment, and changes in wheel design, together with a qualitative analysis of the stresses developed in the wheels are presented.

040190
SD TRUCK PERFORMANCE ON THE BALTIMORE & OHIO RAILROAD AND RELATED WHEEL WEAR ON THE CUMBERLAND DIVISION

Marta, HA

General Motors Company, Electro-Motive Division, Chicago, Illinois

No. 128, Test Rpt, Dec. 1966, 165 pp, 54 Fig, 10 Tab, 11 Phot

This test program was designed to determine the causes of excessive rail wear and associated wheel flange wear, and derailments involving SD-35 locomotive units, which resulted during operation of the first SD-35 units on coal trains between Grafton and Terra Alta, W.V. The test program was to measure the actual wheel-to-rail lateral loads and the associated truck motions under all possible operating conditions. Also, wheel wear tests were run on standard wrought steel and new cast steel wheels as a first step in an effort to find a better wear resistance wheel. Test results are reported and recommendations are made.

040193
INVESTIGATION OF SERVICE STRESSES IMPOSED ON WHEELS UNDER DIESEL LOCOMOTIVES

Assoc of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois

MR-235, Prog Rpt, Jan. 1955, 115 pp, 41 Fig, 34 Tab, 9 Phot, 1 App

Laboratory tests were made to evaluate service stresses imposed on wheels under diesel locomotives. Wheels of AAR standard A-40 and F-36 design and a F-36 wheel machined as nearly as possible to a definite contour were subjected to static and vertical load tests. Vertical loads of 60,000 lb. were applied at two positions on the wheel tread, and a lateral load of 20,000 lb. was applied at the flange. Heat was applied to the wheel tread to simulate that produced by brake shoe action. Additional tests were made on the A-40 wheel wherein this wheel was subjected to actual brake shoe heating in the laboratory. The conclusions are as follows: type A-40 and F-36 diesel wheels are stressed to extremely high levels as a result of heating; stresses due to vertical and lateral loading are relatively low; and, a lateral load tends to produce higher stresses in a thinner plate section.

040197
BOGIE LOCOMOTIVE RIDING PROBLEMS

Batchelor, GH, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, May 1964, pp 353-356, 7 Fig, 2 Phot

The performance of vehicle suspension can be adversely affected by lateral plane design, which appears to be of minor importance. The low order restoring forces due to swinglinks, which are about one ton per inch per bolster, are discussed as to their relationship to ride quality. A Bo-Bo electric locomotive with 20 inch vertical swinglinks is used as an example. The link ends were mounted on rubber and rubber snubbers were required to prevent impact between the bolster and the track frame. Lateral pull tests are described on this system, which were conducted to determine source of the poor ride quality. It is shown that the effective length of the 20 inch swinglinks is only 6.8 inches.

040201
STEEL PRODUCTS MANUAL

American Iron and Steel Institute, 150 East 42nd Street, New York, New York, 10017

Feb. 1955, 61 pp

Instruction Manual

Some of the important steps in the manufacture of wrought steel wheels are outlined, covering standard designs and standard specifications of the Association of American Railroads, the American Society for Testing Materials, and the American Transit Association. Information is presented on selection of wheels for railroad service, design data, computation of stresses in wheel treads and wheel tread failures.

040227
LATERAL LOADING BETWEEN LOCOMOTIVE TRUCK WHEELS AND RAIL DUE TO CURVE NEGOTIATION

Koci, LF, General Motors Corporation
Marta, HA, General Motors Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

65-WA/RR-4, Paper, Nov. 1965, 11 pp, 7 Fig, 18 Ref

Contributed by the Railroad Division of the ASME at the Annual Winter Meeting, Chicago, Illinois, November 7-11,1965.

Curve-negotiation mechanics and forces resulting when locomotive trucks negotiate curves are well recognized. However, meaningful and reasonable prediction of forces resulting in service conditions has been limited. An instrumented wheel-axle assembly was developed and used on 2,3, and 4-axle trucks to study the effect of creep and the transverse load reactions resulting between wheel and rail. Instrumentation was used to measure these forces and the reactions between axles and truck frame under operating conditions. Test results confirm predicted phenomena and indicate the effect of creep on resulting loads. This paper includes a brief and general review of curve-negotiation mechanics and presents the test results and their relation to the theoretical analysis.

040267
LATERAL LOADING BETWEEN LOCOMOTIVE TRUCK WHEELS AND RAIL DUE TO CURVE NEGOTIATION

Koci, LF, General Motors Corporation
Marta, HA, General Motors Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Conf Paper, Nov. 1965, 10 pp, 7 Fig, 14 Ref

Contributed by the Railroad Division of the ASME for presentation at the Winter Annual Meeting, Chicago, Ill., November 7-11, 1965.

An instrumented wheel-axle assembly was developed and used on 2, 3, and 4-axle trucks to study the effect of creep and the transverse load reactions resulting between wheel and rail. Instrumentation was used to measure these forces and the reactions between axles and truck frame under operating conditions. Text results confirm predicted phenomena and indicate the effect of creep on resulting loads. A brief and general review is included of curve-negotiation mechanics and the test results and their relation to the theoretical analysis are presented.

040268
DYNAMIC MEASUREMENT OF RAIL PROFILE AND RELATED LOCOMOTIVE TRUCK MOTIONS

Spangler, EB, General Motors Corporation
Marta, HA, General Motors Corporation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-RR-1, Conf Paper, 12 Fig, 3 Phot, 18 Ref, 1 App

Contributed by the Railroad Division of the ASME for presentation at the 9th Joint ASME-IEEE Conference, San Francisco, Calif., May 4-6, 1966.

The profile of the railroad track on which a railway vehicle operates represents an input into the vehicle. This input is due to vertical and lateral rail irregularities and can cause dynamic loads that result in excessive damage or wear and tear on vehicle components and on the track itself. In order to study the dynamic operation of rail vehicles, it is necessary to know the profile of the track on which they operate. Since the unloaded profile of the rail can vary significantly from the loaded condition, it is the loaded-rail profile that must be known. This paper presents a method for the rapid measurements of the loaded-rail profile and includes some typical rail profiles and related truck motions resulting from these profiles. The instrumentation resulting from this work appears to have immediate application in day-to-day railroad operation and in high-speed rail transportation studies.

040303
RAILROAD ROLLER BEARING LUBRICATION

Paterson, PC, Timken Roller Bearing Company, Incorporated

Northwest Carmen's Association, St. Paul, Minnesota

Conf Paper, Apr. 1961, 21 pp

Lubricants and lubricating techniques for journal and roller bearings are discussed. Correlation between bench tests and actual performance of lubricants is reported. Stressed are the temperature characteristics of various lubricants and storage of cars using various bearing systems.

040306
A VIBRATING RIG TEST FOR RAILWAY BEARING GREASES

Lieser, JE West, CH

Timken Roller Bearing Company, Incorporated, Canton, Ohio

Conf Paper, May 1968, 10 pp, 4 Fig, 4 Tab, 6 Phot, 8 Ref

A test rig utilizing a standard reaction type vibration test machine was developed to determine the consistent stability of grease lubricants in auti-friction bearings. This program was undertaken in view of the ever increasing demands upon greases in railway service and also the lack of direct correlation among performance characteristics obtained through existing standardized bench tests, full scale rotational tests lacking vibration, and those characteristics displayed in the field. General performance of the products tested appeared to be insensitive to the parameters of vibration within the range of parameters occurring in service. A 48 hours test which subjects the test cartridge to 4 G's at 38 cps with the grease bulk temperature thermostatically controlled at 180 F emerged as the condition which yielded results duplicating field service conditions.

040313
SUSPENSION DYNAMICS BY COMPUTER SIMULATION

Diboll, WB, Jr, Washington University
Bieniecki, HS, McDonnell Douglas Corporation

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 708-716, 14 Fig, 7 Ref, 1 App

An Analytical study of the effect of changing the design parameters of a two mass, six-degree-of-freedom suspension system was made. Rail cars with coil and air springs were analyzed by analog and digital computers. Spring stiffness, spring spacing, damping rates, height of center of gravity, and total mass were varied. The effect on frequency and response was determined. With digital computers and commonly available matrix programs, the undamped natural frequencies of a suspension can easily be determined at important design stages to insure that these frequencies are out of range of known excitation frequencies at operating speeds. Dynamic problems that have been annoying in the past may become critical to safety and comfort at ultrahigh vehicle speeds.

040320
LOCOMOTIVE WHEEL-TO-RAIL TRACTION

Albachten, HT, Stanford Research Institute

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Nov. 1966, 9 pp, 6 Fig, 5 Tab, 6 Phot, 11 Ref, 1 App

It is shown (on the basis of laboratory data) that the low values of locomotive wheel-to-rail traction caused by contaminants can be increased and stabilized under both driving and braking conditions by the application of a high-frequency (HF) induction-coupled air plasma torch to each rail ahead of the lead drive wheel. Descriptions are given of experiments to investigate friction effects of RF ionized gases, corona discharge, an acetylene torch, a do argon plasma torch, and an HF induction-coupled air plasma torch. The plasma torch has given a two to three-fold friction increase under laboratory conditions, even with oiled surfaces.

040332
AXLES FOR FULL-GAUGE RAILWAY CARS AND TENDERS–TECHNICAL REQUIREMENTS

Council of Ministers of the Union of USSR, Moscow, USSR

GOST 4008-59, Specs, Mar. 1960, 8 pp, 2 Fig, 1 Tab

The technical requirements for forging, tempering, chemical structure, physical and mechanical properties are outlined. Testing, marking, transportation and preservation techniques are discussed.

040360
IMPROVEMENT IN FATIGUE RESISTANCE OBTAINED BY WATER QUENCHING UNTREATED 5-1/2" TIMES 10" PASSENGER AND FREIGHT CAR AXLES FROM 1000 DEGREES F

Horger, OJ Neifert, HR

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-213, Res Rpt, Dec. 1953, 28 pp, 13 Fig, 4 Tab, 6 Phot

Fatigue tests were made on eleven passenger car axle assemblies and seven freight car axle assemblies prepared from axle forgings which had been modified by water quenching from 1000 degrees F. These forgings were originally produced to AAR Spec. M-101-49, Grade A, but were given this subsequent treatment to determine the improvement in fatigue resistance that could be obtained from the beneficial thermal residual stresses produced by quenching from below the critical. It was concluded that water quenching untreated axle forgings does not improve the resistance to initiation of fatigue cracks in the wheel fit portion, but does greatly increase the resistance to breaking off in the wheel fit. In some cases over 100%.

040364
INVESTIGATION OF SERVICE STRESSES IMPOSED ON WHEELS UNDER DIESEL LOCOMOTIVES

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-235, Res Rpt, 1 p

This report describes laboratory tests made in the program to investigate and evaluate service stresses imposed on wheels under diesel locomotives. In these tests wheels of AAR standard A-40 and F-36 design and a F-36 wheel machined as nearly as possible to a definite contour were subjected to static and vertical load tests. The conclusions of this report are as follows: Type A-40 and F-36 diesel wheels were found to be stressed to extremely high levels as a result of heating. Stresses produced at certain locations on the wheel plate apparently exceeded the static yield point of the steel and there are indications that heat stresses may be a major factor in wheel failures. Stresses due to vertical and lateral loading are relatively low; however, these stresses acting in conjunction with stresses produced by heating could, depending upon their direction, either add to or subtract from the high level heat stresses. A lateral load tends to produce higher stresses in a thinner plate section as represented by the special machined F-36 wheel; however, vertical loading produced very little difference in stresses on a F-36 machined and a F-36 standard wheel.

040376
WHEEL-RAIL ADHESION

Marta, HA
Mels, KD, General Motors Corporation

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

68-WA/RR-1, Aug. 1969, pp 839-859, 16 Fig, 1 Tab, 50 Ref

This publication will briefly review the factors that affect adhesion and some of the published data available on adhesion between locomotive wheels and rail as a function of speed. Instrumentation, testing procedure, and results of adhesion tests on an SD-45 locomotive are discussed, and developed adhesion versus speed curves for different operating conditions are presented. The most important result which was determined from this series of tests was that adhesion is not affected by speed nearly as much as is generally thought. The adhesion limit drops off only a small amount with speed when running on relatively poor condition welded rail. The adhesion limit on jointed rail dropped, as speed increased, to about 75 percent of its maximum value before it began to level off. The results do indicate that good maintenance of jointed rail right-of-way can cause significant improvement in available adhesion. This would be particularly important where high adhesion demands are required. The condition of the rail surface had the most-pronounced effect on the available adhesion. There was a loss of adhesion of almost 30 percent when the rails were sprayed with water. The effect was consistent on jointed and welded rail.

040377
IS RAIL ADHESION A LIMITATION ON THE GROWTH OF INTERNALLY POWERED LOCOMOTIVES?

Meier, DR, General Electric Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

62-WA-294, Paper, Nov. 1962, pp 8, 3 Fig, 4 Tab, 3 Phot, 13 Ref

Contributed by the Railroad Division of the ASME for presentation at the Winter Annual Meeting, New York, New York, November 25-30, 1962.

This paper examines the extent in which internally powered locomotives are pressing the limit of the coefficient of adhesion between wheel and rail. Data are reviewed showing the results of tests to establish the coefficient. These data are compared to operating results on locomotives of high power per axle to show that there is ample room for growth in the power ratings before the adhesion limit is reached.

040383
SAFE OPERATION OF HIGH-SPEED LOCOMOTIVES

Cain, BS, General Electric Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

RR-57-3, Dec. 1935, pp 471-479, 11 Fig, 1 Tab, 6 Ref, 1 App

In this paper are presented the basic theories, test information, and the chief conclusions of an investigation of factors entering into the mechanical design of locomotives for high-speed operation. The fundamental problem in regard to the safe operation of high-speed locomotives has been to explain, and to learn to control by design means, the oscillations of locomotives which develop at high speeds, and which place a definite limit on the safe speed at which any particular design of locomotive can be operated over a given section of track. It was found that in order to keep a locomotive of conventional type from exerting high flange pressures on straight track when moving at high speed, the wheel base should be long and the clearances small to reduce angularity in the track. Springs should be as soft as is practical to cushion blows and reduce the force due to oscillation. On high-speed curves, truck restraints and wheel bases should be studied to avoid instability. The height of the center of gravity of the locomotive is a compromise. In general the height should be reduced where the locomotive is well guided and where the track is good. Excessive axle weights should be avoided. Good track maintenance and uniform construction and stiffness with the minimum practical flange clearance are always of great importance.

040390
UNDERSTANDING WHEEL-RAIL ADHESION

Cabble, GM, Jr, Westinghouse Air Brake Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

60-RR-3, Paper, Apr. 1960, 7 pp, 2 Fig, 57 Ref

Contributed by the Railroad Division of the ASME for presentation at the ASME-AIEE Railroad Conference, Pittsburgh, Pennsylvania, April 20-21, 1960.

The terms of wheel-rail adhesion are defined. An extensive review of the problems associated with adhesion and the attempts to solve these problems is presented. The results of experiments conducted by the author on scale equipment show that creep is present as long as there is adhesion demand. As the adhesion demand increases, the percentage creep increases until creep becomes slip and eventually slide. It is shown that true adhesion varies with velocity. Suggestions are given for means of approaching true adhesion values on the railroad. The danger of wheel damage caused by high adhesion could offset the advantages.

040393
THE DESIGN OF RAILWAY AXLES AND LOCOMOTIVE CRANK PINS

Eksergian, R, Budd (Edward G) Manufacturing Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

RR-60-1, Feb. 1938, pp 153-189, 28 Fig, 3 Tab, 11 Ref, 2 App

Tendencies toward increase in speed have focussed attention on modifications in present axle proportions. High-speed locomotives require corresponding considerations, particularly in the proportioning of locomotive crank pins. The object of this paper to set forth various aspects of loading conditions and stress limitations. A comparison of various methods of axle proportioning has been made with the suggestion of a new interpretation of loadings. Present methods of axle proportioning and an analysis of the division of the loading into various components are given; some consideration is given to stress concentrations and endurance limits of the material. Some characteristics of the nature of dynamic loadings is given, based on simplification of various conditions met in actual operation.

040481
QUALITY ENGINEERING APPLIED TO TRACTION

Bennett, E, English Electric Company, Limited

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 4, Paper No. 671, 65-66, pp 342-362, 9 Fig

A detailed examination is presented of quality control practices implemented in conjunction with locomotive manufacture. The problem was one of maintaining quality on parts supplied by over 200 outside firms. The general approach was to create and maintain historical records for all orders placed with each supplier, and note all defects found. Topics covered include office procedures, dealings with new and existing suppliers, evaluation and testing of new components, investigation procedures for locating service failures, and case histories of several service investigations.

040482
SOME ASPECTS OF DIESEL MAINTENANCE ON INDIAN RAILWAYS

Varma, MG

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 4, Paper No. 672, 65-66, pp 379-395, 21 Fig

Experience on maintenance and operation of Broad Gauge diesel electric locomotive is recalled. These units were operated over a wide range, returning to the base depot on an average once every week for maintenance requirements. From the inception, preventive maintenance as recommended by the manufacturers were introduced. In spite of the various difficulties, the overall performance can be considered as satisfactory. An availability of over 90% has been maintained almost throughout.

040484
THE STANLEY HERBERT WHITELEGG MEMORIAL FUND TRAVEL SCHOLARSHIP—1964 AWARD

Miller, DW

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 3, 64-65, pp 246-257, 9 Fig

Through the scholarship, a study was made of the development and maintenance of electric traction equipment in France, Germany, and Switzerland. The article examines traction motors, transformers, rectifiers, relays, general construction and repair of rolling stock, post-repair testing and electronics.

040485
SOME ASPECTS OF DIESEL AND ELECTRIC TRACTION ON INDIAN RAILWAYS

Sahai, P, Ministry of Railways, India

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 3, Paper No. 656, 64-65, pp 258-268, 5 Fig

This paper presents an assessment of the operational, technical and economic advantages of diesel and electric traction based on the experience of Indian Railways during the last few years and the position as it is likely to be in the near future. While these factors are vital in the choice of traction, there are other considerations also which may affect the final decision. These include factors like the pace at which change in traction is required, availability of diesel oil or power for traction purposes, position of foreign exchange, strategic consideration before deciding any individual case and it is on this account that no hard and fast rule can or should be laid down for the choice of traction on Indian Railways.

040486
SOME DESIGN PROBLEMS OF DIESEL LOCOMOTIVES

Ell, SO, British Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 6, Paper No. 685, 66-67, pp 543-571, 13 Fig, 2 Tab, 2 App

This paper focuses on the problems of diesel-hydraulic vibration systems, the power transmission to axles via a geared system, and the ride problems of the D.800 and D.1000 locomotive classes. Illustrations reveal shaft failures, comparisons of original and tuned vibration systems, crankshaft torsional vibrations, vertical movements of locomotive bogies, and tire profiles of new and worn wheels.

040489
SOME DESIGN AND SERVICE ASPECTS OF COMMUTATORS AND BRUSH GEAR IN TRACTION SERVICE

Jowett, WG, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 1, Paper No. 679, 66-67, pp 74-99, 22 Fig, 5 Ref

In the paper, d.c. traction motors up to 1,000 hp and d.c. diesel generators up to 2,000 kW at 1,000 rpm are considered. The construction of commutators, brushgear and the devices used to improve commutation is delineated. It is mentioned that new forms of solid state switching devices are being evaluated for use as an integral part of the d.c. machines. Other organizations are investigating squirrel cage induction motors as substitutes for d.c. traction motors. Where "limit" d.c. machinery is involved, as in the case of the generators for high power D.E. locomotives, multi-phase alternators followed by silicon diode rectification will take over, but for traction motors the d.c. motor, complete with a conventional commutator and brushgear will still remain the standard solution for a number of years.

040491
"WHITHER MOTIVE POWER"

Stewart, WA, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 59, No. 1, Paper No. 713, 69-70, pp 16-51, 25 Fig, 1 Tab, 10 Ref

In discussing the future of motive power it is suggested that this will be derived as follows: for passenger service: (1) electric, with D.M.U. as interim, (2) electric, diesel-electric, electro-diesel, electro-turbo, turbo-electric, and (3) diesel-electric "G.P." loco-hauled; (all multiple units) for freight service: (1) diesel-electric "G.P." loco-hauled, and (2) diesel-electric "G.P." or M.U. as for passenger service. The future requirements of high speed can best be met by multiple limit stock and the best way to raise power to weight ratios to get the performance required is first to lighten tare weight to a minimum and then spread electric traction under it to get adhesion. Traction motors can eventually be spread to container and other block freight trains, as well as multiple unit parcel and sundries, by the use of power "jumpers" and traction motor powered bogies down the train.

040494
DEVELOPMENT OF THE BRUSH TYPE "4" LOCOMOTIVES OF BRITISH RAILWAYS

Beasant, FH, Brush Electrical Engineering Company

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 4, Paper No. 695, 67-68, pp 368-392, 22 Fig, 2 Tab

While the basic design of the Brush Type "4" 2750 hp locomotive has remained unchanged since 1962, a number of modified and additional features have been progressively developed and introduced and the more important ones are discussed in this paper. This locomotive was designed and is operated as a general purpose mixed traffic locomotive, capable of hauling and heating high-speed passenger trains, liner trains fitted with air-brakes and merry-go-round coal trains. Six major changes were introduced during the production program: Details involved in making these changes are discussed. 1. Omission of electric train heating and change of brake equipment; 2. Change in axle design; 3. Change from series parallel connected traction motors to all parallel connected traction motors; 4. Introduction of Mark I Auto-Air Brake equipment; 5. Introduction of a "Universal" boiler compartment enabling any one of three makes of boiler to be fitted; and 6. Introduction of Mark 2 Auto-Air Brake equipment in place of Mark 1.

040497
AUTOMATIC WHEELSLIP CONTROL

Lucas, HW Wojtas, B

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 313, Part 5, 66-67, pp 442-495, 26 Fig, 8 Ref, 1 App

The principles involved in wheelslip control are outlined and then are applied to control for diesel-electric and electric locomotives. The voltage distribution across the motors during wheelslip is shown, as are the dynamic adhesion characteristics according to the hook up of the motors. Proper use of automatic wheelslip control devices permit a locomotive to be worked right up to the limit of adhesion.

040500
THE EFFECT OF CHANGE IN MOTIVE POWER ON THE RAILWAY WORKSHOP

Ridgway, S, British Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 53, No. 292, Part 2, 63-64, pp 151-201, 2 Fig, 35 Phot

The change in constructional methods brought about by the building of diesel locomotives, and the developments so far in providing for the maintenance of the diesel fleet have been described. So far the main effort has been directed at setting up a number of more or less self-contained sections to overhaul and test particular parts of the diesel hydraulic locomotives and provide an exchange service for motive power depots. If full advantage is to be taken of the ready interchangeability of engines, transmissions and other pieces of equipment, there must be a steady flow of reliable tested unit replacements at low cost.

040501
EXPERIENCE WITH DIESEL ENGINES IN RAILWAY TRACTION

Schur, T, Sulzer Brothers Limited

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 53, No. 292, Part 2, 63-64, pp 203-282, 12 Fig, 16 Phot

This paper describes some of the steps taken in the development of a well-tried type of diesel engine to enhance its performance and economy without sacrificing its reliability. In the process of development, some new problems have inevitably been encountered. Where these have led to trouble, they are described in some detail together with the steps taken to overcome them. The experience described is the use of Sulzer LDA28 engines as used extensively on British Railways since 1958.

040503
THE BOURNEMOUTH ELECTRIFICATION

Sykes, WJA, British Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 325, Part 5, 68-69, pp 445-489, 7 Fig, 7 Phot, 3 Ref

Despite the unduly large number of initial defects in both electrical and mechanical equipment, the end of 12 months' intensive service has seen most of the causes of failure diagnosed and either already remedied or in course of rectification, and the financial results justify the confidence placed in electrification.

040509
THE INFLUENCE OF RAILWAY REQUIREMENTS ON MOTIVE POWER SELECTION

Davidson, D

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 317, Part 3, 67-68, pp 279-289, 5 Fig

The interrelationships between axle load, operating speed, track conditions and adhesion, as they effect motive power characteristics, are shown. Maintenance costs for diesel locomotives are discussed.

040517
SUSPENSION DYNAMICS BY COMPUTER SIMULATION

Diboll, WB, Jr, Washington University
Bieniecki, HS, McDonnell Douglas Corporation

ASME Journal of Engineering for Industry (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1968, pp 708-716, 14 Fig, 2 Tab, 7 Ref, 1 App

An analytical study of the effect of changing the design parameters of a two mass, six-degree-of-freedom suspension system was made. Rail cars with coil and air springs were analyzed by analog and ditital computer. Spring stiffness, spring, spacing, damping rates, height of center of gravity, and total mass were varied. The effect on frequency and response were determined.

040528
THE TRANSMISSION OF POWER BY HYDRAULIC MEANS

Ribbons, RT

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, Pt 11971, pp 19-44, 16 Fig, 2 Phot, 1 Ref

The use of hydraulic transmissions on Western Region of British Railways has enabled certain designs to be taken from a state of virtual prototypes to one of reliable pieces of equipment. But the transformation has been achieved at a high cost to the railways. Design and performance characteristics are described for Voith L6-30rV and Mekydro K.184U transmissions as used on D.7000 class locomotives. Now some nine years after their introduction on Western REgion of British Railways, the hydraulic locomotives are showing that they have potential life and reliability approaching that of the locomotives having electrical transmissions which have been used and developed over several decades.

040529
TWENTY YEARS' EXPERIENCE WITH DIESEL RAILCARS

Wakefield, FHG

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, Pt 11971, pp 45-83, 6 Fig, 1 Tab, 1 Ref

The following topics are discussed: Bodies–A short discussion on the relative merits of light alloy and steel construction together with some notes on our experience with various materials used in the passenger areas and finally a discussion on the problems of heating this type of vehicle. Bogies–Some notes on the problems which have been associated with the brake gear, followed by a discussion of the riding problems experienced with these vehicles and then some notes on the problems which were encountered with axle design. Power Equipment–A short discussion on the relative merits based on experience of gear boxes and torque converters. Some notes on the various problems which have been associated with the final drive units and lastly notes on the performance.

040531
A.C. SUBURBAN ELECTRIFICATION–BRITISH RAILWAYS, EASTERN REGION

Lyon, EC

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 6, Paper No. 676, 65-66, pp 585-627, 26 Fig, 4 App

The author recalls experiences and problems encountered during the electrification of the Eastern Region of British Railways. Attention is directed towards the A.C. Overhead Line System of electric traction in this Region. A comprehensive treatment, the article covers the daily traffic task, power supply, maintenance procedures and training for overhead lines and rolling stock and descriptions of electrical and mechanical equipment.

040532
THE EFFECT OF WEIGHT TRANSFER ON LOCOMOTIVE DESIGN

Birch, PCH

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 6, Paper No. 677, 65-66, pp 672-685, 15 Fig

In the preliminary stages of designing a locomotive the weight transfer properties of any proposals can be calculated and modifications made to the physical dimensions in order to get the best possible arrangement. Spring stiffnesses can be altered but these are fixed within fairly small limits by other considerations and alternatives which can make a considerable difference to the riding of the locomotive. Weight transfer coefficients, axle loads, and adhesion for each axle load are identified for both Bo-Bo and Co-Co locomotives. Methods for limiting weight transfer to achieve maximum performance during starting are also discussed. These include methods both "internal" and "external" to the locomotive.

040533
THE APPLICATION OF NETWORK ANSLYSIS TO LOCOMOTIVE AND CARRIAGE OVERHAULS AT EASTLEIGH WORKS, BRITISH RAILWAYS

Boocock, CP

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 3, Paper No. 706, 68-69, pp 239-258, 9 Fig, 2 Phot

The principles of network analysis are described along with a theoretical approach to locomotive repair schedules. The use of network analysis enables a multitude of known, inter-dependent activities (such as compose a locomotive repair) to be set down in a form revealing most clearly their relationships with one another. The clarity with which this information is thus presented enables a good schedule to be prepared to produce the shortest repair time with an optimum level of manning, and a calculable spares requirement. Practical application of the technique has been insituted at Eastleigh Works for locomotive and carriage overhauls. These applications are reviewed.

040536
RAILWAY ELECTRIFICATION IN INDIA

Awasty, HD, Indian Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 297, Part 1, 64-65, pp 72-97, 13 Fig, 5 Tab

The paper refers briefly to the d.c. electrification and to some operating statistics on the Indian Railways and gives a few details of the electrification schemes undertaken in the second and third Five-Year Plans, using a 25 kV single-phase industrial-frequency system. Power supply arrangements, traction overhead equipment, signaling and telecommunication engineering work and a.c. rolling stock are described. It outlines the technical improvements made in fixed installations and rolling stock in the light of experience gained so far, the organization set up for the execution of electrification projects and the efforts made to develop the manufacture of rolling stock and other equipment in India.

040537
THE USE MADE OF SPECTROGRAPHIC ANALYSIS OF DIESEL ENGINE SUMP OIL BY THE ENGINEER

Dunn, K

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 59, No. 328, Part 2, 69-70, pp 138-142, 1 Tab

The inspection program of the London Midland Region of the British Railways is described. Important metals whose concentration in the oil are measured include: iron, lead, silicon, sodium, aluminum and copper. Bearing wear is predicted by abnormal concentrations of lead from the flushing followed by copper, since the bearing surface contains 90 percent lead and the underly contains 70 percent copper. Piston seizure is predicted by abnormal concentrations of iron and aluminum, since the pistons are of aluminum alloy and the rings are of iron alloy. The oil samples are taken every 200/250 hours or about every 2-3 weeks. A summary of examinations is given for a two year period.

040538
WEIGHT TRANSFER CONPENSATION IN FOUR-AXLE DIRECT CURRENT LOCOMOTIVES

Watts, PH

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 59, No. 328, Part 2, 69-70, pp 143-153, 9 Fig, 3 Tab, 4 Ref

The intention in providing a compensation mechanism is to adjust the individual axleloads or their motor outputs or both so that the adhesion level required at each axle approaches more closely the general level of adhesion required by the locomotive as a whole. Electrical compensation methods use the latter approach of modifying the motor outputs and the mechanical methods affect the relative axleloadings. If the compensated and uncompensated locomotives are compared while producing equal tractive efforts it can be seen that the uncompensated locomotive requires a considerably higher level of adhesion if the leading axle is not to slip.

040539
THE SULZER 12LDA29 DIESEL ENGINE AS APPLIED TO RAIL TRACTION

Holmes, SC

ı 'stitution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 59, No. 328, Part 2, 69-70, pp 153-167, 4 Fig, 10 Phot

It is very difficult to make a fabricated structure which has no 'stress raisers' due to either bad geometry or lack of welding quality. Any fabricated structure which carries a high general stress is likely to develop fatigue fractures in certain areas. In order to avoid this situation and provide an engine structure which will reliably last the life of the engine, it is necessary to design the engine to a standard which will avoid a generally high stress and avoid areas which will concentrate stress. It will also be necessary to ensure a very high standard of welding quality. The additional expense and weight penalty of raising the standard of the structure in this way will tend to narrow the economic gap between the fabricated structure and the cast structure and may indeed close it completely.

040540
MODERN DEVELOPMENTS IN WHEELSLIP CONTROL ON ELECTRIC LOCOMOTIVES

Scott, M

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 59, No. 328, Part 2, 69-70, pp 182-190, 5 Fig

The reasons for wheelslip are discussed indicating what happens when it does occur on different types of locomotive and under different circumstances, and what action can be taken to correct it. The coefficient of friction is shown versus slip speed and the probably maximum useful adhesion is shown for various speeds on wet and dry rail. The natural and slipping characteristics of a number of motors shows why some locomotives are less steady on their feet than others. Wheelslip results in loss of tractive effort and at a standstill or at low speeds can cause wheel burns. Ways of avoiding wheelslip by correcting weight transfer problems, by controlling the acceleration cycle with small notches in the contactors and by limiting the tractive effect. When slip is detected, one of the following actions is recommended: reduction of tractive effort, applications of sand, light application of air brakes, and armature shunting.

040543
SOUTHERN REGION ELECTRIC MULTIPLE UNIT STOCK MAINTENANCE

Perry, P

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 302, Part 6, 64-65, pp 499-540, 11 Fig, 6 Phot

Five maintenance depots are maintained to service the 4,400 electric multiple-unit vehicles belonging to the Southern Region. Maintenance is usually performed on any particular unit at two or more depots, which requires a detailed record to be kept on each unit at the Central Records Office. The geographical distribution of stock types and the maintenance depots are shown on maps. The maintenance schedule is shown and described.

040547
RECENT DEVELOPMENTS IN LOCOMOTIVES USED BY A HEAVY INDUSTRY

Ribbons, RT

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 301, Part 5, 64-65, pp 406-464, 2 Fig, 21 Phot, 1 Ref

The Steel Company of Wales at Port Talbot has a railway system with 39 diesel shunters and 128 miles of rail track. It handles 315,000 tons of material each week. In 17 years of operation, five different diesel shunter designs have been used, each having its own good features and each its own problems. Thus an unusual opportunity existed for comparing the design of various shunting locomotives and for determining which features suited the working conditions best. A very large number of modifications and design changes have been made to enable the locomotives to work more reliably and at lower maintenance costs. Some of the more recent developments are described.

040549
RAIL-WHEEL ADHESION ON DIESEL AND A.C. ELECTRIC LOCOMOTIVES

Narasimhan, RV, Research Designs & Standard Organization, India

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 305, Part 3, 65-66, pp 276-323, 13 Fig, 10 Tab, 8 Ref

This paper is based on the results of dynamometer car tests carried out on Indian Railways to determine the adhesion at start and during running of diesel and a.c. electric locomotives placed in service in recent years on the Broad-Gauge (5 ft. 6 in.) and on diesel-electric locomotives on the Metre-Gauge systems. Dynamometer car results afford a practical assessment of the average maximum values in day-to-day operation under varying climatic and track conditions.

040550
SOME ASPECTS IN THE DESIGN OF TRACTION MOTORS FOR DIESEL ELECTRIC LOCOMOTIVE APPLICATION

Ghani, F

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 305, Part 3, 65-66, pp 323-334

Basic principles involved in the design of a traction motor are as follows: for a given horsepower output the D sub 2 L of the armature is calculated assuming values for the specific electric and magnetic loadings. The object of this paper is to present the limitations on the design of an axle-hung, nose-suspended traction motor, as faced by the traction motor designer.

040791
TRACKING CHARACTERISTICS OF GREAT NORTHERN ELECTRIC LOCOMOTIVES ON A 10-DEG CURVE

Ferguson, R, Association of American Railroads
Magee, GM, Association of American Railroads

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 551953, pp 223-244, 12 Fig, 9 Phot

This report covers a test program to measure the loads imposed on curved track by electric locomotives to determine if their power and size could be correlated with increased maintenance. The test locomotive was No. 5019 of Class W-1, but the other similar locomotive (No. 5018) was also used in the tests. Measurements were also made on two other locomotives as a matter of general interest and for comparison with the test locomotive. Both vertical and lateral forces were measured.

040795
STRESSES IN DIESEL LOCOMOTIVE WHEELS RESULTING FROM BRAKE SHOE HEATING

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-436, Res Rpt, Feb. 1963, 52 pp, 14 Fig, 23 Tab, 4 Phot

This investigation was made to determine stresses in diesel locomotive wheels resulting from brake shoe heating. The report covers the comparison of measured stresses in wheel plates on a standard or regular production type A-40 diesel locomotive wheel and stresses in the wheel plates on a special machined A-40 wheel. Each wheel was tested at identical combinations of speed, brake shoe pressure, and number of stops. The brake shoe and wheel test machine is expecially adapted to the type of tests covered in this report. The results of this study show that there was no stress concentration in the plate of the rolled production A-40 wheel. Machining the wheel plate to uniform thickness resulted in an increase in stress at the outside hub location and a decrease in stress at the inside rim location. The highest stresses were measured at the outside hub on the machined wheel where a maximum stress of 53,000 psi was recorded under conditions of braking from 80 miles per hour, 5,000 pounds brake shoe pressure and a temperature gradient of 400 degrees F. The comparable stress for the production wheel was 47,000 psi, a decrease of 11.5 percent.

040828
TRACTION RESEARCH

Barwell, FT, Wales University

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, Pt 2, Paper No. 680, 66-67, pp 158-196, 17 Fig, 3 Tab, 8 Phot, 27 Ref

Curves showing the increase in labor costs are used to indicate the urgency of the transition from a labor intensive to a capital intensive industry and indeed the transition is long overdue. Public transport with its high labor content, has shown an increase in price well above average. The inherently high track utilization of coupled captive vehicles provides the railway with an asset to which no serious challenge has yet appeared. The paper surveys traction research in Britain under the following topics: control theory, statistical methods, semi-conductors, and instrumentation.

040830
MAINTENANCE OF DIESEL ELECTRIC LOCOMOTIVES ON THE EASTERN RAILWAY, INDIA

Chandra, S

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, Pt 2, Paper No. 681, 66-67, pp 219-242, 3 App

This paper describes the history of the maintenance of the WDM-1 Class locomotives on the Eastern Railway. Attention is focused on defects occurring on this locomotive, maintenance records, development, training of drivers and maintenance workers and quality checks of indigenous produced parts.

033073
BRAKING SYSTEM OF THE HIGH-SPEED TRAIN

Nakane, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp48-50

The results of running tests carried out in the last fiscal year 1963 to approximately 1964 with the revised prototype and production type C-train, proved that such problems as insufficient braking force and failure of the electric brake, etc., were almost solved. Problems as slippage, heat crack or deformation of the brake disc were not sufficiently solved, and characteristic tests of the anti-skid device and tracing study of the growth of cracks in the brake disc were performed.

033098
LABORATORY TEST OF THE REMODELLED K-1 TRIPLE VALVE FOR FREIGHT CARS

Kito, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Quart Rpt, Dec. 1960, p76

Test was conducted in 1958 on a freight train equipped with a K-1 triple valve without the conventional brake cylinder choke for the purpose of speed-up of freight train operation. Results suggested the necessity of improvement on the brake apparatus and the car-end buffer, because undesirable impacts occasionally occurred.

033102
BRAKING SYSTEM FOR THE HIGH SPEED TRAIN

Kano, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Apr. 1960, pp66-71

Discusses the problems of braking systems for high speed trains. Includes consideration of factors related such as: limits of adhesion, brake types such as disc, wheel tread, materials for brakes, electric brakes and aerodynamic spoilers.

033103
EXPERIMENTAL RESULTS FOR TEMPERATURE RISE OF RAIL WHEN APPLYING EDDY CURRENT RAIL BRAKE (NO. 2)

Sookawa, H, Japanese National Railways
Saito, T, Japanese National Railways
Shimizu, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 1, Quart Rpt, Mar. 1970, pp40-41

A fundamental test for eddy-current rail brake, brake coils in four types were measured for temperature rise in rail and temperature distribution when brake force and train operation interval were varied. Results of measurements are summarized.

033106
RUNNING TEST OF THE TIRE-CLEANING DEVICE ON THE SHIN KANSEN VEHICLES

Maruyama, H, Japanese National Railways
Ohyama, T, Japanese National Railways
Satoh, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 2, Quart Rpt, June 1970, p118

A running test was carried out about the new type tire-cleaning device equipped with grindstone shoe for the purpose of preventing the wheel-slip during braking time. The object of this test was to grasp its real conditions on the vehicles as well as to investigate its effect in the prevention of the wheel slip.

033107
STANDING TEST OF EDDY CURRENT RAIL BRAKE SET TO A NEW TEST ELECTRIC CAR

Sookawa, H, Japanese National Railways
Sato, Y, Japanese National Railways
Itakura, E, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 3, Quart Rpt, Sept. 1970, pp149-152

To strengthen the braking force of the car at higher speed newly developed eddy current rail brakes (ECB) were tested in standing conditions with use of a new test electric car. Following items were studied in the test. (a) flux intensity of pole, (b) vertical displacement of exciting ECB, (c) displacement and strain of track and turnout, (d) distribution and effect of flux near ECB, (e) magnetization of rail.

033108
ON THE THERMAL EFFECT OF TREAD BRAKING UPON CAR WHEELS

Hirooka, T, Japanese National Railways
Teramura, H, Japanese National Railways
Saito, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 3, Quart Rpt, Sept. 1970, pp160-162

Some effects of tread braking with composite brake shoe upon solid wheels were studied by a full-size brake testing machine. The temperature rise, the temperature distribution in the wheel, and the friction coefficient of brake shoe were measured during drag or stop brakes. The residual stresses set up in wheels after the brake applications in different conditions were also studied, and some clear differences were observed between the states of residual stress in the wheel drag braked and the one repeatedly stop braked.

033112
DEVELOPMENT OF HIGH PERFORMANCE AIR BRAKE SYSTEM

Nomura, Y
Matsui, S, Japanese National Railways
Takami, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 12, No. 1, Quart Rpt, Mar. 1971, pp41-49

Increase of train speed and train length requires the air brake control system to be of much quicker propagation. In order to meet this requirement, a new pressure control valve has been developed in JNR. This report deals with the theory on pressure wave propagation in the brake pipe, gives a brief explanation of the new valve and the road test results in both passenger and freight trains.

033113
ROAD TEST FOR THE MEASURE OF SKID PREVENTION ON SHIN KANSEN CARS–MEASUREMENT TEST OF ADHESION FORCE UPON BRAKING

Wada, H, Japanese National Railways
Ohbu, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 12, No. 1, Mar. 1971, pp49-51

For the purpose of studying the limit of adhesion between rail and wheel upon braking, the measured results of adhesion force on SHIN KANSEN electric railcars, under the condition of watering, in both short and longer period tests are described in this report. Actual state of adhesion on cars in service were clarified such as follows: (1) adhesion force has difference of significance each by speed and by day of testing, even though the test conditions are seemingly same, and (2) the relation between mean adhesion force and skidding risk is to be known.

033131
BRAKING SYSTEM FOR HIGH SPEED TRAIN

Kano, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Nov. 1961, p27

Article discusses the various types of brakes to be used on the New Takaido Trunk Line. Comparison of various friction materials brake types, control of braking power and the limit of adhesion are subtopics which are discussed in detail.

033136
EXPERIMENTAL RESULTS FOR TEMPERATURE RISE OF RAIL WHEN APPLYING AN EDDY CURRENT RAIL BRAKE

Soogawa, H, Japanese National Railways
Saito, T, Japanese National Railways
Shimizu, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 1, Quart Rpt, Mar. 1969, pp58-59

The eddy current rail brake operates without friction between rails and wheels of vehicle. This brake system can be used on a conventional railway as well as on a high speed railway. The brake force is obtained by converting the kinetic energy of the vehicle into heat energy in the rail, the temperature of the rail will be raised. Since the rail is essential equipment for operating railway vehicles, the temperature rise of rail is a very important factor as to whether or not this brake system can be used.

033173
RUNNING TEST FOR THE STUDY OF COMPOSITION BRAKE BLOCKS

Wada, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968, p122

The study of composition brake blocks has been advanced in JNR to obtain better brake efficiency for the operation of high speed train. As a part of its study a car running test at Sanyo line (the rail condition is straight and flat) was carried out using the composition brake blocks specially made for trial. Since a part of the brake equipment was provisional in this test, brake cylinder pressure rose slowly and idling time was 0.7 to 1.2 sec longer than usual. If it is possible to shorten the idling time by any brake equipment up to that of the emergency brake, the brake distance will be shortened within 600 m at the initial brake speed 120 km/h. In this case the variance of brake distance may be involved in it.

033197
BRAKING SHOCK TEST OF PASSENGER–AND FREIGHT-CARS MIXED TRAIN

Nomura, Y, Japanese National Railways
Kikuchi, K, Japanese National Railways
Matsui, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 2, Quart Rpt, June 1964, pp43-44

According to the existing regulation on train operation of the Japanese National Railways, cut-off of the supplementary auxiliary air reservoirs of passenger cars is required in a mixed composition of train, when six or more freight cars are included in the train, in order to alleviate the difference of brake effects. The present test was planned for examining the effect on train impact of application of emergency brake under the condition of the supplementary reservoir included or excluded in the operation, and for exploring the possibility of modernizing the regulations.

033219
IMPROVEMENT OF MATERIALS FOR THE TIRE-CLEANING DEVICE

Maruyama, H, Japanese National Railways
Ohyama, T, Japanese National Railways
Satoh, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 4, Dec. 1969, pp226-228

In order improve the adhesion and decrease the frequency of "flat" damages due to the wheel-slip, a resin-bonded grindstone type tire-cleaner was developed for the SHIN KANSEN vehicles. Vehicles braked by the electric and disc brake are apt to be soiled on the wheel-tread and so the braked wheels have greater possibility to slip and produce a "flat" due to the decrease of adhesion value. Test has shown the tendency to reduce the frequency of the wheel-slip under use of the grindstone type cleaner. Experiments with the adhesion tester showed that the scouring with the grindstone type cleaner increased and stabilized the adhesion value.

033236
THE DIGITAL TYPE SLIP DETECTOR

Obu, T, Japanese National Railways
Wada, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 4, Quart Rpt, Dec. 1968, pp245-246

Article discusses the system used on the new Tokaido line electric cars to minimize wheel slip when the brakes are applied. This wheel slip detector is designed to release brakes when any one axle exceeds 20-30 percent of the train velocity. A block diagram of the system is included.

033256
BRAKING SYSTEM FOR HIGH-SPEED TRAIN

Nakane, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Oct. 1963, pp28-36

After completion of prototype train for trunk line operation, operation tests were performed to provide data for comparison with lab data for comparison of brake operation. Generally operation was satisfactory but problems still remain to be solved before final design of rolling stock. These include wheel flat, heat crack-deformation of brake disc, better lining material and failure of electrodynamic brake.

033263
BRAKING SYSTEM FOR HIGH SPEED TRAIN

Kano, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Nov. 1962, pp23-25

An experiment of adhesion limit continued from the preceding year, basic research on the disc brake and the performance test of the air brake equipment which was tentatively manufactured in the middle of this year. Adhesion Limit and Anti-Skid Devices; Disc Brake; Air Brake System.

033270
THE ELECTRO-PNEUMATIC BRAKE FOR RAILWAY ROLLING STOCK

Laplaiche, M, French National Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Nov. 1963, pp751-702, 1 Ref

Article compares the "standard" single pipe air brake with several modified forms which use electric control. Including the Achard, Carpenter, Lipkowsky and the Chapsal. The advantages of electrical control are named and discussed. Conclusions are that the air brake with electrically controlled valves is the best system and the advantages are named.

033271
LATEST DEVELOPMENTS IN THE BRAKING OF RAILWAY ROLLING STOCK (SYSTEMS, CONTROL, TYPES OF EQUIPMENT, MATERIALS USED...)

Kazarinov, VM, Ministry of Communications, USSR

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

1962, pp836-861

Since the increase in speed, length and weight of trains continues to increase, the development of braking systems becomes more and more important. Recommendations considered the utilization of braking force within the limits of wheel adhesion, trains exceeding 120 km/h should use anti-skid systems, non-metallic discs or brake shoes are recommended for high speed operations, the development of electropneumatic controls should be further developed as should continuing research into the development of disc and rail brakes.

033337
BRAKING SYSTEM FOR HIGH-SPEED TRAIN

Nakane, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

S.I., Quart Rpt, Sept. 1964, pp26-33

From the results of running tests carried out with the prototype car train in the last year (1962 to approximately 1963) on the test track section, several problems were pointed out to be solved or improved for maximum safety and better traffic service, such as insufficient braking force, failure of electric brake, wheel slip and heat crack or deformation of brake disc. To certify the practical effects of these revised designs in the course of manufacturing of the mass production type cars, several kinds of running tests were carried out using prototype cars, about the modified circuit of electric brake, plans to eliminate the flat of wheel tread, improvement of brake disc and certification of the supposition running resistance formula.

033372
DEVELOPMENTS IN BRAKING SYSTEMS FOR EXPRESS TRAINS TO MEET THE DEMANDS OF INCREASING OPERATING SPEEDS

Laplaiche, M, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21970, pp51-66, 2 Ref

Increase in the speed of trains poses numerous problems, amongst which those concerned with braking are becoming more and more important. Speeds of the order of 200 km/h at the price of relatively inconsiderable modification to the signalling to retain conventional solutions for the rolling stock, such as the cast iron brake block. In the very high-speed field, 250 to 300 km/h on specially constructed new lines. It becomes necessary to resort to combined systems amongst which may be other types of frictional brake.

033374
REPORT ON SOME RECENT TESTS BY THE "DIVISION DES ESSAIS DE MATERIEL OF THE S.N.C.F. 1. RAILWAY DYNAMICS SECTION (S.D.F.) 2. BRAKE TESTING SECTION (S.E.F.) 3. VITRY-SUR-SEINE TESTING STATION (S.E.V.)

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31970, pp105-115

Report of French rail technology including tests of braking and effects on vehicle stability, stability of an experimental gas turbine, locomotives with rubber block suspension. The second section deals with testing of braking systems of passenger and freight units. The last section reports testing of a modified suspension system, air suspension and an Eddy Current Brake.

033376
THE EVOLUTION OF BRAKING FOR FAST TRAINS IN RELATION TO THE RISE IN SPEED

French Rail News (Federation des Industries Ferroviaires, 92 rue Bixio, 75007 Paris, France)

No.2, 1970, pp 20-24

Discusses unique problems of braking systems in trains where the speed is in excess of 160 km/h. Systems for the 200 km/h rolling stock have unique problems because of limits in braking power by present materials and available adhesion. Units examined include electromagnetic, electrical controlled air and disc brake. Very high speeds (250-300 km/h) require combination systems at present stage of development.

033380
RAILWAY BRAKE. POSSIBILITIES OF INCREASING ITS POWER AND THEIR CONSEQUENTIAL EFFECTS

Moller, E

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

July 1961, pp501-524, 8 Ref

Overview of the conditions which make rail the economical transport in Europe. Recognizes the need to increase speed of passenger and freight trains to answer the increased demands. Discusses the need to develop more efficient braking systems to permit this increase in train speeds. Suggests modifications of disc brakes, airbrakes and magnetic brakes operating with anti-skid devices to achieve increased rail speeds.

033387
THE PROBLEMS ARISING WHEN BRAKING AT PRESENT DAY SPEEDS

Svagel, J, Yugoslav Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 37, No. 7, July 1960, p569

Discusses the basic law of braking and the ways in which it is accomplished. Further the Bozic, Knorr, Oerlikon and F.S. brake regulators, Type "M" Anti-Slip systems are discussed. The modes of operation, advantages and disadvantages are discussed also. Finally, the problems of braking systems and some of the forms suggested for high speed operation are compared.

033391
DERIVATION OF INITIAL SPEEDS AND STOPPING DISTANCES FROM DECELERATION/TIME CURVES

Law, J

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 38, No. 7, July 1961, pp449-453

Brake testing involves the measurement of deceleration. This can be obtained by direct means or by calculation knowing the initial speed, stopping distance, and stopping time. The method to be described involving the use of a recording decelerometer and stopwatch only gives a full assessment of the braking performance, and since no electrical or mechanical connection with the test vehicle is required has the obvious advantage of permitting tests on any brake at any time without previous preparation. Success of the method has been proved over a number of train tests where independent measurements of speed and distance have been available.

033427
BRAKE SHOES USED BY JNR

Omori, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 3, No. 4, Quart Rpt, Dec. 1962, pp11-13

Standardization of product in any industry is of paramount importance in promoting management efficiency. This is especially true of rolling stock parts. In other words, if the cost of production is to be cut down and the method of maintenance work rationalized, it would be imperative to minimize the number of parts and direct every effort toward that end. The JNR uses about 80 kinds of cast-iron brake shoes for its rolling stock, and annually produces as much as 50,000 tons of them (Ref. Table 1). This enormity in diversity not only is a great deterrent to our efforts to rationalize the casting operations through mechanization, but also involves a number of operational disadvantages. To do away with these disadvantages, the research and development committee for rolling stock has conducted a detailed study of its past findings and worked out a plan for the standardization of brake shoes for JNR.

033439
DISC BRAKES FOR RAILWAY VEHICLES AND THEIR LININGS

Sauthoff, F, German Federal Railways
Schmidt, E, German Federal Railways

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Vol. 38, No. 3, Mar. 1961, pp159-188, 17 Ref

Discussion of the use of disc brakes for railroad use. A comparison of disc brakes and shoes brakes. A study of the various materials used in the construction of each and the respective advantages of disc vs shoe types is included. Recommendations in the solution of materials for the best performing disc brake are also included.

037205
EFFECTS ON TRAIN OPERATION OF MIXED CONSISTS OF ON-TREAD AND DISC BRAKED ROLLING STOCK—PART I

Schmuecker, B Kolbeck, E

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

No. 4, Apr. 1967, pp 104-112, 4 Fig, 5 Ref

This article deals with the problem of attaining uniform braking power for service, sustained grade and emergency braking on mixed consists of equipment with disc and on-tread brakes. Formulae are developed and charts show the relative proportioning of braking power arrived at between disc and on-tread braked cars. The conclusions reached show that this proportioning of braking power on such mixed consists can provide up to 30 minutes of sustained braking without any difficulties for all types of braking requirements.

037252
RECENT TRENDS IN BRAKING PRACTICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, June 1965, pp 498-499, 2 Ref

Developments in brake types and methods of control effected over the past few years are surveyed. Under the stresses imposed by new high speed (200 km/h) and heavy (up to 8500 hp) trains, tyred wheels have not demonstrated the necessary reliability and monoblock wheels do not withstand the braking heat. Disc brakes with grey cast-iron have shown promise on streamlined trains. Flat wagons are under construction in Germany wherein the disc brake is being incorporated in the wheel assembly. In Belgium and Germany successive, short interval applications of air-operated disc brakes followed by electric resistance brakes are being used on moderate speed (120 km/h) passenger trains. British Railsway liner trains have been equipped with monobloc wheels in which the wheel center forms the brake disc; however, some trouble has been encountered within the past two years speed-controlled air-electromagnetic brakes have enabled much greater deceleration on Rheingold trains (1000 m for 160 km/h) than wheel-and-rail adhesion systems permit. Track speeds of 200 km/h are possible using disc-magnetic rail systems, and the recommended 1-1/4-in. through brake pipe and double-pipe air brake system might provide the control and protection needed at this velocity.

037257
INNOVATIONS IN CONTINENTAL BRAKING PRACTICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Apr. 1963, 3 pp, 3 Fig

The article describes the addition of a quick-action valve to the "U" graduated-release distributor as designed by the Italian Westinghouse company of Turin (Westinghouse Freni e Segnali, Cia). The quick-action feature is the distributor proper gives a rapid drop in brake-pipe pressure all down the train for emergency application, ensuring that brakes apply fully almost in accordance with the timing of the distributor. For example, on a 20-coach train travelling at 140 km/h the stopping distance without quick-action was 940 meters. With quick-action, the stopping distance was 850 meters. A comment is made to the effect that if improvements in service braking and flexibility in release are to be made, the only logical way of achieving this is to incorporate "e.p. control" (electro-pneumatic control).

037259
CONTROL OF RAILWAY BRAKES BY ELECTRICITY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Apr. 1963, pp 416-418, 3 Fig, 1 Phot

This article surveys the field of electro-pneumatic braking systems as applied to suburban and high speed services, to ensure rapid and simultaneous operation. Consideration is given to brake systems, brake equipment (including valves and (controllers), control systems, and the future development of electro-pneumatic control by extension to main line trains. The latter may be either by providing a straight airbrake in parallel with the existing pneumatic arrangement, with control either on timing or by a code arrangement, or by using the electric control to synchronize brake pipe reduction and recharge down a train, hence reducing the time lag to apply and release the brakes.

037290
CLASP BRAKES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, May 1946, pp 505-506

Clasp brakes are compared to single-block design brakes. The clasp brake involves two brake blocks per wheel, arranged if possible at opposite ends of a diameter. Clasp brakes are not only more efficient than the single-brake block apparatus; they must be regarded as essential for all high-speed services. With clasp brakes the pressure per brake block is halved and the rate of renewal, and hence all maintenance costs, is proportionately reduced. Due to the lower pressures secured by clasp brakes, the temperature attained during a stop is also reduced, as the arrangement offers twice the area for the dissipation of the heat generated. The durability of clasp brake blocks has been shown by observations in America, to be increased to as much as 40 percent above the life of single-block brakes. Several British applications of clasp brakes are mentioned.

037292
A NEW BRAKE TESTING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, June 1946, pp 684-685, 2 Fig, 5 Phot

The Inertia Machine Mark V, which can be used for recording deceleration, torque, and friction surface temperature in one operation, is described and illustrated. The machine is capable of dealing with any of the shoe or disc brakes used on railcars, and it should eventually deal in a similar manner with brake blocks for actual wheel rim braking. The design, generally, resembles a fully floating back axle, the motor taking the place of the differential gear, and the flywheels replacing the road wheels. The brake units are mounted on a shaft coupled to a torque recording gear carried in headstocks, which may be retracted axially to remove the brake units from their drums. The machine is a double-ended one to allow two brakes to be tested simultaneously, alternately, or individually. The flywheel specifications, torque recording system, and pyrometer are briefly described.

037299
THE BRAKING OF RAILWAY VEHICLES

White, J

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 85, Dec. 1946, pp 114-716, 3 Fig

The factors affecting the stopping distance of freight trains are: increased length of trains; increased speed; and increased ratio of gross weight to tare. To secure 40 lb per sq. in. brake cylinder pressure on the rear car of 35-, 50-, and 70-car trains required 6.5, 10.5, and 20 sec, respectively. Increasing the maximum speed of freight trains from 30 to 40 mph almost doubled the stopping distance. To reduce the effect of increasing the ratio of gross weight to tare two methods are suggested: 1) application of an emergency feature whereby air is dumped from the brake pipe to the atmosphere at each equipment causing rapid buildup of brake cylinder pressure, or 2) empty and load brakes procedure, by which the braking power of the loaded vehicle is increased substantially over that of the empty vehicle. The tests were conducted in Australia. Discussion of high-braking forces for high-speed passenger trains focuses on both U.S. and European efforts. Data are presented on the Zephyr showing the relationsip of different braking ratios on stopping distances.

037419
NEW BRAKE SHOE CUTS STOPPING TIME, REDUCES WEAR AND SPARKING

Modern Railroads (Watson Publications, 5 South Wabash Avenue, Chicago, Illinois, 60603)

May 1971, pp 49-52, 1 Fig, 2 Phot

A new brake shoe completely interchangeable with the standard metal shoe promises better train control, increased life and almost total spark suppression. Key to the breakthrough is an alloy of iron which exhibits a vastly different metallurgical structure from that of a standard shoe. The Samson shoe reduced stopping distance 32 percent and confirmed the improvement in train handling. The Samson retained the favorable friction characteristics of the standard metal shoe at static breakaway and low speed. Comparative sparking under drag braking conditions tested with cheese cloth placed in the trajectory of sparks leaving the wheel. At 45 mph, sparks from the standard metal shoe ignited the cheesecloth in seven minutes; Samson caused no fire.

037432
NEW CONCEPT IN BRAKES FOR BART CARS

Myers, ET

Modern Railroads (Watson Publications, 5 South Wabash Avenue, Chicago, Illinois, 60603)

Dec. 1970, 1 p, 4 Phot

Automatic control blends dynamic and hydraulic disc brakes for a smooth, fast non-slide stop with use of electro-hydraulic disc brakes. These operate under solid-state automatic control, which blends the hydraulic disc brake into the dynamic braking of the motors. An advantage of hydraulic brakes in their quick-acting ability to respond to the electro-hydraulic controls which detect skids and momentarily ease braking. The hydraulic disc brake linings will last 20 to 25 runs; however, when working with dynamic braking, the linings normally last longer.

037469
AIR-BRAKE DEVELOPMENTS ON JAPANESE RAILWAYS

Kondo, K, Japanese National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, July 1968, pp 347-549, 4 Fig, 1 Phot

Application of self-lapping brake for the locomotive as well as the train and use of brake diaphragms in place of cylinders are discussed. The D.E. 10 General-Purpose C-B diesel-hydraulic locomotive brake system is described in some detail. The use of diaphragms instead of cylinders to operate the brake obviates air leaks, reduces linkage to a minimum, and hence lubrication, and also the need to adjust the linkage to take up brake-wear.

037475
COMPOSITION BRAKE SHOES ON BRAZILIAN ELECTRIC STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, June 1968, pp 469-470, 1 Fig, 3 Phot

Extensive trials on the Central Railway of Brazil have led to the adoption of Cobreq non-metallic brake shoes for multiple-units and ore wagons. Compared with cast-iron shoes the distance run between reblocking has increased sevenfold and the life of the tire between turning has been more than doubled. The tests extended over some three years. Cast-iron shoes weighed 29 lb and had an average life of 7,000 km. Tire profiles show almost complete absence of grooves forming on the tread, a disadvantage frequently associated with non-metallic brake shoes.

037586
EFFECTS ON TRAIN OPERATION OF MIXED CONSISTS OF ON-TREAD AND DISC BRAKED ROLLING STOCK–PART II

Schmucker, B Kolbeck, E

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 16, No. 5, May 1967, pp 177-187, 9 Fig, 1 Tab, 5 Ref

This article deals with this problem of mixed braking systems under conditions of very frequent stopping at short intervals. Formulae are developed for these conditions and charts show the results and comparisons with half, service and emergency braking from various speeds, and the heating effect on treads and wheel plates and brake discs. It is shown that mixed system braking is possible under all these conditions without overstressing the brake discs through over-heating, and that cars with different systems can be accepted in German passenger trains from other countries without affecting the operations adversely.

037671
DISC BRAKES IN THE U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, June 1958, pp 677-678

In 1948 the Union Pacific Railroad decided to use disc brakes in new stock. When the first disc-braked cars were put in service, they were mixed with cars equipped with clasp brakes. Trains composed exclusively of cars with disc brakes were assembled. The results have been a reduction in noise and in jolting when trains are being stopped. Thermal cracking of wheel tires has been virtually eliminated. Certain interesting cost figures have been got out comparing the use of clasp and disc brakes on one of the trains over a 12-month period. The cast-iron tread shoes of the clasp brakes required renewal after every round trip of 4,598 miles, 73 changes of shoes thus being made during the year; the disc brake shoes ran an average of 90,000 miles each, and so required an average of 3.73 changes only. Over a full year, the renewals of short clasp brakes cost a total of $48,865.60 and of the long type $65,045.26, whereas the corresponding expenditure for Budd disc brake renewals was $7,221.48.

037676
FRICTION MATERIALS FOR RAILWAY BRAKING

Pritchard, C, Ferodo Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 108, Feb. 1958, pp 250-252, 3 Fig, 3 Phot, 3 Ref

The Ferodo composition brake block is compared to cast iron brake blocks. The braking characteristics are shown for the average of 20 stops using emergency brake applications of a train travelling 50 mph. The deceleration time for the Ferodo brake was greater than the cast iron brake, but the stopping distance was less. A composition brake block is less abrasive to the wheel than a cast iron block, and the product of wear less harmful. Although the Ferodo block still wears more rapidly than the wheel, its life has been found to be equal to as many as five cast iron blocks in some instances. Flange profiles are shown comparing the two types of brake blocks as to flange wear.

037688
THE TRANSVERSAL STABILITY WHEN IN MOTION OF RAILWAY VEHICLES ON THE STRAIGHT

Rail International Railway Congress Association, 17-21 rue de (louvrain, 1000 Brussels, Belgium)

Nov. 1959, pp 1058-73, 16 Fig, 1 Phot, 9 Ref

The theory of car rocking was investigated by means of an analog computer. Wheel-rail dynamics are first established for an isolated axle with differential equations. The theory is then expanded to a two axle locomotive bogie with the axles having transversal play, and an ordinary bogie vehicle with sliding surface between the body and the bogies. Yet to be established is the relationship of actual performance with the theoretical predictions.

037767
A NEW BRAKE SYSTEM FOR DIESEL LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Aug. 1955, pp 243, 2 Fig, 2 Phot

The vacuum brake system is particularly suitable for diesel locomotives where the problem of finding room for orthodox brake cylinders is difficult. It is designed to give augmented locomotive brake power by taking advantage of an increase of cylinder vacuum at the moment of brake application without interference with the normal working vacuum throughout the train. A two-pipe driver's valve is used, which isolates the exhauster side of the system before admitting air to the train pipe. Both vertical and horizontal types are available with pull or push action. The new cylinders are so designed that the driver can manipulate the brakes separately on locomotive and train, or both simultaneously.

037783
CONFINES OF BRAKING–1

Broadbent, HR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Oct. 1952, pp 488-489, 5 Fig

Factors reducing braking rates below the limit imposed by adhesion between wheel and rail are discussed. Braking efficiency can be related to adhesion, but only when the braking is straight line from moment of application to standstill. This is never so in practice, and the braking efficiency can therefore be considered only as an average ratio, and not the adhesion value which is the limit in maximum braking. No braking starts at the maximum rate instantaneously, nor does it usually carry on to a stop at the maximum rate. The reasons are regard for passenger comfort and the speed of equipment response. Manufacturing inaccuracies and maintenance problems which cause differences in brake cylinder air pressure are mentioned.

037784
CONFINES OF BRAKING–2

Broadbent, HR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Nov. 1952, pp 514-515, 4 Fig

Characteristics in service of electro-pneumatic brakes and calculation of brake rigging efficiency are discussed. If I.P. feed valves are used, a variation in setting can also produce variations in the rate of rise of brake cylinder air. Differences in brake cylinder stroke can also cause considerable variations in rates of rise. A record of an emergency stop is shown where the brake cylinder air has been controlled by a retarder, blow-down valve, and additional relay vent valve. The restrictions which can cause variations in rate of feed through triple valves appear with an E.P. brake in other places, in, for instance, the variation in lift of an application valve.

037785
CONFINES OF BRAKING–3

Broadbent, HR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Nov. 1952, pp 546-547, 3 Fig

The factors considered are the brake block itself, and the various conditions of control between wheel tire and block. The variations in braking which occur through the mutual contact of wheel tire and block are as follows: variation of the coefficient of friction of a brake block with speed; block friction and applied force, block friction and tire temperature; block friction and weather; and effect of wheel diameter with drum, disc, and dynamic braking. These effects are briefly described.

037786
CONFINES OF BRAKING–4

Broadbent, HR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Nov. 1952, pp 570-571, 2 Fig

Braking force can be no higher than the co-efficient of friction between wheel and rail will allow. Various factors affecting the friction between the wheels and rail are discussed, such as, variation in passenger loading, weight transfer, deposits on the rail, effect of speed, mutual wheel/rail contact, gradients, winds, and frictional resistance of the train.

037787
CONFINES OF BRAKING–5

Broadbent, HR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Dec. 1952, p 627

This article discusses the economics of brake systems, especially that extras costs in changes should bring about greater safety, train handling improvement and easier maintenance. Factors of higher speeds, increased loading as reflected in higher air pressure requirements, problems of brake block and wheel temperatures, as well as increased stresses in the components are considered. Increased wear in brake blocks and wheels can result either in higher costs or spatial limitations for the hardware necessary to perform the tasks.

037798
HYDRODYNAMIC BRAKES ON DIESEL-HYDRAULICS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Mar. 1970, pp 172-175, 4 Fig, 4 Tab, 1 Phot

The hydrodynamic brake, which has been applied to diesel electric locomotives, also has been applied to small rail car transmission and gas turbine trains in Europe. The cooling equipment of diesel power plants is not present in gas turbine but with the use of oil air cooling equipment modified for the hydrodynamic brake, the braking power is equivalent to that developed by the turbine.

037799
BRAKES FOR HIGH SPEED TRAINS

Wise, S, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Mar. 1970, pp 169-171, 1 Tab, 3 Phot, 1 Ref

The article gives the background in need for improved brake blocks for trains when speed exceeds 160 km/h. The traditional cast iron block is reliable and simple but the material creates problems at higher speeds. The major problem in selecting braking systems is complicated by the dependence upon adhesion which decreases with speed increase. Cast iron brakes are not suitable for high speed operation therefore either composition blocks or disc brakes are more effective on nonpowered axles as is the rheostatic brake for powered axles.

037816
WHEEL SLIP PROTECTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 123, Apr. 1967, pp 263-264, 1 Fig, 2 Phot

The problems associated with wheel slip of rail vehicles are minimized with the use of axle mounted detectors on each track. These detectors are designed to control axle behavior by the application or release of brakes to prevent sliding. The system consists of a detector fitted to the driving axle box and a pneumatic relay on each track which are connected by flexible air hoses.

037831
ITALIAN U-TYPE AIR-BRAKE DISTRIBUTOR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Feb. 1967, pp 110-111, 1 Phot

Thousands of Italian Westinghouse brake distributors of U and U-R types are now in use on the Italian State Railways (F.S.) and other systems. An advantage of the basic U distributor is the time delay of 30 sec in the re-opening of the control reservoir after the end of a brake release. This permits the re-charging of the system in full release position of the brake valve for a longer time than permitted by other distributors. It also provides a positive security against exhaustion of the brake. The U-R distributor is in use only on passenger stock, for it is only in these vehicles that the brake cylinder filling time need be as low as 4 to 5 sec.

037835
HYDRODYNAMIC BRAKING FOR LOCOMOTIVES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Oct. 1966, pp 837-42, 8 Fig, 1 Tab, 2 Phot

Dynamic braking has one feature in common with the normal air or vacuum brakes. The limit of its force is dependent on the adhesion between a steel wheel and a steel rail. However, with dynamic braking there is no possibility of slide; over-braking dynamically produces a reverse slip, which is much less damaging to wheels, rails and braking elements. A very detailed description of this type of brake is provided, covering such topics as cooling factors, braking efforts and ranges, decelerating characteristics, driving technique and air control.

037860
BRAKING OF HEAVY TRAINS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Apr. 1965, p 275

Trends in dealing with formations up to 14,000-tons with proposals for 22,000-tons freight and mineral trains are discussed. Air braking as applied to very heavy and very long trains is of two types. On the Vitoria a Minas line in Brazil the specifications are all based on AAR practice. For the proposed 22,000-ton trains of the future, the present idea is to insert a special brake van with diesel-powered compressors and other air-brake details to which more rapid filling at the back end of the train after the full release, which is all that is possible with direct-release brakes. All the other examples quoted have graduated-release brakes of Knorr KE type, because only with an inexhaustible graduated application and graduated-release brake is it possible to have full control over a train at all times.

037866
FREIGHT CAR BRAKE RIGGINGS

Rihosek, J

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 71, Sept. 1939, pp 319-320, 3 Fig

The design of the rigging influences the maximum brake effect, and the stretching and deformation of the brake rods, levers, and associated parts unfavourably influence the piston travel. The U.S. type of freight car bogie truck, due to its two independent side frames, has a great disadvantage regarding braking technique. On European cars, clasp brakes are used, whereby the axle is not influenced by the brake shoe thrust. The problem of play in joints in the single show type of brake is illustrated. The clasp brake system and a diagram of the eccentric force by rods from the body in the U.S. type bogie are also shown.

037899
WEIGHT TRANSFER

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 92, June 1950, p 672

Both acceleration and braking are produced at the expense of weight transfer from one axle to another. The examination of the degree is normally confined to acceleration and more particularly to locomotives. It is further simplified by ignoring the acceleration of the masses of the locomotive itself. The tractive effort is regarded as drawbar pull and calculations are made on this basis. The still widely held idea is dispelled that single outside brake blocks cause more weight transfer than double blocking or single inside blocks; the net primary weight transfer is in each case the same. There is more tilt on the bogie frame with single outside blocks, and the impression could be given that the weight transfer was greater. Energy is stored to a greater degree in the springs, and its release as the train comes to rest produces the unpleasant reaction. This should not be confused with true weight transfer.

037915
NEW DEVELOPMENTS IN AIR BRAKES

Stewart, CD, Westinghouse Air Brake Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Aug. 1947, pp 126-127, 4 Phot

The article surveys a number of recent improvements in brake equipment and associated pneumatic controls. The D22 special control valve design differs from the "universal" control valve in that the air is governed by a relay valve. A device called the Decelostat momentarily reduces braking force on slippery wheels permitting them to return to train speed. Hot-box detectors utilizing the Wheatstone bridge principle provide warning when overheating is imminent. A new type of driver's brake valve (No. 24) incorporates five sections to suit various requirements for freight and passenger service. A new variable-load brake has been designed for light-weight wagons. A brake-cylinder release valve device isolates reservoirs and vents the brake cylinder when the "bleed" valve is pulled, thus permitting the shunter to pass from one vehicle to the next without waiting.

037920
THE WESTINGHOUSE EMPTY AND LOAD BRAKE

Fawcett, B

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Sept. 1947, p 312

This article contains excerpts from a technical paper on specially designed compressed-air brakes. The Westinghouse company devised this system in which the simple "straight" air brake is superimposed on the automatic air brake, which thereupon functions as an emergency brake. This arrangement has the advantage of retaining the automatic brake in fully-charged condition, ready for use if needed, so that there is no danger of a train getting out of control. Methods of arranging the brake components on freight and on passenger vehicles are given in the original paper.

037922
THE PROPORTIONING OF BRAKE BLOCKS

Parker, RC, Ferodo Limited
Marshall, PR, Ferodo Limited

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Nov. 1947, pp 546-547

Excerpts are presented from an article dealing with the temperature effects produced between two sliding bodies. The investigation had two main aspects: first, the development of a satisfactory method of measuring the surface temperatures and, second, the application of this method to actual railway brake blocks in a full-scale series of tests. In applying the apparatus to the measurement of surface temperatures of a railway tyre, the aim of the experiment was to correlate the results obtained with three variables: speed, block pressure, and contact area. It was found that in all the tests contact area was very small and moved along longitudinal strips parallel to the width of the block. Working on the assumption that contact area should be a function of block material and block pressure, and should thus vary with the ratio of block length to block width, the authors began the most striking part of their research. A block was progressively shortened to give three-quarters, one-half, and one-quarter the original area. Blocks of type 1 and type 2 were used, as well as cast iron, at initial speeds of 60 and 30 m.p.h. and a brake block pressure of 1,240 lb. The result was an astonishing decrease of temperature maxima for both the non-metallic blocks, although there was no such decrease in the cast-iron blocks. Contact areas in the nonmetallic blocks now covered the full tyre width, instead of being confined to narrow longitudinal strips. Measurements of wear show that the normal and half-blocks wear at exactly the same rate. Since cracking of the tyre is known to arise from the true heat spots, it can be taken that by reducing brake block areas from the present standard size, in the case on non-metallic materials, the liability to the formation of cracks is minimized and the life of tyres can thus be greatly increased.

037931
RHEOSTATIC AND REGENERATIVE BRAKING–1

Prigmore, BJ

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, 4804-48121948, 6 pp, 11 Fig, 1 Phot, 16 Ref

A five-part series is presented that discussed various aspects of rheostatic and regenerative braking. Information is included on main lines with long and steep gradients, equipment for three-phase and single-phase systems, applications with compounds and series d.c. motors, principles of the metadyne for motor control and regeneration, and, the acceptance of regenerated power at substations with rotary and static rectifying equipment. This document, 1125, contains the complete series of articles and this subject, beginning on April 23, 1948, p. 488 of the Railway Gazette, and continuing through the June 18, (p. 716) September 10, (p 296) December 3, (p. 636) and December 31 issues.

037970
PROBLEMS IN RUNNING BRAKED AND UNBRAKED TRAINS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, June 1944, pp 588-589

Acknowledgment is made of a paper presented at a technical meeting in 1944 on brake equipment and tests. This is an account of the highly specialized equipment that was developed by the Westinghouse Brake and Signal Co., Ltd., to provide a complete braking installation capable of dealing with every kind of service demand.

039406
STUDY OF A LGIHTER BRAKE SLIPPER

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-23,29, Report, 6607-6907, 4 pp, 3 Fig

Question D91.

This document discusses the need for new materials to be used in the construction of brake slippers. The use of epoxy and fiberglass has not been successful in prototype construction. Future design should also include the incorporation of light, resistant steel and composites used in brake shoes.

039412
COMPOSITION BRAKE BLOCKS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

No. 29, ORE Pub-29, July 1969, pp 13-15, 2 Fig

Question B64.

The research question is a determination of the limits of brake heating applied to wheelsets with shrunk on tires. The limits were determined by measuring the time of constant braking before the tire loosened on the wheel. As a result, the shrinkage allowance for shrunk on wheels should be placed at a high value and brake blocks used with such wheels should be selected for good thermal conductivity.

039455
COMMENTS ON LONG TRAINS

McDowell, EL, IIT Research Institute

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-WA/RR-6, Conf Paper, Dec. 1966, 4 pp, 1 Fig, 2 Ref

Equations of motion appropriate to long trains are derived which include the effects of undulating terrain. The formulation of a nonlinear dynamic programming problem to be applied to programmed braking is presented and the class of problems within the capability of available computing equipment is discussed. An analysis of the effect of undulating terrain on the operational response of long travelling at constant speed is presented in detail and numerical results for particular train configurations are given. The critical velocity for longitudinal resonance as a function of train length and terrain characteristic is given, and from the specialized results for the uniform train it is possible to discern the influence of changes in car mass, coupling stiffness, and so on.

039462
A GENERALIZED SPECIFICATION FOR COMPOSITION BRAKE BLOCKS FOR RAILWAY VEHICLES

Barnard, JH

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

Oct. 1970, pp 694-703, 3 Fig, 2 Tab, 4 Phot, 6 Ref

The braking of railway vehicles may be improved technically and economically by a direct replacement of cast iron brake blocks by blocks of a composite material of the correct design and functional characteristic. Numerous available composite materials can introduce large savings due to their good wearing properties when compared to cast iron. As a result of excessive heat dissipation rates and thermal shock, rolling stock wheel treads can be seriously overstressed at the higher operating speeds by blocks of incorrect friction characteristic and physical design. This paper deals with the definition of the physical requirements related to the design of composition brake blocks for railway vehicles, and motivates a generalized specification for the performance characteristic.

039482
LOAD-COMPENSATING FREIGHT BRAKES

Stewart, CD, Westinghouse Air Brake Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 82, May 1945, p 513

A variable-capacity brake is required, which automatically compensates for increase in loading. This new equipment uses a double brake-cylinder arrangement to provide a maximum braking force of 60 percent for the empty vehicle, a maximum braking force for fully loaded vehicle, of 20-30 percent, and some intermediate figure for vehicles partly loaded. The mechanism for setting the car braking ratio must be automatic. Setting must take place when the car is stationary. On the engine manual adjustment is needed, as there is no simple means for registering on the locomotive the load of the cars.

039521
MODERN CUSHIONING DEVICES FOR FREIGHT CARS AND THEIR EFFECT ON TRAIN ACTION

Fillion, SH

Symington Wayne Corporation, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1964, pp 46-49, 3 Fig

Technical Proceedings from 1964 Railroad Engineering Conference.

A mathematical prediction for dynamic braking forces is illustrated. The emergency braking of a train of 100 cars is used for the prediction. The roughest action is obtained when the train has been accelerated as rapidly as possible from a standstill just before the brake application. This action stretches out the train, closing or partially closing the draft gears. In this problem the solution was simplified by taking each group of ten cars as a unit. Thus, the 100-car train was reduced to a ten-car train. However, each one of these fictitous cars had the mass of the original ten cars it replaced. The draft gears on these cars had ten times the travel and ten times the capacity of the draft gears in the original cars. The solutions are illustrated for trains with and without standard draft gear and with hydraulic draft gear.

039590
DYNAMIC BRAKING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Sept. 1951, p 311

In the light of 60-70 percent brake wear reduction by the use of dynamic braking with American diesel-electric locomotives, it was recommended that dynamic braking systems be considered for the British railways: electric--some form of power brakes; steam—Riggenbach brakes, diesel— exhaust brake on railcars plus dynamic brakes on locomotives, gas-turbine-feed current to dynamic and thence to brake compressor, and turbo-mechanical— brake compressor driven by separate turbine on hot side of power turbine.

039946
ELECTRO-PNEUMATIC BRAKE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Publ No. 21,26, Rpt, 6507-6801, 4 pp, 2 Fig, 1 Phot, 2 Ref

Question B 83

The article compares two forms of the electro-pneumatic brake in laboratory tests and in field tests. The two forms of braking system consist of the automatic system with 2 brake pipes; and the direct acting system with a single 1-1/4 inch brake pipe. Tests showed both systems were equal in operation, but the direct system requires a circuit check for safe operation whereas the indirect is not dependent upon electronics but brake pipe pressure. Findings show both systems superior in operational ease to the pneumatic system in use.

039953
BRITISH RAILWAYS DECISION ON BRAKES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, 5602-5604, Apr. 1956, pp 152-153

After extensive research and practical trials the British Transport Commission adopted as standard the vacuum type of automatic brake. Although the time needed to couple up and to create the vacuum will mean that a made-up train will stand longer in the yard than with the present standard coupling for goods vehicles, this disadvantage is believed to be more than offset by the faster running time which will result from fitting throughout. The substitution, by new construction and conversion, of a fully-braked fleet of wagons will enable freight trains to run at maximum speeds of up to 60 mph. The higher average speeds of train movement will lead to reduction of about 2,000 locomotives and will enable the total wagon stock to be reduced.

039959
BRAKING SYSTEMS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, July 1956, p 4

After discussing the advantages and disadvantages of the vacuum and the air brake it is concluded that they balance, except the delay of release with the vacuum. Members of the brake industry have undertaken much research into the vacuum brake, and in its latest form, with improved brake cylinders and valves. There seems little doubt that for all freight trains of the length likely to be practicable in this country, taking into consideration yard capacity and loading gauge, it answers well. The faster running possible with a fitted train will more than recoup the greater time required for starting by the vacuum brake.

039965
DUAL AIR BRAKE SYSTEM

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Nov. 1956, p 555, 1 Fig, 1 Phot

The Westinghouse Brake and Signal Company, Ltd. has developed a simple dual brake system, which is claimed to represent an advancement in modern vehicle braking technique. The provision of independence pneumatic storage and control for front and rear brake systems ensures that, in the event of any part of one system being rendered inoperative, braking is obtained from the unaffected system. A typical layout is shown in which a common air compressor, controlled by a single unloader and safety valve, supplies air to two main reservoirs; each of these provides independent, air storage for one part of the dual system, and is isolated from the other by inclusion of check valves in the supply from the compressor. The supply and release of air from the reservoirs to the piston type brake cylinders' or diaphragm brake chambers is by means of a lightweight dual control valve.

040006
MATERIAL CHARACTERISTICS OF RAILWAY BRAKE DISCS OF VARIOUS IRON-CARBON ALLOYS

Zeuner, H

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 13 No. 7,8, Aug. 1964, pp 349-354, 10 Fig, 1 Tab, 12 Ref

The results are described of tests and investigations carried out in the Research Station of the Bergische Steel Industry in Remscheid, on various iron-carbon and steel alloy materials for use in disc brakes on railway vehicles. While chrome-molybdenum steel alloy castings showed some desirable characteristics under repeated heatings, the pearlitic cast iron with lamellar graphitic inclusions showed greater resistance to fine hair line cracking. The group of malleable, ductile and pearlitic cast irons appeared to develop relatively few cracks, up to 6 mm depth and widely dispersed, while the cast steels with no or little alloys sustained many short cracks only 1.2 mm deep. There remains the need for further research for combinations of materials that will withstand better the high and repeated high temperature shocks to which brake discs are subjected.

040010
THE RAIL MOTOR-BRAKE

French Rail News (Federation de Industries Ferroviaires, 12 rue Bixio, 75007, Paris, France)

No.4, 1968, pp 58-59, 1 Fig, 1 Phot

Achieving train speeds of 300 to 400 KMH are discussed. Over 200 km/h no conventional technical solution is suitable as to the fundamental aspects of traction, and mainly the braking. The rail would become an integral part of the electric motor, propulsion and braking systems regenerating linearly, rapidly and indefinitely under the field part of the motor, of which it becomes, electrically, the armature. The motor or braking effort, the system being reversible, hence are produced between the rail head, wherein flows induced currents producing the effort. A magnetic core, provided with windings, constitutes this part of the motor which provides the inductor field necessary for propulsion, asynchronous sliding field, by its feed with variable frequency, polyphase, alternating current. This motive power unit would employ classical railway, yet would be independent of traction adhesion and braking limits.

040051
AUTOMATED TESTING OF RAILWAY FREIGHT BRAKE CONTROL VALVES

Barth, PW, Westinghouse Air Brake Company
Skantar, ET, Westinghouse Air Brake Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

60-RR-4, Conf Paper, Apr. 1960, 8 pp, 3 Fig, 9 Phot

Periodic testing of railway freight brake-control valves has been required so that established standards of performance will be maintained throughout the life of the equipment. The accomplishment of such a test program has required a considerable investment in equipment and trained manpower. This paper describes the design and construction of a prototype automated test machine, the design objectives of which are to provide superior testing methods, to allow the use of unskilled personnel as operators, and reduce total testing costs. Although the prototype rack has seen limited service, hopefully all of the design objectives will be realized.

040052
RELATION OF WHEEL TREAD WEAR AND BRAKE SHOE WEAR

Jennings, JR, Wilson Car Lines

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

61-WA-217, Conf Paper, Dec. 1961, 11 pp, 7 Fig, 5 Tab, 1 Phot

Conventional brake rigging are not completely equitable at conventional brake rigging are not completely equitable at all shoe locations. Studies indicate that replacements of mated shoes on the same brake beam can vary from 8 percent on the inside beams to 13 percent on the outside beams. Four diagonal locations are found to have a shoe requirement approximating 55 percent, and the four mating positions 45 percent of total replacements. The unequal shoe wear affects wheel wear adversely in so far as realizing uniformity of service life on the wheels in the four positions as well as on mated wheels at the respective locations. The pattern of wheel wear disclosed is not conducive to economy of car maintenance nor to the best standard attainable in car utilization.

040053
PERFORMANCE OF FREIGHT CAR BRAKE REGULATORS DURING STATIC AND DYNAMIC CONDITIONS

Mc Lean, LA, Seaboard Coast Line Railroad
Mims, WE, Seaboard Coast Line Railroad

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

68-WA/RR-4, Conf Paper, Dec. 1968, 16 pp, 12 Fig, 2 Phot, 1 App

The continued observation of improper brake piston travel on freight cars equipped with automatic brake regulators prompted an investigation of factors affecting the operation of these devices. Tests made statically and dynamically showed a marked difference in performance of regulators. The factors surrounding this problem and the effect on train braking are discussed. Selected for the test were representative cars of a large group of covered hopper cars. These 2929 cu ft 100-ton cars are virtually identical, having 12 in. by 10 in. brake cylinders, cast iron shoes and four types of brake regulators. Conclusions would include: brake regulators do not adjust for false or running piston travel, improvements of rigging efficiency will yield more uniform piston travel, lower leverage ratios make piston travel variation less susceptible to rigging dynamics and stretch; piston travel increases with speed of train regardless of cylinder pressures;

vibration or impacts caused by rough track or train slack action appear to have no effect on operation of the brake regulator after the unit locks up and although greater than nominal piston travel occurs on cars at speed, the brakes still retain effective stopping ability.

040054
DEVELOPMENT OF HYDROPNEUMATIC BRAKING SYSTEM FOR RAIL VEHICLES

Engle, TH, New York Air Brake Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

69-WA/RR8, Conf Paper, Nov. 1969, 12 pp, 16 Fig, 12 Phot

Contributed by the Railroad Division of the ASME at the Winter Annual Meeting November 16-20, 1969 Los Angeles California

The operation of a hydropneumatic booster with two-stage pressure development and automatic double-acting slack adjustment features two distinct types of brake cylinders including a mechanical locking safety feature, and hand-brake controls to allow manual pressurization of the system and control of the mechanical cylinder locks is described. Production of the three types of hardware followed the study for a brake system that would solve the problems of larger and heavier cars, longer and faster trains, and rising maintenance costs. The various features of the brake system are illustrated. The results of limited testing are reported.

040055
BRAKING HIGH-SPEED FREIGHT TRAINS AND EFFECTS ON RAILROAD CAPACITY

Blaine, DG, Westinghouse Air Brake Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-WA/RR-7, Conf Paper, Nov. 1967, 16 pp, 14 Fig, 4 Tab

Contributed by the Railroad Division of the ASME at the Winter Annual Meeting and Energy Systems Exposition Pittsburgh Pennsylvania, November 12-17, 1967

The effect of improving freight train braking levels is to increase railroad capacity by allowing higher speeds with heavier cars within present or specific signal spacings. Freight train braking abilities can be improved 20 to 30 percent by equipping cars with WABCOPAC truck-contained foundation brake equipment and by converting existing cars to the use of COBRA high-friction composition brake shoes. Combining these two improvements give improved train braking abilities from 30 to 50 percent which will allow speeds to be increased from approximately 10 to 20 mph within existing signal spacings. Establishing a basically higher loaded-car braking level some 50-70 percent higher than the existing minimum with a load-sensitive brake equipment would allow raising the maximum speed, based on braking considerations only, close to 100 mph within signal spacing now suitable for 65 to 70 mph. Freight train braking abilities can be improved 10 to 30 percent by adding modern-design continuous quick service valves to all freight cars.

040212
REPORT OF COMMITTEE ON BRAKES AND BRAKE EQUIPMENT

Association of American Railroads, Chicago, Illinois

CIRCULAR NO DV-1749, Annual Rpt, May 1971, pp 25, 4 Fig, 8 Tab

A total of 21 agenda items and 5 exhibits are published as part of this Annual Report to the committee members. Topics include brake cylinders, hoses, and shoes, hand brakes, brake-testing racks, valves, and a braking ratio for frieght cars.

040221
INVESTIGATION OF THE THERMAL CAPACITY OF RAILROAD WHEELS USING COBRA BRAKE SHOES

Weaver, GR, Penn Central Transportation Company
Archibald, PA, Baldwin-Lima-Hamilton Corporation
Brenneman, EB, Cobra Shoe Engineering
Cabble, GM, Westinghouse Air Brake Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

69-WA/RR-2, Cont Rpt, Nov. 1969, 8 pp, 1 Fig, 7 Tab, 11 Phot, 3 Ref

Contributed by Railroad Division of the ASME for Presentation at the Winter Annual Meeting Los Angeles, California November 16-20 1969

An objective evaluation of the thermal capacity of 36 in. CR wheels braked with COBRA brake shoes is presented and related to that of wheels braked with cast metal brake shoes. The wheel tread conditions, hardness and macrostructure of the tim, and residual stress patterns, which developed from high speed dynamometer braking were investigated through three progressive test series. The results indicate that the thermal capacity of wheels braked with COBRA brake shoes far exceeds limits previously established for cast metal shoes.

040228
DISTANCE FOR BRAKE RECOVERY OF WET AND ICED SHOES

Erie Mining Company

Feb. 1960, 2 pp, 2 Fig

Four types of brake shoes were tested with clasp brakes and a standard Cobra Shoe was tested in a single brake. The shoes tested with the clasp brakes were: standard Cobra, special Cobra V-132-B, standard Comet, and standard metal. The results are presented graphically.

040229
ABEX CORPORATION DYNAMOMETER STATIC TESTS FOR ELECTRO-MOTIVE DIVISION OF GENERAL MOTORS CORPORATION LOCOMOTIVE SERVICE

Abex Corporation, Valley Road, Mahwah, New Jersey, 07430

One cast iron and five Comet brake shoes were tested at loads from 6000 to 25,000 pounds. The static friction was measured and is plotted against the applied load.

040231
NEW BRAKE SHOE CUTS STOPPING TIME, REDUCES WEAR AND SPARKING

Modern Railroads (Watson Publications, 5 South Wabash Avenue, Chicago, Illinois, 60603)

May 1971, 2 pp, 1 Fig, 2 Phot

Completely interchangeable with the standard metal shoe, the new Samson shoe promises better train control, increased life and almost total spark suppression. A 75-car coal unitrain with 100-ton hoppers equipped with single capacity brakes was used for field testing from Helper, Utah to Fontana, California. Shoe replacement over the 1600-mile round trip dropped to one-half by switching to the

Samson shoe. Tests showed the Samson shoe reduced stopping distance 32 percent from that with standard metal and confirmed the improvement in train handling reported by locomotive engineers. Stopping distance with the Samson are comparable with composition shoes.

040236
STATIC HOLDING FORCE–COMPOSITION VS IRON BRAKE SHOES

Abex Corporation, Valley Road, Mahwah, New Jersey, 07430

The brake cylinder pressure is plotted versus the drawbar pull for composition shoes and cast iron shoes. Clasp brakes were used.

040248
ROAD TESTS WITH TYPE AB FREIGHT BRAKE EQUIPMENT–CHAPTER VII GENERAL SUMMARY AND CONCLUSIONS

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

AAR MR-193, Rpt, 3303-3304, 4 pp

Demonstration tests of the "AB" freight brake equipment are summarized. This series of tests was made for the purpose of (1) checking the operation of the new "AB" equipment with the operation of the "FC-3A" equipment as developed during the American Railway Association tests on the Southern Pacific Lines in Oregon; (2) investigation the operation of the new "AB" equipment with trains containing both empty and loaded cars; (3) investigating the effect of the "AB" equipment when operated in trains composed of both "AB" and "K" equipments, and (4) determining whether the "AB" equipment would meet road conditions safely in service. Sixty-one tests consisting of 234 trials were made during the demonstration tests. The different types of trains tested included "AB" equipment trains of all empty cars, mixed loaded and empty car trains, all loaded car trains, and also mixed "K" and "AB" equipment trains of all empty cars. In conclusion it may be stated that the "AB" equipment would meet road conditions safely in service.

040308
STUDY OF FRICTIONAL CHARACTERISTICS OF COMPOSITION COMPARED TO CAST IRON BRAKE SHOES

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

MR-448, Res Rpt, Apr. 1968, 50 pp, 17 Fig, 5 Tab, 18 Phot, 1 App

Braking force developed by the brake system is dependent upon the fundamentals of coefficient of friction of the brake shoe on the wheel and pressure applied on the shoe. The stopping distances measured in the test are independent of the type brake shoe or whether single or clasp brakes are used, provided that proper coefficient of friction of brake shoes and brake shoe pressure are used in the design. Brake shoe pressures that develop restraining forces greater than can be withstood by the wheel-rail contact will result in the tendency to reduce braking effort and cause slid flat wheels. Brake systems should be designed and maintained for the type of brake shoe it is desired to use. The coefficient of friction values for the cast iron shoe compared with the composition shoes are sufficiently similar to permit use of either type of shoe provided proper brake cylinder pressure is maintained and suitable lever ratios are used in the design.

040324
RELATION OF WHEEL TREAD WEAR AND BRAKE SHOE WEAR

Jennings, JR, Wilson Car Lines

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

61-WA-217, Dec. 1961, 11 pp, 7 Fig, 5 Tab, 1 Phot, 1 Ref

Brake shoe requirements on freight cars equipped with conventional brake rigging are not completely equitable at all shoe locations. Studies indicate that replacments of mated shoes on the same brake beam can vary from 8 percent on the inside beams to 13 percent on the outside beams. Four diagonal locations are found to have a shoe requirement approximately 55 percent, and the four mating positions 45 percent of total replacements. The unequal shoe wear adversely in so far as realizing uniformity of service life on the wheels in the four positions as well as on mated wheels at the respective locations. The pattern of wheel wear disclosed is not conductive to economy of car maintenance not to the best standard attainable in car utilization.

040399
BRAKE-SHOES MADE FROM SYNTHETIC MATERIALS–REPORT OF ENQUIRY

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Feb. 1963, 3 pp

Summary and conclusions. Question B64

An enquiry was made to member organizations to gather information on the interest in and experience with the use of non-metallic brake blocks for railway brakes. Information was also sought from the literature on this subject. The interest in non-metallic brake blocks is very great, and it seems that there introduction may result in economical advantages, no steps of any importance have so far been taken for the drawing-up, on an international level, of specifications for these brake blocks. Only a few organizations have gained sufficient experience of many years standing or have introduced these brake blocks on any appreciable scale.

040400
COMPOSITION BRAKE BLOCKS–COMPARATIVE TESTS ON THE TESTING PLANT

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 1, June 1965, 2 pp, 1 Fig

Only two pages of a report. Question B64

This report contains the results of braking tests from speeds of up to 160 km/h to a stop, and continuous braking tests at about 60 km/h. These were made employing 15 different existing types of composition brake blocks, on the brake block testing plant of the SNCF. The various types of brake blocks investigated had coefficients of friction remarkably similar both in character and magnitude. At the moment of coming to rest, the percentage increases in the instantaneous coefficient of friction is up to one tenth of that when braking is affected with cast iron blocks.

040401
COMPOSITION BRAKE BLOCKS–INTERACTION BETWEEN COMPOSITION BRAKE BLOCKS AND WHEELS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Interim Report No. 2, Mar. 1967, 4 pp

Summary and conclusions only of a report. Question B64

The service tests with various makes of K-block on the Berliner S-Bahn are described. The object of the tests was to study the interaction of the two friction elements, block/wheel. Although a strong tendency for the formation of cracks in wheel tires had occasionally been observed with K-blocks, in the service tests such a tendency could not be detected. All the stages of grooving and follow-wear were present on the tires. Similar phenomena had been observed by the SNCF on suburban services. Experience gained by the DB showed that some difficulty arose due to metallic particles sometimes becoming embedded in the braking surface of the block. K-blocks were used extensively on the London Transport Underground lines. Thermal cracking, tire spalling and wear constituted a special problem on the frequently-stopping motor coaches with heavily-loaded small diameter wheels, running in tube tunnels. The performance of a K-block depended on various parameters: characteristics of the block and of the wheel steel, application conditions, service conditions, weather, and shape of block. The development of a universal K-block would be difficult.

040402
COMPOSITION BRAKE-BLOCKS-EFFECTS ON ADHESION

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 3, Nov. 1967, 18 pp, 55 Ref, 1 App

Partial Copy. Question B64

The effects of composition brake blocks on adhesion were investigated by the DB. The measurements were analyzed statistically and the results plotted in the form of curves. Generally, lower adhesion values were ascertained when braking with K blocks than when using cast-iron blocks. As such an effect is only acceptable if it is small, severe testing is, in this respect, considered to be necessary when submitting K blocks to acceptance tests.

040403
COMPOSITION BRAKE-BLOCKS-EFFECTS OF HUMIDITY ON BRAKING

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 4, Apr. 1968, 3 pp, 1 Fig

Partial Copy. Question B64

Tests carried out by the SNCF, to determine the effects of humidity on braking; were made with 20 different types of existing composition brake-block. On the test rig at Vitry, braking tests were made from speeds of up to 160 km/h to a stop, and continuous braking tests were made with single cars at about 60 km/h. In service, fly-shunting tests at speeds of up to 140 km/h were made. The brake-block wear was not measured during the tests on wet rails. The similarity of the curves obtained with the different makes of block on dry wheels was not repeated on wet wheels. It would seem that not all the blocks have been designed and manufactured with the same object of obtaining satisfactory performances under wet conditions.

040404
COMPOSITION BRAKE BLOCKS-METALLIC INCLUSIONS IN THE COMPOSITION BRAKE BLOCKS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 6, Oct. 1969, 5 pp, 1 Tab

Partial Copy. Question B64

Metallic inclusions is given types of composition brake blocks lead to excessively severe wear of the tires and of the blocks. Recent experience has shown that not all composition brake blocks are affected by metallic inclusions. A list indicates those composition brake blocks which, according to data collected up to mid-1969, are unaffected or are affected only in certain isolated instances by metallic inclusions, and which therefore behave favourably with respect to undue wear of the wheel-tire. The list also shows which organizations obtained these favorable results, with which type of vehicles and in which kind of service.

040405
COMPOSITION BRAKE-BLOCKS-EFFECTS ON ICE AND SNOW

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 7, Apr. 1970, 4 pp

Partial Copy. Question B64

The effect of winter conditions on the braking distance proved to be considerable. Using the results of all the tests undertaken in winter with composition brake-shoes it was calculated that the braking distances in winter were on average 36% longer than in summer. The great amount of humidity due to the melting of the snow and the ice probably contributed considerably to the increase in the braking distances. With one type of composition brake-shoes, the braking distances were, on the whole, shorter in the winter tests than in the summer tests. This might have been due to the effect of the temperature on the coefficient of friction with these types of brake-shoes. The braking distances obtained with the low-friction brake-shoes were in certain instances more than 100% longer than those obtained during the summer tests, because of the effect of the snow and ice adhering to the blocks. Since only a small number of preliminary-braking tests were carried out it is not possible to deduce from the results any valid conclusions concerning the effect of preliminary braking.

040406
COMPOSITION BRAKE-BLOCKS-TESTS WITH COMPOSITION BRAKE-BLOCKS OF VARIOUS DIMENSIONS AND SHAPE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

Report No. 8, Oct. 1970, 5 pp, 1 Ref

Partial Copy. Question B64

The German State Railway conducted the necessary tests on the bench and on the Berlin S-Bahn. The tests were based on the assumption that the wheel wear might be diminished if the shape of the composition brake blocks was altered from the usual rectangular shape taken over from cast-iron blocks. A number of different geometrical shapes of the friction surface of composition brake blocks were considered. The coefficient of friction under various conditions was similar with all block shapes tested. None of the block shapes tested produced any bad side effects. It was not possible to find any significant differences between the different block shapes when braking with one block per wheel or with two blocks per wheel; though tire wear for braking with one block per wheel was slightly lower than that for braking with two blocks per wheel. The tests have not revealed any compelling reason for diverging from the customary simple rectangular shape brake blocks.

040488
THE CHANGEOVER FROM VACUUM TO AIR BRAKES ON BRITISH RAILWAYS

Roberts, HP, British Railways Board

Institution of Locomotive Engineers Journal (Institution of

Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 1, Paper No. 678, 66-67, pp 8-36, 14 Fig, 1 Tab, 4 Ref

Vacuum and air brake characteristics are compared, both for passenger and freight trains. Propagation rates are examined. Other topic include: brake release characteristics; brake pipe leakage, air brake development outside England, UIC conditions for braking, and features of graduated release distributors on modern air brakes.

040492
DEVELOPMENT OF THE DISC BRAKE WITH PARTICULAR REFERENCE TO BRITISH RAILWAYS APPLICATION

Tompkin, JB, Railway Products, Gibling Limited

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 59, No. 1, Paper No. 714, 69-70, pp 84-117, 31 Fig

The development of disc brakes for passenger vehicles for British Railways is reviewed. In the last year a brake has been developed for service up to 125 mph incorporating wheel cheek discs and lightweight cylinders. A 12-car train has now been built and is also fitted with a new design of electronic Wheel Slide Prevention equipment. This is completely self-contained in two units, one fitted to the axlebox and containing the sensing and control modules, the other comprising a pneumatic valve fitting in the adjacent bogie pipe work. No external electrical supply is needed and no wiring is used other than a flexible cable joining the two units. Design trends are now towards one cylinder for each brake. To reduce costs, light pressed steel cylinders, mass produced for road vehicles are being introduced. This paper describes in some detail the design and operation of some disc brake installations within the period 1954-1968.

040504
RHEOSTATIC BRAKING WITHOUT MOTORING ALL AXLES

Manser, AW, London Transport Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 55, No. 303, Part 1, 65-66, pp 18-58, 12 Fig

The power circuits for the system are shown. The detailed sequence of events during a stop using rheostatic braking is as follows: A command is received to brake at one of the specified rates (1.5, 2.1, or 2.6 mph p.s.), both electro-pneumatic and rheostatic brake circuits are energized. When a rheostatic braking current has been established on every equipment on the train a change-over relay is energized and this releases the air brakes on all cars. The rheostatic braking continues to build up through the operation of a camshaft switching unit, which reduces progressively the degree of field divert until it is checked by the operation of the rheostatic current limit relay (RCLR) when the current value is reached which represents the maximum which can reasonably be permitted under tare conditions. The performance is shown which was obtained with the equipment in terms of percentage of train energy dissipated rheostatically for various speeds of entry and various rates of retardation. The degree of success which is achieved with this scheme will be revealed by the extent to which wheel wear is reduced.

040506
COMPOSITION BRAKE BLOCKS AND TYRES

Wise, S Lewis, GR

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Part 41970, pp 386-443, 5 Fig, 4 Tab, 7 Phot, 13 Ref

This paper describes some of the problem which have arisen from the use of composition brake blocks in the past. For at least two of these, wet stopping performance and thermal cracking, there is now an understanding of the problem and possible solutions. Present-day production has also resulted in blocks free from the other difficulties. Other methods of avoiding the dangers associated with thermal cracking have been indicated: these involve moving away from the classic wheel and tire arrangement and the materials which have persisted for many years.

040508
A METHOD FOR ESTIMATING BRAKING DISTANCES

Singh, A, Ministry of Railways, India

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 317, Part 3, 67-68, pp 251-278, 14 Fig, 2 Tab, 1 Phot, 12 Ref, 1 App

This method allows for a time delay in the development of full brake power after a brake application has been initiated at the driver's cab, by taking note of the actual pattern of this development during this period. Thereafter, the distance traversed with full brake power before coming to a stop can be computed. Allowance has also been made of the brake power development characteristics of the motive power units. The method is suitable for application to all brake systems, compressed air standard AVB, and AVB with Quick Application valves–in fact, for any system where the brake power development curves can be established.

040545
VACUUM BRAKING OF HEAVY FREIGHT TRAINS ON THE BROAD GAUGE, INDIAN RAILWAYS

Mohan, C, Research Designs and Standards Organization, India

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 300, Part 4, 64-65, pp 328-365, 17 Fig, 5 Tab, 13 Ref

Indian Railways are the largest system using vacuum brakes. Braking distances for 2200 ton trains are shown. Clasp brakes improved the coefficient of friction; the shoe pressure and friction are plotted as a function of speed. The initial developments comprising emply-load change-over devices, slack adjusters, clasp brakes, etc., have made possible the running of 3,200 ton trains without increasing braking distances over those obtaining with 2,200 ton four-wheeler trains. With the rapidly increasing transportation requirements, running of 4,500 ton trains is an immediate necessity. Improvements under consideration to permit 4500 ton trains include, modified cages, direct admission valves, and 80 mm train-pipe. Incorporation of the developments now under study, such as higher brake ratios, improved rigging, composition brake shoes, etc., will enable the vacuum brake to meet the future transportation requirements of 6,000 to 7,000 ton trains at higher speeds.

040780
AIR BRAKE EQUIPMENT: PERFORMANCE AND MAINTENANCE

Wilson, SH

Railway Division Journal (Institution of Mechanical Engineers, 1

Birdcage Walk, London SW1, England)

Vol. 1, Pt 31970, pp 322-348, 5 Fig, 4 Phot

This paper discusses some of the more troublesome problems that have been experienced together with the remedies and maintenance procedures adopted to overcome them on air brake equipment. These problems relate to (1) teething troubles which require modifications to equipment, (2) training of both the operating and maintenance staff, (3) having to maintain a more sophisticated system of braking which has tight operating tolerances, and (4) operating two completely different systems during the transition period. In conclusion it is important to emphasize that the two-pipe air brake system as adopted by British Railways for locomotive-hauled trains, is considered to give the best performance that can be obtained from a purely pneumatic system, being second only to the electro-pneumatic brake such as is used on electric multiple units.

040831

STUDY OF FRICTIONAL CHARACTERISTICS OF COMPOSITION COMPARED TO CAST IRON BRAKE SHOES

Britton, JC Knoblock, OW

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-448, Res Rpt, Apr. 1968, 50 pp, 12 Fig, 5 Tab, 18 Phot, 1 App

An investigation was made to study the braking characteristics of various types of brake shoes on switching locomotives. This work was conducted on the Seaboard Coast Line Railroad at Waycross, Georgia, in 1968. The field work was supplemented with laboratory work conducted at the AAR Research Department on the brake shoe dynamometer machine. The frictional effect of breakaway resistance of wheels was also studied by the use of this machine. It was concluded that: 1. Braking force developed by the brake system is dependent upon the fundamentals of friction of the brake shoe on the wheel and pressure applied on the shoe. 2. The stopping distances are independent of the type brake shoe or whether single or clasp brakes are used, provided that proper coefficient of friction of brake shoes and brake shoe pressure are used in the design. 3. Brake shoe pressures that develop restraining forces greater than can be withstood by the wheel-rail contact will result in the tendency to reduce braking effort and cause slid flat wheels. 4. The coefficient of friction values for the cast iron shoe compared with the composition shoes are sufficiently similar to permit use of either type of shoe provided proper brake cylinder pressure is maintained and suitable lever ratios are used in the design.

033087
FIELD TEST ON C-TYPE CAB WARNING APPARATUS

Yokoi, K, Japanese National Railways
Hasegawa, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 1, Quart Rpt, Mar. 1960

C-type cab warning apparatus was tested with respect to the coupled operation of engine equipments with wayside equipments on Japan-sea coast main lines between Maibara-Aomori Section, 1957. Dynamic and static characteristics were tested to find the sensitivity for high speed train running and for various conditions of wayside equipment. As a result of this test, the prospects of practically using the apparatus are good in view of its satisfactory working except in case of diesel car having electromagnetic valves which may cause some errors.

033096
TRAIN SAFETY CONTROL SYSTEM (REPORT 2)

Ishiai, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Quart Rpt, Dec. 1960, pp40-45

When a train safety control system is newly installed in a certain section of railway line, the first problem is to choose the most suitable system for the section in full consideration of its traffic condition, peculiarities and operation system adopted there. Next it is important to organize the working of the system so well that the highest degree of safety may be secured. The present study purports to make investigations of train safety control system, to define the basic requirements of the system on the basis of probability theory, and ultimately to facilitate selection of it.

033097
INFLUENCES OF CIRCULATING SIGNAL CURRENT ON SIGNALLING DEVICES

Kawanabe, H, Japanese National Railways
Nakayama, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Quart Rpt, Dec. 1960, p71, 1 Ref

Influences on signalling devices of circulating signal current which flows through negative feeder and track circuits in adjacent line in the case of broken rail or broken arm of impedance bond were measured in the territory of 60 c/s AC electrified double track on the Hokuriku Line. The circulating signal current was maximum when return rails were connected with each other and two negative feeders were connected with each rail. If two accidents occur in track circuits with the same signal frequency, the dangerous condition, that the track relay of AF track circuit can not drop away on account of the circulating current when a train occupies the track circuit, may possibly result. Countermeasures, such as different frequencies, adequate output of signals power, etc., must be taken to prevent the dangerous condition.

033152
HIGH-SPEED ROLLING STOCK. I. AERODYNAMICAL PROBLEMS

Hara, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Oct. 1963, pp7-11

Special Issue

The main purpose of the tests on the test track section is to examine various problems which may occur when a high speed train is running in the tunnels and when two high speed trains are passing each other in the tunnels. At first, tests were made to clarify phenomena which actually occur, and then experiments were made to study the countermeasures for the results if necessary.

033157
TEST ON TRAIN PASSAGE DETECTORS UTILIZING RADIO-ISOTOPES

Kobayashi, A, Japanese National Railways
Nakaya, R, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 2, Quart Rpt, June 1967, pp112-114

A train detector utilizing radio-isotopes was tentatively manufactured and tested on the Shimogawara-line during the period from February to March in 1963. Since the train speed on the line was below 60 km/h and the test period was too short, further tests were carried out in order to confirm its ability under more practical conditions. A type of ground spot detector, composed of a Radio-Isotope 137 Cs of 25 mCi (milli-curie) laid inside a track, and a stainless steel cathode halogen Geiger tube of 40 mm phi time 400 mm in length fixed on the floor of a car was perfectly operated even when the car passed over the isotope at a speed of 200 km/h. Another type with the isotope 60 Co of 100 alpha Gi (micro-curie) laid inside a track, and with a scintillation radiation detector fixed beneath the floor of a car, was also operated satisfactory at a speed of 200 km/h. As for the train detector of gamma-reflection type, in which both of the isotope 137 Cs of 25 mCi and a Geiger tube are laid inside a track, its performance was good both on narrow gauge lines and on the new Tokaido line. In its life test for a long period, it could detect train passages of about 14,000 times without even one miss or overcounting.

033161
A TRAIN DETECTOR FOR LEVEL CROSSING PROTECTION

Nakayama, M, Japanese National Railways
Sase, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 3, Quart Rpt, Sept. 1967, pp163-164

A train detector for the use of the level crossing alarm initiation was developed. It does not require any exclusive line wires between the detector and the crossing like in the standard type detector now in use in JNR. The detector is attachable to any part of a conventional AC track circuit and can detect approaching trains by decrease of track voltage to specified value. The detected information is transmitted to the crossing with a carrier frequency over a pair of existing line wires. The effect of attaching the detector on the track relay is negligibly small.

033162
LOOP-COIL TRAIN DETECTOR

Sase, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 3, Quart Rpt, Sept. 1967, pp173-175

Many devices, mechanical or electrical, are available for guarding the railway crossings against the approaching train. The author proposes a loop-coil frequency deviation type detector for a light weight vehicle like railbus. The detector works on the principle of detecting the inductance change in a loop-coil placed in the track as caused by the approaching train.

033193
FIELD TESTS OBSTRUCTION DETECTION AND ROCK-FALL WARNING DEVICES

Kawanabe, H, Japanese National Railways
Mihara, H, Japanese National Railways
Horie, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 1, Quart Rpt, Mar. 1964, pp50-52

At the request of the Disaster Prevention Measures Committee for the Dosan line, Shikoku, JNR, the authors worked out a device for detection of track obstruction with rock-fall, landslide and flood and a cab warning device supplemented with a rock-fall alarm. These devices have been tested in the field.

033336
A TEST ON THE CONSTRUCTION GAUGE VIOLATION WARNING

Kawanabe, H, Japanese National Railways
Yoshikoshi, S, Japanese National Railways
Sakurai, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt

The Ratio Alarm system was developed to detect overheated or distressed journals of hot-boxes by using a ratio between temperatures at the hot end and the cold end compared for their performance. Various principles of is used. When a signal at the scanner is set off, a tape in conceived. The present prototypes worked on a cheap conductor, which controlled the alarm circuit through a snapping or a short-circuiting of the detecting wire by a derailed car on the adjoining track or worked on a mercury switch, of which a tilting by a derailed car caused the circuit to open.

033369
THE DEVELOPMENT OF SPECIAL SIGNALLING FOR HIGH-SPEED OPERATION ON EXISTING LINES

Michaux, J, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 41969, pp213-222, 1 Ref

It is important to develop signal systems when train speeds exceed 160 km/h. Such factors as stopping distance at such speeds preclude the use of the system used in the noraml automation block section. At higher speeds, the warning distance may reach 2 or 3 blocks. One solution is to develop a 3 aspect signaling system which covers 3 blocks with signals fed through cables laid along the track.

033401
HIGH SPEED RUNNING AND TRAIN SPEED CONTROL

Plaiche, M, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 21966, pp59-65

Conventional on-tread braking equipment and operation is used up to 160 km/h (100 mph), and is based on the best possible use of available adhesion during braking. The available adhesion has restricted the average possible deceleration to 1 m/sec square (3.27 ft/sec square). Having established the minimum safe stopping distance to be within three blocks, the signaling was adapted to this operation, and cab signals were designed to give the engine men specific limits of operation.

037206
MINIMUM TRAIN HEADWAYS ON RAPID TRANSIT RAILWAYS WITH ADVANCED TRAIN CONTROL AND CONVENTIONAL SIGNALLING

Lueddecke, C

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

No. 1,2, Jan. 1968, pp 29-54, 14 Fig, 2 Tab

This article deals with the problems of rapid transit to and from cities, both urban and interurban systems. It describes investigations into the extent to which theoretical train spacing employing "running with elastic vision" can be achieved with various signal and train-control systems. An ideal system based on headways equal to braking distance and a developed practicable system are compared with four conventional signal systems with long and short protected sections and up to three permissive follow-on signals. The comparison, supported by fully developed formulae and diagrams, shows that the time spacing between trains with a refined fixed signalling system with three follow-up signals and immediate speed control is only a few seconds longer than the practicable train control with cab signals for train spacing equal to the braking distance. With the use of more powerful locomotives, and an acceptable slight increase in journey times, the proposed 90 second interval between trains appears to be a reasonable prospect even with trains of 200 meters length.

037207
CONTINUOUS AUTOMATIC TRAIN CONTROL FOR SAFETY AND CONTROL OF RAPID TRANSIT RAILWAYS

Koehler, EJ Kupper, D

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

No. 1,2, Jan. 1968, pp 15-17, 1 Fig

The emphasis on speed with safety is a necessary consideration in the planning of any railway signaling system. This article describes a system such as used with the operation of the 200 km/h passenger trains on the German Railways. The prerequisite emphasized for properly functioning signal systems is the interdependence existing between train spacing, train length, length of the protected sections and the speed over the route. A further development of the signal system described, where command information is constantly being imparted to the train through a special communications line, is the possibility of programmed automatic operation of these trains.

037215
METHODS OF CONTROL AND REGULATION OF MOTIVE POWER UNITS

Pierick, K

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

No. 6, June 1965, pp 265-276, 15 Fig

The function of the locomotive engineman is reviewed. Motive and braking power instructions are formulated from various train control systems. These systems include timetable schedule controls, train velocity controls, and danger point distance controls. In the discussion of the distance controlling cycle, the present customary safety system is described, whereby fixed signals are used as the distance-measuring equipment and as an aid to the distance comparison.

037243
INDUCTIVE TRAIN COMMUNICATION TRIALS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Nov. 1965, pp 900-901, 1 Fig, 3 Phot

This survey describes British Railways field experiments on a continuous cab signalling system for speed control and position monitoring. In this system, cables are laid between the rails using a small motorized trolly. Although technical feasibility was demonstrated, little progress was made with the engineering of the system. Problems yet to be solved include physical damage to the cables by platelayers and other workers and the design of a memory device for the locomotive since the cables cannot be continued through points.

037590
SIGNAL TRANSMISSION FOR HIGH SPEED OPERATIONS OF 200 KM/H ON THE GERMAN RAILWAYS

Luetgert, R

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 15, No. 3, Mar. 1966, pp 69-75, 6 Fig, 6 Phot, 17 Ref

For speeds of 200 KM/H improvements in braking power was not sufficient to enable stopping within a required distance. A more sophisticated system using an electronic control system was designed, which displays to the engineering the following: the permitted speed goal, the distance ahead for which the goal speed pertains up to 5000 meters, speed changes depending on conditions, and the actual speed of operation. If deceleration, in response to predicted conditions ahead, is not actuated by the engineer, the control system activates emergency brakes. A full description of this system is illustrated with diagrams and charts.

037613
OPERATING TRAINS ON ELECTRIC VISION–WHY AND HOW?

Lagershausen, H

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 6, June 1965, pp 221-238, 9 Fig, 6 Ref

The author presents the signalling system of today as an example of the way in which much of the present state of the art of the railways reflects the developments from past methods and states of the art. New techniques have been superimposed onto the old, without changing the fundamental principles. A new system is envisioned where the operations would be through constantly moving blocks, with a predetermined time interval controlling the movement of the trains. This system is described in considerable detail, as also its advantages in congested train conditions. Complete safety of operations, including the absolute protection at railroad crossings at grade, and protection to maintenance of way workers, as well as supervision of compliance with speed restrictions, are included in the functions of this system. Economic considerations are also dealt with. The characteristics and simplicity of this system makes it suitable for application to all transportation systems, including urban rapid transit.

037614
USE OF COMMUNICATIONS TECHNIQUES IN A FUTURE TRAIN AND LINE SYSTEM

Fricke, H Form, P

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 14, No. 6, June 1965, pp 140-262, 35 Fig, 8 Ref

The task of communications techniques is not only the transmission of information from one source to the user, but also the processing of this information according to scheduled programs. In transportation safety, the initial information in the form of an oral instruction or a programmed coded order must be transmitted to the vehicle and received by it. From the communications standpoint, it is necessary to differentiate between, (1) one-way transmission from train to track or from track to train, and (2) two-way transmission between track and train. In one-way transmission from train to track, direct current circuits are generally used, together with axle counters. Two-way communication between track and train can be accomplished by superimposing both transmission directions onto a closed circuit. The planning of a linear safety system begins with the desired speed-related headway interval. Three safety systems are described and the economics of expenditures on train and track are discussed with particular reference to the wide variety of signalling tasks on the one hand, and the relationship between the length of line and the quantity of rolling stock on the other. The article describes a digital system, with specially simple vehicle equipment, designed for underground railways.

037750
ELECTRONIC SURVEILLANCE AND CONTROL SYSTEM FOR ADVANCED TRAIN OPERATION

Cope, GW

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 59-68, 13 Fig

The "ESACS" concept started as a relatively small advancement in the form of an improvement in automatic couplers. Some means of reducing the complexity of the electric couplers of the MU car type was needed. It became apparent that once a communication means with the capacity to handle hundreds of bits of information in either direction was installed on a train, so as to connect all cars, a great many things could be achieved in the form of surveillance and control with benefits in operation, car utilization, lading damage control, safety and performance. Efforts at developing this system are presented.

037828
SIMPLE VIGILANCE AND DEADMAN DEVICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Aug. 1967, pp 626-628, 9 Fig.

Current requirements for checking the vigilance of the driver and safeguarding operation, if this falls below an accepted standard, make it clear that two safeguard functions are essential: to provide an effective deadman operation, and to check constantly that the driver is alert. Very recently a completely fresh design approach was made to the way the equipment can be made to fulfill the operating requirements and which lends itself to a much cheaper first cost, a very great reduction in maintenance, and is readily adaptable to fitting to locomotives without or with deadman equipment. The approach has been to provide a completely electronic unit incorporating relatively recently devised equipment, the metallised polycarbonate capacitor which has an infinitely small leakage characteristic and is used as the delay element, and the uni-junction transister which fires off the circuit operation when the voltage in the capacitor reaches a

predetermined value. Incorporation of safety and vigilance cycles into the one control circuit provides a compact and straightforward arrangement which does not require the driver to choose between two courses of action to prevent a brake application once he hears the bell.

037857
AUTOMATIC REGULATION OF TRAIN SPEED

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Mar. 1965, 4 pp, 3 Fig, 7 Phot

Successful trails on the Belgian National Railways of an inductive control system are reported. Signal aspects are displayed in the driving cab. Transmission of information from the track to the locomotive is carried out by a pair of inductors between the rails, each of which contains a coil of litz wire tuned by a capacitor. Beneath the locomotive there are two detectors. The input and output of a wide-band amplifier are connected to the loops. The effect of an inductor on the track beneath a detector is to couple the two loops by a link having a resonant frequency between 50 and 100 kc/s, and the amplifier will then generate a signal of the same frequency as the inductor. Inductors may be tuned to 15 different frequencies in this range so that a large variety of information can be transmitted to the locomotive as compared with electro-magnetic systems.

037877
ELECTRIC CATCHPOINT WORKING ON SINGLE LINES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, June 1942, pp 695-696, 2 Fig

An accident occurred in March 1940, on a single line between Aviemore and Carrbridge, on the L.M.S.R., when a number of cars became detached and ran back to meet an oncoming train. The accident report recommended that electrically operated catchpoints be installed north of Carrbridge. The signalling layout is shown indicating the general layout of the section and the gradient profile. The circuits designed to ensure proper control being obtained over the working of the points is illustrated. The process for operating the signalling system is described.

039305
DETECTORS FOR ACCIDENT PREVENTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Oct. 1959, pp 241-242, 1 Fig, 3 Phot

For dragging equipment detection, a series of brittle, cast-iron loops are mounted between and outside the rails, just below standard clearnace for rolling stock. Hanging parts break one or more of the detector loops and these being connected in a detector circuit de-energise a relay and operate warning devices. A device that automatically detects broken wheel flanges as well as wheels that are loose on the axle, while wagons are in motion, is described. The hot box detector has proved that the principles employed have been most successful in detecting hot axleboxes. The equipment was designed by a firm who are manufacturers of infra-red control systems.

039470
DETONATOR OF OPTIMUM AUDIBILITY AND SAFETY

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-21, Report, July 1965, p 24

Question B63

This report is the result of an ORE inquiry into the uses of detonators as signalling devices. Other types of devices are suggested which could replace or supplement detonators. The report concludes by suggesting that torches should be used which burn long enough and bright enough to be seen while other means of protection can be explored.

039494
WARNING DEVICES OTHER THAN DETONATORS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-24, Jan. 1967, p 45

Question B92.

Luminous torches for signalling used in Europe and Japan were tested as a part of the task of Specialist Commitee B92. Work is now directed toward warning devices with a range of 2-3 km. A Hertzian torch, which is a transmitter, would emit radio warning signals to a receiving device to be installed in every motive power unit. Another solution would be the installation of transmission and reception devices on the motive power units, connected by inductive coupling through conductors along the railway track. This method is especially advantageous in tunnnels and hilly terrain. Cost comparisons are being made.

039675
HOT-BOX DETECTORS IN THE U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, May 1960, pp 561-562

The problem is now being solved by the installation of hot-box detectors situated at strategic points beside the track and susceptible to any overheated box on a train passing at speed; they report the occurrence automatically to a controller or other operating officer. There is one detector on each side of the line and if there is an overheated box on one side or the other it is picked up by the detector on that side. The heat signal imposed on the telephone lines is instantaneously transmitted from the detector to the control office. Two separate Harmon F.M. carrier channels are provided, one reporting from each detector. The respective frequencies are 40 kcs. and 55 kcs. Any abnormal temperature is indicated to the controller on a graph, and he arranges for the train to be stopped by a special signal five miles after it has passed the detectors and for a maintenance call-light to be switched on. The train crew answering the call is informed of the position on the train of the heated journal, and decides whether the vehicle involved must be cut off.

039916
ELECTRONIC SURVEILLANCE AND CONTROL SYSTEM

Spaulding GB

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 39-42, 5 Fig

Proceedings of 1968 Railroad Engineering Conference.

This article discusses the application of the ESACS system to train operation. The system is a technique for encoding or connecting analog or switch position data over two wires to a second location where the data is decoded and displayed. The elements of the system, costs, and maintenance are described as well as the benefits.

039994
THE HOT BOX PROBLEM IN ITS RELATION TO BEARING METALS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-MR-124, Tech Rpt, Apr. 1952, 10 pp

The relationship between overheated journals in "hot boxes" is discussed as related to metals used as bearing metals. Although overheating is caused by the loss of oil film between the bearing and journal, the reasons for some bearings to overheat are not known. This article discusses the need to either determine new metals for bearings or reduce the temperature of journals to avoid the problem.

039995
FIRST PROGRESS REPORT OF THE COMMITTEE ON HOT BOX ALARMS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-MR-187, Tech Rpt, Apr. 1947, 1 pp

The object of the tests was to determine whether a device exists or might be developed which can effectively warn the train crews of the danger of a hot box. As a result of tests it was determined that the sensitive element of the device must be located in the bearing or the journal itself. The alarm should be sounded at a bearing temperature of approximately 350 degrees F for plain bearings. No one type of sensitive element or means of transmission was found superior to the others.

040035
SIGNALLING ON A MODERN RAILWAY SYSTEM

Ernst, W

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20 N, -2, Feb. 1971, pp 21-27, 7 Phot, 9 Ref

Signalling techniques on the railways have progressed through the manual block system to the Centralized Traffic Control, where the movement of trains is controlled from a central headquarters, with the track display of a district and the appertaining switch and signal actuating equipment located in the usual desk arrangement, observed and operated manually. Interlocking of crossings at grade are included in this system. The longer braking distances resulting from the 200 km/h and more operation presently necessitate modification of this system to include continuous automatic train control, which can be projected ultimately to automatic train operation and travelling on instrument vision. This article describes the use of computers for this type of control of trains. The computers are presently used for indirect control of train movements through existing signal equipment. The problems of extending this system to direct control of train movements are under consideration. The question whether the direct control of trains is possible or economical without local interlocking frames is at present unresolved.

040050
A COMPUTER SIMULATION OF CTC RAILROAD OPERATIONS

Hudson, CJ, Canadian National Railways

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017 8 pp. 7 Fig

A computer program is shown for determining the most economic number and locations of signalled sidings which will adequately handle the current and anticipated traffic. The computer technique enables the Transportation Department to evaluate various siding configurations easily and quickly and to compare alternatives quantitatively.

040069
AUTO-DISPATCHING

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

Aug. 1966, 6 pp, 4 Fig

An automated dispatcher system was developed and tested by the Moscow Railroad and Leningrad Railroad Institute. The system tried consisted of six fundamental components: 1. Controlling calculating machine 2. Centralized traffic control system, 3. Interfacer to connect computer and CTC, 4. Equipment at the dispatcher location will provide communication with the computer, 5. Communication with end terminals, 6. Logic program for direction of the computer, for various conditions of dispatching. Three series of tests (using Ural-1, Ural-4 and Dnepr-1) showed that the autodispatcher increased average speed of freight trains by 5-8%. This will produce savings of 200-300 thousand rubles per year on a division of 200-300 klm. This is against an expenditure of 500,000 rubles for two computers and 30-50 thousand rubles/year for additional maintenance. The system will thereafter pay for itself in about 3 years.

040136
THE FUNDAMENTALS OF INFRARED HOT BOX DETECTION

Menaker, EG, General Electric Company

American Institute of Electrical Engineers, 345 East 47th Street, New York, New York, 10017

Conf Paper, 21 pp, 7 Fig, 1 Tab, 8 Ref

Existing data on railroad car plain bearing temperatures are presented and interpreted by means of equivalent thermal circuits. Analyzing the radiation from the car truck, relating it to the characteristics of infrared measuring equipment, and discussing the handling of the resulting data suggests approaches to more efficient use of wayside hot box detectors. The effects of some ambient phenomena are presented. Further study of transient temperature conditions following lubrication failure is suggested.

040147
SAFETY AND RELIABILITY OF COMPUTER-CONTROLLED RAILWAY OPERATION

Delpy, A, Bundesbahn-Zentralamt, Minden
Suwe, KH, Bundesbahn-Zentralamt, Minden

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 18, No.10, Oct. 1969, pp 386-395, 8 Fig, 14 Ref

The application of computer techniques to the problem of handling train movements is discussed. All phases of such a system and its workability are investigated for safety and reliability. The chances of an erroneous output from the computer that could affect a train movement are computed to be extremely small. The duplex computer system provides a method of safeguarding against a failure in the output. The conclusions reached in all questions relating to this possible means of controlling train operations gives the go ahead for computer-controlled railway train operation.

040166
DETERMINE THE OPTIMUM LOCATION OF HOTBOX DETECTORS

AREA Bulletin (American Railway Engineering Association, 59

East Van Buren Street, Chicago, Illinois, 60605)

Vol. 711969, pp 131-139, 5 Fig

Two methods are presented to determine the optimum spacing of hotbox detectors. In both methods, optimum spacing is determined by economic factors, as well as other considerations. Growth or decline of traffic, changes in types and values of commodities hauled, changes in operating practices and changes in locations of car inspection points, all have a bearing on the results obtained from hotbox detectors. It may be desirable to change locations of detectors to fit new operating and/or traffic patterns. The increasing use of roller bearings must be taken into consideration when locating hotbox detectors. There is a short lead-time between the start of heating in a roller hearing and the presence of a critical case of a broken journal possibly within a distance of 30 miles or less. A good record should be kept of hotbox occurrences, set-offs and derailments, including costs, to determine if the study results are producing savings and reductions in hotbox set-offs and derailments due to hotboxes.

040205
THE CONTRIBUTION OF SIGNALLING TECHNIQUES

Koeth, W, Bundesbahnzentralamt Munchen
Wolf, O, Bundesbahnzentralamt Munchen

Eisenbahntechnische Rundschall (Hestra-Verlag, Darmstadt, West Germany)

Vol. 17, No.12, Dec. 1968, pp 533-539, 8 Fig, 1 Tab, 1 Phot

Since the braking distance for the 200 Km/h trains is 2200 m for emergency and 3500 m for service brake applications, additional changes in signalling systems are necessary. The lengthening of the signal blocks is neither appropriàte nor desirable to accommodate all kinds of trains. The alternate was the development of the continuous train control system. The effective distance between blocks is lengthened for the high speed trains, by changing the intervening blocks to display caution, whereby the affected train must reduce its speed to 160 Km/h. The control system provides automatic control of the high speed train by binary coded information which is transmitted through a separate signal communication line to the locomotive. Signal messages can be transmitted over the same frequency back to the control headquarters. The technical processes of this interchange of information and the manner of control of the train through the programmed cab signals and information and the automatic operation of the locomotive controls are described in detail.

040240
GRS OPTICALLY GATED WHEEL THERMO-SCANNER UNIT–OPERATION INSTALLATION MAINTENANCE

General Railway Signal Company, Rochester, New York, 14602

PAMPHLET 1421, June 1971, 144 pp, 68 Fig, 1 Tab, 1 App

The GRS Wheel Thermo-Scanner Unit is a solid-state system for detecting and indicating abnormally hot journal temperatures of railroad cars traveling at speeds ranging from 5 to 85 mph. In the basic bidirectional system, magnetic wheel detectors on both approaches to the scanner location initiate system operation. The track-mounted equipment consists of two mounting assemblies (scanner and blower), four wheel detectors, three arrester boxes, two junction boxes, and connecting cables. The basic bidirectional system also includes a modular equipment cabinet, with plug-in printed circuit boards, which is designed for mounting in a 19-inch rack in a wayside housing. A basic unidirectional system requires two wheel detectors and a direction relay printed circuit board. Transmission lines for output are described.

040357
ANALYSIS OF HOT BOX DATA SUBMITTED BY FOURTEEN MEMBER ROADS

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR MR-210, Res Rpt, Dec. 1953, 2 pp

The result of this study of 2,161 hot boxes' data indicates that hot boxes occur less frequency on spring plankless trucks. However the cars with spring plankless trucks are newer cars, a fact which should be given weight in any conclusions reached. The ratio of ownership of spring plank trucks to spring plankless trucks is 2,48 to 1.0 but the ratio of hot boxes on spring plank trucks to spring plankless trucks is 3.45 to 1.0. It was concluded that the major causes of hot boxes (71.16%) are derived from the conventional waste pack. Elimination of this waste pack by substituting an improved method or material to provide the lubrication would eliminate many hot boxes. Periodic repacking, and the associated attention to the box assembly at that time does not reduce the frequency of hot boxes during the immediately following months, as might be expected. The higher capacity cars run hot less frequently than the lower capacity cars, but the higher capacity cars are generally more modern. The number of hot boxes caused by bearing defects indicates need for improvement of bearing design and box assembly. Tank and refreigerator car performance is less satisfactory than the average of all other types.

040478
COMMUNICATION DEVELOPMENTS IN THE RAILWAY INDUSTRY

O'Farrell, MA, London Transport Board

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Pt 2, 1970, pp 148-172, 13 Fig, 9 Phot

Communications systems in use in 1969 by Dutch, German, Swiss, French, and British railways are discussed. British systems favor inductive and direct contact systems, whereby the other railways studied preferred radio communication. Radio offers the greater amount of flexibility, which makes it attractive for a transportation system.

040513
INVESTIGATION OF FAILURES IN CONTROL-COOLED RAILROAD RAILS

Cramer, RE, Illinois University

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 56, No. 521, Feb. 1955, pp 896-904, 1 Fig, 3 Tab, 8 Phot

The causes of failure of 49 control-cooled rails evaluated during a one year period are summarized. A graph summarized the number of years 150-hot torn steel rails were in service before failure developed. Laboratory tests are described of Tigerbraze rail bonds which gave results that were superior to previous tests of other kinds of welded rail bonds.

040779
SIGNALLING FOR HIGH SPEED TRAINS

Tyler, JFH, British Railways Board

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Pt 3, 1970, pp 297-322, 9 Fig, 1 Tab, 2 App

In this paper the author has tried to analyze the signaling problems of high-speed operation, and to bring them into perspective. The paper discusses the limitations of contemporary modern signaling when applied to higher speeds and the principles upon which an acceptable solution might be based. Speeds higher than 100 mph bring other problems than signaling, notably those of line capacity, track maintenance, and automatic train control. It was claimed that signaling requirements for speeds of 100 to 125 mph and 100 to 150 mph are different. In one case existing signaling can be modified to achieve desired safety requirements, and in the other a new and additional system must be considered.

040829

DISCUSSION ON "THE ENGINEERING ASPECTS OF HIGH-SPEED TRAINS" (1) MOTIVE POWER: (2) PASSENGER ROLLING STOCK; (3) BRAKING AND SIGNALLING; (4) PERMANENT WAY

Sharp, E Thring, JF Peacock, DW Loach, JC

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, Pt 2, 66-67, pp 196-219, 9 Fig, 1 Tab, 1 Phot, 1 Ref

This paper surveys the engineering aspects of high-speed trains in terms of motive power, passenger rolling stock, braking and signaling, and permanent way. In developing high-speed trains there is clearly a need to examine all aspects of vehicle performance on the track, and also a need to subject every item of traction equipment to the closest secrutiny to ensure that it is suitable for onerous high-speed duties. The car of the future will probably be lower and smoother, and with smaller windows than present-day cars. It will be pressurized and adjacent body ends will be closer to incorporate peripheral coupling and improve passenger access. It will also cost more. A basic consideration in obtaining the best brake performance of high-speed trains is the maximum braking retardation. When high retardations are used and as the maximum speed of trains increases from about 100 mph to 120 mph (or even 150 mph) two problems of braking which become increasingly important are adhesion and heat dissipation. Both necessitate modifications to present braking practice when higher speed stops are to be made. It is generally agreed that at high speeds some form of cab signaling is essential, and systems in use vary from the relatively simple A.W.S. as used in this country to apparatus which starts, controls, and stops the train automatically. There is every justification to believe that, from the point of construction, modern track would be quite suitable for speeds up to 160 mph—possibly more—where it is straight or flat-curved.

033074
COLLISION TEST OF RAILWAY CAR AND DUMP TRUCK (SECOND SERIES)

Arai, S, Japanese National Railways
Nihonyanagi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 2, Quart Rpt, Mar. 1966, pp28-32, 1 Ref

Collision test of actual cars is one of the projects for the prevention of railway crossing accidents. The shock, the movement and the deformation of the car body are investigated by the test using actual railway cars and dump trucks at a railroad crossing, and furthermore it is examined how passengers and drivers are affected by the collision. Problems on collision are divided into five items as follows: (1) Shock deceleration, (2) Velocity change and mean deceleration, (3) Deformation of front surface of car, (4) influence on passengers and drivers, (5) Prediction of train collision.

033200
ON THE COLLISION TEST BY ACTUAL CARS

Matsui, S, Japanese National Railways
Arai, S, Japanese National Railways
Nihonyanagi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 3, Quart Rpt, Sept. 1964, pp54-56

There are sometimes great damages at the front faces of the front cars of electric trains, which collided with damp trucks at railroad crossing. The aim of this test is to obtain data necessary for determining the proper strength of the front face of motor cars to prevent passengers and drivers from danger.

037589
THE PROBLEMS OF CALCULATING RESPONSE INTERVALS FOR FLASHING LIGHTS (AND GATE PROTECTION) AT RAILWAY GRADE CROSSINGS

Endmann, K

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 15, No. 3, Mar. 1966, pp 101-106, 5 Fig, 2 Tab, 5 Ref

The length of the response interval for flashing light signals to be activated depends upon the approach time of the highway vehicle, the speed of the train, and the relationship between certain signalling and operational conditions. Since safety requires the assumption of the fastest train when calculating the response interval, slower trains and trains that come to a stop before reaching the crossing impose longer waiting times, and cause annoyance to the highway users. This can be avoided by having the response made sensitive to the speed of the train, which will cause the response interval to be adjusted accordingly. This article describes this system, presenting mathematical equations, charts and tables of the data.

037935
UNBROKEN MAIN-LINE CROSSING FOR CATCH POINTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, May 1948, p 549, 2 Phot

A special crossing was designed and tested for heavily traveled sections of the London Transport system. The advantages of this unbroken crossing are: (a) elimination of wear on the wing rail and nose of a normal crossing, resulting in much longer life; (b) elimination of the jolt as every wheel passes over a normal crossing, with reduction in wear on rolling stock; (c) reduction of maintenance packing of the crossing; and (d) elimination of one crossing check rail. This same type of crossing may be used in turnouts to sidings which are little used.

040164
DETERMINATION OF MAINTENANCE OF WAY EXPENSE VARIATION WITH VARIOUS TRAFFIC VOLUMES AND EFFECT OF USING SUCH VARIATIONS, IN TERMS OF EQUATED MILEAGE OR OTHER DERIVED FACTORS, FOR ALLOCATION OF AVAILABLE FUNDS TO MAINTENANCE OF WAY

Christianson, HB

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 701968, pp 75-94, 8 Fig, 7 Tab

The purpose of this study was to determine the relationship between the characteristics of traffic and track and track maintenance costs. In this preliminary study a procedure was developed and checked in a general way against actual maintenance of way costs as reported by the C&O—B&O for the year 1966, with reasonable correlation. For general application it is believed that some further improvements can be made in the procedure that has been developed, to take into account the effect of climatic conditions on weed and brush control, of age of rail, etc. Extensive data are shown.

033111
BIOLOGICAL DETERIORATION OF RAILWAY MATERIALS AND COUNTERMEASURES

Kawamura, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 11, No. 4, Quart Rpt, Dec. 1970, pp194-199

Various materials used in railroad operations are subject to biological destruction. The use of wooden materials, synthetic polymers, and metals are all subject to attack. Suggests that the object and potential biological destruction be considered in the manufacture of such items.

033209
MODERN NON-DESTRUCTIVE METHODS FOR MATERIALS TESTING-DOCUMENTARY REPORT

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

E29/RP1, Intrm Rpt, 89pp, 137 Ref

This report deals chiefly with flaw detection which is a small part of the wider science of non-destructive examination of metals. The Committee has kept strictly to its main objective which is to produce a balanced account of applications of non-destructive testing to railway problems. The directly practical part of the Committee's account is to be a catalogue of procedure charts describing and illustrating the methods actually used in the workshops of the various Administrations, and drawing attention to those which merit special recommendation. This catalogue will constitute Part 2 of the Committee's report (ORE report E 29/RP 2). The present documentary report is a single guide to the principles on which non-destructive testing is based and does not take the reader beyond the minimum of information required for a proper understanding of Part 2. Its production has nevertheless entailed a search among recent publications in several countries. It applies to cast, forged and rolled products, but does not include rails. The techniques of liquid penetrant, magnetic flux, ultrasonics, X-ray gamma ray, and eddy current testing are covered.

033210
MODERN NON-DESTRUCTIVE METHODS FOR MATERIAL TESTING-CATALOGUE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

E29/RP2, Final Rpt, July 1962

The purpose of this report is to give an overall view of the results obtained so far and the development of non-destructive test methods by the railway Administrations. The Committee collected data on the application of non-destructive tests, of which the catalogue leaflets represent a concise summary. The leaflets of this catalogue refer to a selection of important components which are at present examined by non-destructive test methods on those Administrations included in the inquiry. The descriptions relate to components whose design, or behaviour in service, must be of immediate interest to all who already have experience of them and to those about to adopt similar designs. The sketches provoke thought not only in regard to service performance, but also to the necessity of repairing or of tolerating the presence of certain defects until such time as repairs can be carried out. Documentary report E 29/RP 1 is of considerable assistance for a sound understanding of the Catalogue. The report covers the detection of flaws in axle shafts, wheels, locomotive rod drives, plates, sheets and welded seams, diesel engine parts, and bearings by liquid penetrant, magnetic flux, ultrasonic, X-ray and gamma ray inspection.

033448
WHY METALS BREAK

Wise, S

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 2, Mar. 1971, pp162-188, 7 Ref

To list some of the principal modes of failure at present known: 1 Collapse due to buckling or general yielding, 2. fatigue, 3. brittle fracture, 4. creep, 5. stress corrosion, 6. corrosion fatigue, 7. tearing or shear failure. This paper has endeavoured to list some of the failure mechanisms which can lead to fracture in metals, and to show that the tensile strength of the metal has virtually no significance in any of the important failure modes, although it may be useful as a simple basis for comparison between different steels or non-ferrous alloys. Photographs show failures of rail, axles, wheels and bogies.

037288
RADIO-FREQUENCY CRACK DETECTOR

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 84, Apr. 1946, p 457, 1 Phot

The crack detector was designed for the precise and rapid indication of the presence and depth of cracks and seams in ferrous and non-ferrous electrically-conducting materials. Its principal features are: the giving of a direct reading, high speed of testing, high speed of operation, adjustment and operation by unskilled staff after brief and elementary instruction; a breakdown indicator, which gives immediate warning if the automatic apparatus fails. The instrument indicates cracks from less than 0.001 in. up to 0.250 in. deep. The crack detector was developed primarily for testing wire and bar stock materials up to 36 in. diameter. Round, hexagonal, tubes, angles and channels, and variations of these shapes of material can also be monitored with special order head coils.

037452
ELECTROSTATIC FLAW DETECTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Sept. 1969, p 713

The processing of large component parts through the various stages of liquid dye penetrant flaw detection is often costly and wasteful. The Ardrox Speedspray system has been developed from the electrostatic method of paint spraying. The equipment consists of a high voltage d.c. generator and two pressurized spray units, one for liquid penetrant and one for powder developer, each feeding a spray pistol connected to a high voltage supply.

037631
PROTECTION OF ROLLING STOCK

Fancutt, F, British Transport Commission

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 106, May 1957, p 529

A paper by Mr. F. Fancutt on cleaning and painting of rolling stock is summarized. Railway vehicles cannot be parked under cover; thus, they are fully exposed to weather conditions. The corrosion problem is especially acute in urban systems due to a concentration of air pollutants. Various paint compositions are discussed to minimize the corrosion problem.

037911
PLASTICS FOR RAILWAY ROLLING STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 86, June 1947, p 580

The use of plastics and their advantages for particular applications are cited. In addition to comments on the merits of laminated and moulded products, a description of a coach interior and its subsequent fitting entirely in laminated paneling is provided along with an indication of the problems encountered.

037964
PLASTICS IN RAILWAY ENGINEERING

Williams, TL Brown, DW

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Mar. 1944, pp 337-339, 1 Fig, 4 Phot

Some of the many outlets for plastics in various branches of the railway industry are surveyed. These areas include: civil engineering; signals and telegraphs; locomotives; carriages and wagons; hotels and refreshment services.

037972
PHENOLIC PLASTICS FOR JOURNAL BEARINGS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, July 1944, p 61

The advantages of plastics as bearing materials include: lightness, good tensile strength, high compressive strength, low water absorption, negligible oil absorption, low coefficient of friction, and safe working temperatures. A principle disadvantage at the time this article appeared was poor heat conductivity. Also, it was fairly costly to produce moulds.

039307
ALUMINUM TECHNOLOGY FOR ROLLING STOCK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 111, Oct. 1959, pp 324-325

This article is digested from a paper by K.P. Brockway which was presented to the Institution of Locomotive Engineers in London in October, 1959. The paper discusses the principles and features of rolling stock design; the durability of aluminum, its elastic properties, deflection, impact strength, proof stress, bearing strength, compressive strength, thermal expansion, design loadings, and geometry of the structure. The use of thin sections and the adoption of the most efficient structural shapes assist the designer in his quest for economy.

039463
USE OF SYNTHETIC RESINS AND GLUED CONNECTIONS

Rail International (International Railway Congress Association, 17-21 rue de Louvrain, 1000 Brussels, Belgium)

May 1971, pp 500-501, 1 Fig, 1 Tab, 1 Phot

The results of an inquiry of the ORE concerning applications of fibreglass and other synthetics in railway vehicles. Mainly the inquiry points up the lack of experience, and knowledge in the application of such materials. The structure of a SNCF vehicle incorporating these materials is described, as well as applications of such materials in parts of locomotives, passenger coaches, and freight cars.

039527
PLASTICS FOR RAILWAY PURPOSES

Trevor, JS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, Sept. 1940, pp 303-305, 4 Phot

A review is given of the physical properties of plastics and their various applications on railways for bearings, gears, decorative, and other utilitarian purposes. The most interesting application is for bearings of various kinds, including axle bearings. These are self-lubricating and wear evenly under extremely bad conditions of service. They work best when water lubricated; the water serving a dual purpose of lubricating and carrying away the heat. For electrical applications requiring an inert strong material possessing an extremely low moisture absorption and high dielectric strength, a paper base laminated sheet, rod or tube is extensively used. Impregnated wood is also used for insulated fishplates for track-circuited railway tracks.

039619
THE USE OF RUBBER ON RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Dec. 1952, pp 676-677

A brief historical account of the development of rubber is presented. Reference is made to the use of rubber for railway car wheels.

039629
BESSEMER STEEL IN RAILWAY SERVICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Aug. 1943, p 177

The reintroduction of the basic Bessemer process at the large new Corby works in Northamptonshire, chiefly for the purpose of making tube steel, has proved that with iron smelted from the orebeds of this and adjacent Midland areas it is possible to make a reliable basic Bessemer steel from British raw materials. Similarly the Luxembourg and Lorraine ores, such as minette, have been well suited always to basic Bessemer steel production, and British railways which were compelled in 1921 to buy basic Bessemer rails from Luxembourg. The War Production Board has now laid it down that in the manufacture of certain details of railway equipment the railways must be prepared if necessary to accept Bessemer in place of openhearth steel. The list of such material covers 66 items.

039634
THE IMPROVEMENT OF THE STEEL RAIL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 73, July 1940, pp 39-40

The article discusses differences in thermal treatment of rails between the U.S.A. and Europe. The quenching treatments used in Europe are described as well as the rationale for such treatment both of which are related to transverse cracking of rails. As a result, the controlled cooled rails are also proven to be stronger and more resistant to low temperature shocks.

039681
THE APPLICATION OF RUBBER TO RAILWAY USES

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Aug. 1960, pp 242-243, 3 Phot

Two specific applications of rubber for railway use are described. The first is for rubber-faced guide grooves intended for use on the Milan underground railway which will use coaches with rubber ties that run on narrow wheel tracks between which is the guide-groove. The second application is that of rubber rail pads to reduce track maintenance and replacement costs.

040174
THE DISTINCTIVE PROPERTIES OF CREOSOTE WITH SPECIAL REFERENCE TO PROTECTION OF WOOD FROM DECAY AND WEATHERING

Roche, JN, Koppers Company, Incorporated

American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605

Vol. 671966, pp 720-730, 4 Fig, 1 Tab, 1 Phot

Creosote is a mixture containing upwards of 160 separate and distinct chemical compounds all identifiable as to name, chemical structure and boiling point. The entire list is shown. About 50 of the chemicals in this long list have been tested individually in the laboratory against the fungi that cause wood decay and all were found to be toxic to the fungi. Infrared spectra of creosote extracted from a 63-year old pole and today's creosote are identical. The AREA specification for creosote are listed.

040395
REPORT ON A STUDY OF METAL SPECIMENS REMOVED FROM TANK CAR TANKS INVOLVED IN A DERAILMENT AND EXPLOSIONS AT LAUREL, MISSISSIPPI

Byrne, R .

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

MR-453, Test Rpt, July 1969, 90 pp, 25 Fig, 13 Tab, 50 Phot, 1 App

On January 25, 1969, Southern Railway freight train 154, derailed at Laurel, Mississippi as a result of a broken wheel on the leading truck of the 62nd car a non-insulated, non-continuous center-sill tank car transporting liquified petroleum gas. Fifteen tank cars of similar design and containing LPG were involved in an ensuing general derailment. Thirteen of the cars ruptured at various time intervals following the derailment resulting in ignition of contents and a general fire. General elements of this study were as follows: specimens were selected to determine if the tank steels met the minimum requirements; tests to determine the brittle and ductile characteristics of the steels involved; studies of the tensile properties of tank steels at elevated temperatures; studies of welds and weld quality; and, metallographic analyses. All data is tabulated. Temperature-impact energy transition curves for the Charpy tests are shown. It appears that tank steel toughness requirements at low temperatures should be incorporated in appropriate steel specifications for the cars involved. Research should be immediately progressed to determine performance characteristics of current designs of pressurized tanks exposed to high thermal inputs, both general and localized and to temperature gradients produced in the tank shell when exposed to high localized temperatures.

040534
MEASURES TO COUNTER FATIGUE FAILURE IN RAILWAY AXLES

Maxwell, WW, London Transport Board
Dudley, BR, Nottingham University, England
Cleary, AB, Imperial Chemical Industries Limited
Richards, J, London Transport Board
Shaw, J, London Transport Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 322, Part 2, 68-69, pp 136-171, 5 Fig, 2 Tab, 4 Phot, 27 Ref, 3 App

This paper reviews the experience in London Transport of fatigue cracking in railway axles, and presents the results of laboratory fatigue tests on full-scale axle specimens under simulated rotating bending. The investigation was undertaken with the aim of entirely eliminating fatigue cracking and fretting under the press fits of wheel-axle sets. Cold rolling of wheel seats strongly inhibits the propagation of such fatigue cracks but it does not prevent their initiation. The introduction of a stress-relieving groove, such that the edge of the press fit overhangs the groove, leads to a marked reduction in fretting and increase in life of test specimens, and the results of a limited service test suggest that the presence of such a groove reduces the stresses under the wheel hubs to a level at which cracking is eliminated.

033090
THE ALLOWABLE LEVEL OF NOISES TENTATIVELY ACCEPTED IN 1953

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Quart Rpt, Sept. 1960, p10

Actually high signal-to-noise ratio is only needed, however, for radio listeners to enjoy pleasant listening, regardless whether a noise level is larger or not beyond the allowable level. Therefore there is no harm to radio listeners in vicinity of the large cities even when the noise level is beyond 40 dB, but there is complaint for noises in the secluded place among the mountains even in the case of low noise below 40 dB. The level has been practically fixed to make clear the action which should be taken by railway administration for the broadcasting services in reducing the noises.

033235
NOISE FROM SUPER-HIGH-SPEED RAIL VEHICLES

Arai, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Quart Rpt, Sept. 1968, pp177-178

The characteristics of noise external to the super-high-speed rail vehicles of various types are estimated. For the existing-type vehicles, the data on the NTL indicate that the noise power increases as the square to cube of the speed, and the noise level at 350 km/h can be estimated to 5 equivalent to 7.5 dB higher than the level at 200 km/h. For the new-type (non-adhesive) vehicles, noises from lifting fan and due to air turbulence may become the problem.

033280
VIBRATION OF GROUND AROUSED BY TRAINS AND OTHER DYNAMIC LOADS

Ikeda, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 4, Dec. 1965, pp15-16

The author explains the correlation between vibration amplitude, acceleration generated by dynamic loads, properties of the dynamic loads, medium surrounding the loads, and travel distance of elastic wave. He makes a proposal of permission limits to vibration and its damage in conformity with the questionnaire.

037426
AUTOMATED POLLUTION CONTROL FOR SCL

Roberts, R

Modern Railroads (Watson Publications, 5 South Wabash Avenue, Chicago, Illinois, 60603)

Oct. 1970, pp 44-45, 1 Fig, 1 Phot

The pollution-control system of the Seaboard Coast Line Railroad near Tampa is far more automated than any other oily waste water system to date. The system comprises two subsystems: a gravity-separation-type roughing operation designed to save money and trouble in final purifying; and the main treatment plant, where the water is chemically treated before final discharge. A diagram shows the system flow.

037796
RAISING TRACK STANDARDS TO CATER FOR HIGH SPEEDS

Beatty, WF, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Mar. 1970, pp 225-228, 2 Fig, 2 Tab, 4 Phot

The article discusses changes in track and traffic on the British Railways from 1959 to 1969. The necessity of changes in track maintenance and design to allow higher speeds and heavier traffic is discussed. Details of changes in track, inspection methods, as well as planning of maintenance and construction with the pressure of higher speeds, greater loads and frequency is also mentioned.

039413
THE DIESEL ENGINE AS NOISE SOURCE

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

No. 28, ORE Pub-28, Jan. 1969, pp 33-35, 5 Fig

Question B104.

This report is the result of an investigation into the noise generated by a diesel engine. The various noise sources were located. The contribution to the overall noise level is described and suggestions are made to minimize these noises by engine redesign, which will surmount the portions producing the greater amounts of noise with sound-absorbent material.

039491
NOISE DEVELOPMENT IN STEEL RAILWAY BRIDGES

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-24, Jan. 1967, pp 42-43, 1 Fig

Question E82.

Measurements were made at the following characteristic points: on the bridge, 2 m laterally from center of track 2 m above rail level; 25 m laterally from bridge, 1.6 m above ground; and below the bridge, 1.6 m above ground. The frequency spectra have been recorded. A survey is given of the noise levels emitted by 16 bridges, the latter being classified according to method of track laying. A outline of future tests is given. The track will be sound proofed before the tests are run.

040036
SEPARATION AND COMBUSTION DISPOSAL PLANTS FOR WASTE OIL ON THE GERMAN FEDERAL RAILWAY

Gramatke, W

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No.4, Apr. 1971, && 160-166, 3 Fig, 8 Phot, 3 Ref

The efforts of the German Federal Railway to comply with the governmental regulations regarding oil safety precautions and anti-pollution are described. The plants for the disposal of the burning of waste oils and greases are described. The design of these plants provide for a combination of these waste oils with heating oil and propane gas for combustion in a revolving drum under specified conditions to result in ash and gas pollution-free emission of stack gases, and a means of collecting the ashes and dust for proper disposal of these solids.

033151
EXPERIMENTAL STUDY ON META-RADAR SYSTEM WITH MILLIMETER WAVES FOR OBSTACLE DETECTION

Amemiya, Y, Japanese National Railways
Kurita, N, Japanese National Railways
Uematsu, K, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 1, Quart Rpt, Mar. 1967, pp50-54, 1 Ref

In this paper, experimental results are presented on meta-radar for obstacle detection with millimeter electromagnetic waves. Using the best adjusted waveguides with coupling factor of minus 90 dB/m and attenuation constant of 4.75 dB/km, one can detect an obstacle of the order of 30 cm cube in the space 10 cm high and 3 m wide. One can evaluate a detectable distance of more than 3 km apart from the transmitter.

033265
OBSTACLE DETECTION SYSTEM

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt, Nov. 1962, pp43-46

The Obstacle Detection Investigation Committee, who has been entrusted with the task, reached the conclusion that at the present level of technology no single system exists which alone can fully satisfy the requirement; there is no alternative but to combine several different means depending on the given conditions. Surface Wave Radar System, which has been studied for this purpose by the Railway Technical Research Institute, is now past the stage of theoretical calculation and laboratory test. The 1961 research results on the signal and safety equipment to be adopted for the new Tokaido line are outlined. With the advent of 1962, tests using real trains will take place on the completed section of the new line.

033740
HOW FAST CAN TRAINS GO?

Shilkoff, MJ, Society of Automotive Engineers

Society of Automotive Engineers Journal (Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10001)

Vol. 75, No. 7, July 1967, pp74-92

Two high-speed trains are described: the French Aerotrain, which rides on an air cushion on an inverted-T-shaped track; and a modified standard rail car fitted with jet engines by the New York Central, which was tested on standard tracks. General characteristics are presented for the Aerotrain and data on dimensions, weight and performance are listed. Discussion on the NYC train include; train design, jet conversion and jet engine characteristics, computer simulation of acceleration and deceleration track and vehicle instrumentation for measuring axle and wheel stress, vertical and lateral acceleration and displacements, speed, temperature, and crosslevel and running statistics for train.

039177
TRAIN ELEVATED GUIDEWAY INTERACTIONS

Kaplan, A Lipner, N Roberts, FB Strom, RO

TRW Systems Group, Washington Operations, Washington, D.C.

06818-6036-RO-00, Feb. 1970, 141 pp

Contract DOT-C-353-66

Report on High - Speed Ground Transportation Systems Engineering Study.

The report describes a computer program modeling the response of an elevated guideway to the passing of a high-speed train. The train is modeled by a lumped parameter dynamic system. Specifically, the model consists of a two-vehicle train, traveling at constant velocity, over a series of similar, simply-supported bridges which may have initial camber. The response of the bridge is represented as the sum of normal mode responses. These are coupled to the equations of motion governing the response of the vehicles. The resultant system of equations is numerically integrated from arbitrary initial conditions. For evenly-spaced time intervals, depending on the size of the integration step chosen, the program calculates and prints out the displacement of centers of gravity of the cars, the wheel displacements, and the displacements of the truck masses, as well as the first and second time derivatives of these motion parameters. The output also includes the wheel loads and beam deflections as functions of time. The program has a plotting capability and a restart capability. It also has several options with respect to the modeling of the vehicles. (Author)

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039205
A STUDY OF THE STABILITY AND DYNAMIC RESPONSE OF THE LINEAR INDUCTION MOTOR TEST VEHICLE

Pearce, TG May, BJ

British Railways Board Research Department, Advanced Project Division, Derby, England

Final Rpt, 6806-6906, Sept. 1969, 86 pp

Contract DOT-FR-3-0261

The results of extreme dynamical analyses of the suspension system of the linear induction motor (LIM) test vehicles are presented. Suspension stiffness and damper rates are selected on the basis of computations of lateral dynamic stability, curving and response, which should enable the vehicle to travel at speeds up to 250 mph with satisfactory riding characteristics. The influence of variations in suspension parameters is also discussed in relation to possible experimental studies on high speed, wheel supported and guided vehicles, using the LIM vehicle.

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039477
RAIL-GUIDED VEHICLES ON CONCRETE TRACK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 87, Aug. 1947, pp 237-238, 2 Fig, 1 Phot

In western India, an apparently successful attempt has been made to solve the feederline problem by constructing a nine-mile Guideways track carrying penumatic-tired passenger and goods vehicles. The track consists of a continuous lime-concrete slab, 3 ft. wide and 6 in. to 9 in. deep, surfaced with cement plaster and having

a central guide rail to prevent vehicles leaving the track. Great economy is claimed for Guideways, both in prime cost and maintenance. One man patrols a four-mile length, sweeping the track clear of sand and stones.

040044
HIGH-SPEED GROUND TRANSPORTATION TUBE VEHICLE CONCEPTS

Miller, M, Department of Transportation

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

64-WA/RR-J, Conf Paper, Nov. 1967, 6 pp

A general overview is presented of high-speed ground transportation alternatives with specific focus on those concepts that operate within a tube or tunnel. The system objectives are defined and alternatives described. The tube vehicle concepts are described by categorizing them in terms of the manner used to minimize the air pressure buildup in front of the moving vehicle. The discussion of the alternative concepts examines the important system interactions and pertinent related on-going research.

040056
AN ANALYSIS OF THE RIDE RESPONSE OF A PNEUMATIC-TIRED RAPID-TRANSIT VEHICLE RIDING ON A CAMBERED-BEAM ROADBED

Isada, NM, New York State University

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

67-TRAN-1, Conf Paper, Aug. 1967, 11 pp, 10 Fig, 20 Ref

Prepared for presentation at the Sesquicentennial Forum on Transportation Engineering New York, New York August 28-30, 1967

This paper deals with the formulation and digital-computer simulation of the equations for the vertical ride motions of a single pneumatic-tired rapid-transit vehicle riding on an elevated beam-type roadbed. Dynamic bending, static longitudinal camber, and equivalent viscous damping of the simply supported roadway beam are included. It also discusses the digital-computer solutions and conclusions drawn for the vertical ride behavior of two vehicle-roadbed systems.

040204
THE TRAIN WITH A FLEXIBLE SPINE–FOR FASTER CHEAPER RAIL TRAVEL

Cassidy, RJ

Research Trends (Cornell Aeronautical Laboratory, PO Box 235, Buffalo, New York, 14221)

June 1971, pp 42-45,, 48

The new concept seems practical for both passenger and freight trains, up to 200 m.p.h. Today's familiar string of rigid, independent cars would be replaced by a continuous, flexible trainbed. The train becomes a long single vehicle onto which specialized containers of various size and content can be counted. Wheels–more closely spaced than on a conventional train, but smaller–are located uniformly along the flexible trainbed's length. Calculations indicated that the train can be bent safely around the sharpest curves on existing tracks, and that the flextrain will be far less affected by hunting. The flexible train's backbone is a steel beam, two to four inches wide and about 12 inches high. This size is perfectly adequate to withstand an 800,-000 pound longitudinal load. The flexible train is not subject to the normal jolting between cars.

033094
RUNNING SAFETY OF RUSSEL SNOW PLOW FOR DOUBLE TRACK

Matsui, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Quart Rpt, May 1959, p79

Running safety from derailment of the Russel snow plow for double track was studied by test and analysis. Shape is useful to push snow away to one side only, but it increases the amount of side pressure of the front wheel on the rail and may endanger the car for possible derailment. In the course of the test and analysis (a) the snowplowing resistance, (b) the equilibrium of forces applied to the car during the operation, (c) the amount of the lateral and vertical thrust of the front wheel on the rail, (d) the derailment quotient—the ratio of lateral thrust to vertical load at the wheel tread—and its critical value, and (e) the recommendable speeds for safety under various operational conditions.

033128
WHERE AND WHEN DID TRAIN ACCIDENTS OCCUR? (PART 1)

Urabe, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 2, No. 4, Quart Rpt, Dec. 1961, pp56-58

Discusses the application of theory and statistics in the solving of train operation problems. Used in an attempt to prevent train accidents by finding the external causes, the internal factors which are part of the interaction. Includes analysis by month and year to determine the most probable occurrence number.

033232
OPTIMAL ALLOCATION AND OPTIMAL LONG-RANGE INVESTMENT POLICY OF SAFETY DEVICES IN RAILWAYS

Abe, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 1, Quart Rpt, Mar. 1964, pp46-47

In railways there are many kinds of safety devices, such as cab warning devices, signal and switch apparatus, safety tracks, railroad crossing protections, avalanche warning devices, falling-rock detectors, train dispatching communication system, A.T.C. and C.T.C. A reliability model is discussed here, but this is a little more general than the usual multicomponent models, and is a special case of the so-called allocation processes. Problem of safety investment is, therefore, to find the method to improve the safety level of the whole system with a given cost.

/
033328
FIRE PRECAUTIONS IN LOCOMOTIVES AND ROLLING STOCK

Jarvis, JM

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 2, Mar. 1971, pp94-162, 16 Ref

Presentation concerning the types of fires on British Railways, the causes, and discussion concerning the means to avoid such hazards. Discussion includes types of extinguishing systems, detecting equipment, and types of equipment. Locomotives, passenger and freight cars, as sources of fires, are among the topics included, as are materials which are hazardous as inflammables and sources of toxic gases. Discussion between members is included.

033363
ROUTINE INSPECTION IN SERVICE OF RAILWAY ROLLING STOCK SAFETY EQUIPMENT

Gauthier, P, French National Railways

French Railway Techniques (Federation des Industriels Ferroviaires, 92 rue Bonaparte, 75 Paris 6e, France)

No. 31967, pp139-148, 1 Ref

Discusses the problems involved in inspection of rolling stock. Suggests that organization of such inspections is as important as the technology of them. The nondestructive inspection of axles and wheels and the technology is discussed as is the training and selection of personnel. The results of such a system of inspection are discussed in terms of fewer serious damages to rolling stock and cost in equipment and personnel.

033394
RAILWAY ACCIDENTS–REPORT TO THE MINISTRY OF TRANSPORT ON THE SAFETY RECORD OF THE RAILWAYS IN GREAT BRITIAN DURING THE YEARS 1967-1966, 1965, 1964

Her Majesty's Stationery Office

140 pp

Report for 1967 shows increase in accidents, though those due to technical defects are reduced. Derailments reduced were those which were caused by small wheelbase cars. Lines where accidents increased were those which had replaced steam with diesel locomotives, possible due to inexperience of personnel, higher speeds and larger loads.

033415
DERAILMENT TEST WITH EXPERIMENT TRACK

Oki, H, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 4, Quart Rpt, Dec. 1967, pp14-17

Outline of the derailment test on the experiment track was conducted there. We expect to make, from next year on, experiments with practicable and likely irregularities attached to rolling stock and track, and experiments with a train of rolling stock instead of single car. It is hoped that the causes of derailment will be fairly clarified, and more effective preventive measures will be worked out through the future tests, thereby paving the way for a derailment theory.

033420
JNR IMPROVING METHODS OF SUPPRESSING TRAIN OPERATION ACCIDENTS

Akashi, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 6, No. 2, Quart Rpt, June 1965, pp10-12

Discusses the increase of railroad accidents, the contributory factors and steps which are being taken to eliminate them. Includes the prevention of grade crossing accidents by reducing the numbers, erection of warning devices, automatic train stop system, automatic signal and relay interlock plus devices to cut off power to catenary lines when an obstruction is present.

037735
MEMORANDUM DESCRIPTION OF DERAILMENT

Magee, GM

Association of American Railroads, 1920 L Street, NW, Washington, D.C., 20036

May 1968, 8pp

Unpublished data.

A memorandum discussing a derailment includes the vehicles involved (4 diesel locomotives, 112 loaded and unloaded freight cars) and the probable causes of the derailment. The scene of the accident is described, list of possible causes, with each discussed in detail. Causes are not clearcut, but probably the rolling of an empty car, the wheel of one track on that car hitting a rail joint on the outer rail of a curve, the upward force from car roll, the bad joint caused the wheel to run over the rail causing the derailment. It is suggested that differences in rail height at joints be limited to 1/16 in. and rail wear be limited so that wheel flanges will not be raised by joint bars when hit by wheels with worn treads.

037232
RAILWAY ACCIDENTS IN GREAT BRITAIN DURING 1965

McMullen, D, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Jan. 1967, p 73

Railway accidents in Great Britain increased by 59 to a total of 1,268 in 1965. The greatest increase was in "other cause" accidents. Malicious acts by the public increased from 76 to 111. Technical defects were responsible for 227 train accidents compared with 259 in 1964. There was a 20 percent increase in 1965 in the rate per million train miles of significant accidents for passenger and freight trains. Maximum permitted speed of freight trains with four-wheeled short wheelbased wagons was reduced from 50 to 45 miles per hour. Total fatalities was 162 compared to 167 in 1964. Of these, 19 occurred in train accidents compared with 30 in 1964. Passenger fatalities numbered 28 of which 2 occurred in train accidents. Overall fatality rate was 1 in 690 million passenger journeys. Railway staff fatalities increased by 7 percent. The accident rate at public level crossings increased over the past two years from 32 to 47 accidents per 1000 crossings. During 1965, 41 public crossings were equipped with automatic half barriers bringing the total number so equipped to 56.

037233
DERAILMENT AT COTON HILL

Robertson, JRH, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Mar. 1966, pp 207

The running away and consequent derailment of a goods train on January 11, 1965, was ascribed to driver failure to observe the instructions for descent of an incline (falling 1 in 100). The leading 22 wagons were equipped with vacuum brakes and weighed 245 tons. The other 24 wagons and brakevan were unbraked and weighed 530 tons. The 2,750 hp type 4 C-C Brush-Sulzer locomotive weighed 114 tons and was equipped with vacuum/air brake equipment. As a precautionary measure to eliminate the possibility of a complete failure of the locomotive air brakes, it was recommended that the pipe connection between the vacuum train pipe and the triple valves be duplicated as the locomotives go into shops for overhaul.

037234
DERAILMENT OF PASSENGER TRAIN

McNaughton, IKA, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Dec. 1964, p 1032

The derailment of a six-car diesel passenger train followed the dropping of a diesel engine and its torque converter onto the track under the leading power coach. It was caused by the working loose and subsequent loss of the bolts securing the torque converter end of No. 1 engine assembly to the outside suspension bracket. It is not possible to detect this looseness of these bolts visually due to the static load on the bracket, but it should have been apparent to a fitter trying them with a spanner after the recent overhaul or just two days previously. As a result of this accident, examination of all similar bolts was carried out, and a number were found loose or missing. Instructions were then issued for subsequent examination at intervals of 20-24000 miles. In view of the inaccessibility of these bolts on this type of power car, it was further recommended that a bolt with a turned shank and more positive locking than Grover washers be investigated.

037235
DERAILMENT OF ELECTRIC PASSENGER TRAIN

Robertson, JRH, Ministry of Railroads, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Nov. 1964, pp 953

The derailment of the last coach of an electric multiple-unit down passenger train on December 13, 1963, which subsequently came into glancing contact with the side of another passenger train, was caused by axle fatigue. This fatigue would have been detected if the prescribed frequency for ultrasonic inspection had been observed. It was suggested that no axle be tested less frequently than every 18 months. One passenger was killed and 31 injured.

037237
DERAILMENT OF GOODS TRAIN

Reed, WP, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Aug. 1964, p 658

On September 10, 1963, the Up Dover Marine continental depot train consisting of 24 loaded continental ferry vans and a bogie brakevan weighing about 618 tons, became derailed on curved track. It was drawn by a Bo-Bo 2,500 hp electric locomotive and travelling at about 60 mile/h at the time of derailment in a valley where a long steep falling gradient changed to a steep rising gradient. The train first parted between the first and second van, but the brakes were not automatically applied on the engine. It was assumed for lack of evidence of materials failure that the parting and derailment were caused by variations in cant which helped an oscillation to develop in the play between the bodies and axles. The failure to automatically apply the engine brakes when the vacuum was severed was traced to a systems design deficiency in the air-vacuum isolating valve. It was agreed that the addition of a magnet valve connected so it was energized when the exhauster switch was at "off" and de-energized when at "on" would correct this braking system deficiency.

037240
VAN DERAILMENT AND COLLISION

Robertson, JRH, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Feb. 1964, pp 121, 1 Tab

The derailment of a lightly loaded 12-ton insulated box car and subsequent collision with the Up "Royal Scot" passenger express passing at 20 mph was ascribed to poor spring adjustment. Whereas 2-1/16-in. was the prescribed distance from the top of the eyebolt to the underside of the solebar, the eight eyebolts on this van ranged from 1/16 to 2-7/16 in. In view of the number of similar derailments involving four wheeled car with 10 ft wheelbases approaching the velocity limit of 60 mph, it was recommended that (1) there be greater availability of spring adjustment facilities, (2) lock nuts be welded after eyebolt adjustment, and (3) unauthorized adjustment of lock-nuts be prohibited.

037242
DERAILMENT AND COLLISION AT HENWICK HALL

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Dec. 1965, p 963

This accident report describes the derailment of a freight train and consequent collision with a passenger train on October 28, 1964, near Henwich Hall, England. It was concluded that the basic cause of the accident was the condition of some of the privately-owned tank cars in the train, the events leading up to the derailment being initiated by the failure of a rear coupling at a fault in the weld. Both crowns of this link had been severely reduced by wear, and the quality of the iron was inferior to that specified. The derailment itself occurred due to excessive difference in face camber in four bearing springs and excessive wear on the locating lugs in all four brass bearings in the axleboxes on one wagon.

037246
INQUIRY INTO DERAILMENTS ON THE VICTORIAN RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Sept. 1965, pp 688-690, 5 Tab

This summary of a committee of Public Accounts inquiring into derailments during the years 1954-1964 examines the incidence of hot boxes, fracture of axle-box guides, track defects, mileage and ballast with total derailments. The conclusions were that the recent increase in freight trains derailments was due to the use of four-wheel wagons and poor track conditions on low traffic country lines. Also, cross ties were in poor condition on some lines, and ballast was inadequate.

037251
PREVENTION OF ACCIDENTS ON INDIAN RAILWAYS

Khosla, GS, Indian Railway Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Aug. 1965, pp 607-608, 2 Fig

The reduction of consequential train accidents in India to about 1400 in 1964-5 from about 2000/year average during 1957-62 is ascribed to expansion and streamlining the safety organization. Since 68 percent of the accidents were caused by staff failure, the human factor was the main target in the safety program. This program included short orientation courses at safety camps, provision of leaflets and posters, optimizing education and experience with job requirements changing recruitment policy, and introduction of new mechanical and electronic appliances and a safety exhibition.

037253
DERAILMENT AT ELM PARK

McMullen, D, British Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Nov. 1965, p 916

The accident report describes a derailment of an entire passenger train resulting in 2 deaths and 18 injuries. Cause of the derailment was striking an obstruction on the line resulting in the leading bogie becoming derailed and striking an underline bridge girder. Investigation showed derailment was caused by pieces of metal deliberately placed on the rails with the object of wrecking the train. Conclusions reached were: (1) this particular incident was not an isolated case, (2) acts of sabotage are increasing.

037254
DERAILMENT AT KENTISH TOWN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Dec. 1967, p 959

The accident report describes the incident of derailment of an empty freight train and the consequent collision with a passenger train. Cause of the derailment was due to part of the brake rigging on the leading bogie of the fourth coach striking and operating an economic facing point lock with the result that the trailing bogie and following coaches took the wrong route. Evidence showed that the trailing end of the brake pull rod of the coach had been dragging along the track during an overnight journey. The pin which should have secured the pull rod to the fulcrum lever was missing, and both safety loops were broken. An on duty coach examiner improvised safety loops of wire. Conclusions reached were: (1) the improvised safety loops were ineffective, (2) the examiner made error in judgment in not removing the brake pull rod completely from the bogie, or at least releasing the brakes on the coach before securing the pull rod, (3) failure of R.R. staff to detect broken safety loops indicates examination of the train was not adequate.

037255
DERAILMENT AT KINGHAM

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Sept. 1967, p 677

The accident report describes the derailment of the last coach of a passenger train resulting in blockage of lines in both directions. Investigation showed that stretcher bar nuts had been removed from a switching unit permitting free movement of the switchblade. Vibration of the passing train caused movement of the switchblade and subsequent derailment of the last coach. Conclusions reached were: (1) a ganger had removed the nuts while preparing the switch for removal, (2) prime responsibility rests on the ganger with the realization that other members of the gang must have known what was done and should have realized the danger.

037261
MINISTRY OF TRANSPORT ACCIDENT REPORT

Robertson, JRH, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Mar. 1963, p 325

The article describes the derailment of a passenger train comprising two three-coach units. Investigation shows that the leading left hand wheel of the trailing bogie under the second coach mounted the switch of a pair of facing points at a crossover, and the whole bogie took the wrong road. The leading bogie of the third coach took the right road with the result that these two coaches were derailed and jack-knifed across adjacent tracks with consequent damage to the overhead electric-traction equipment. Conclusions reached were (1) basic cause of the derailment was excessive speed through the crossover resulting in track distortion, (2) the permanent way staff was considered at fault.

037265
COMMITTEE ON RAILWAY ACCIDENTS IN INDIA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Feb. 1963, p 180

This item relates to a committee report on railway accidents in India. Briefly a three-point program is suggested that deals with (1) selection and training of staff, (2) improvements in working conditions, and (3) measures to increase discipline and raise staff morale. Subjects considered are: a pilot project for psychological tests, expansion of training facilities, refresher courses, decentralization of administration, railway family tradition, engine instrumentation, signalling, accident levels, sabotage, creation of an ad hoc organization throughout the railways.

037266
SAFETY ON THE RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 118, Feb. 1963, p 147

The article comments on the improvement of railway safety on the German Federal Railways over the past 15 years. Between 1954-1960 a relatively short period, passenger deaths dropped from 115 to 72 and the number of passenger injuries decreased from 830 to 531. The improvement in railway safety is attributed to a general improvement in technical standards. Many improvements have been or are proposed to meet the demand for higher maximum speeds and to cope with the higher bending stresses and slightly higher axle-loads produced by diesel and electric locomotives as compared with the heaviest steam locomotives. An important measure is the introduction of the S54 rail which may supercede the S49 standard profile. Also, improvements in bridge and tunnel construction, the redefinement of clearance gauges and signalling techniques have enhanced safety operation.

037274
ACCIDENTS ON BRITISH RAILWAYS IN 1960

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 115, Nov. 1961, pp 562-563

A comparison of accidents, deaths, and equipment failures for the years 1959 and 1960 show that there were a total of 1213 train accidents in 1959 (1175 in 1960). Out of these, passenger and freight trains were involved in 416 in 1959 (415 in 1960). The total accidents at level crossings were 231 (1959) and 242 (1960). Deaths at level crossings totaled 37 (1959) and 35 (1960). Railway personnel deaths were 160 (1959) and 143 (1960). Failures, including engines, couplings, and rails amounted to 1271 in 1959 and 1395 in 1960.

037304
A CHAPTER OF AMERICAN ACCIDENTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 80, Jan. 1944, pp 31-32

Causes of several serious accidents in the United States during 1943 are reviewed. The City of Denver of the Chicago and North Central and Panama Limited of the Illinois Central were sabotaged. The Twentieth Century derailed due to the bursting of the boiler through low water level and overheating of the crown sheet. The Congessional of the Pennsylvania derailed as the result of a burned-out journal on one of the cars. A number of collisions, especially on single lines, have been due to failure to adhere to rules of the timetable and train-order method of working laid down in the Standard Code. A disturbing feature of other collisions is that they have occurred on lines provided with the latest automatic signaling and train-stop apparatus. Two accidents which occurred despite the automatic signalling and train-stop apparatus are mentioned. The advisability of slowing down express trains during the war emergency is discussed.

037451
DERAILMENT AT CONNINGTON

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Sept. 1969, p 675

An express passenger train formed of 11 bogie vehicles, approached Connington South on the down main line at about 75 mile/h, and when passing over the facing connection to the down goods line, the rear five vehicles became derailed and the train divided between the seventh and eighth coaches. This derailment was caused by the movement of a pair of facing points under the train. The points could only have been opened as a result of deliberate irregular actions on the part of the signalman, who was solely responsible for the derailment.

037461
SETBACK IN BR SAFETY RECORD FOR 1967

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Dec. 1968, p 897

The marked increase in the number of freight train derailments, from 1963 to 1967, is attributed to the rapid changeover from steam to diesel locomotives hauling unbraked or partially-braked trains consisting largely of old short-wheelbase four-wheel cars. The British Railway is retiring the short-wheelbase, four-wheel cars and replacing jointed track with continuously welded track to reduce accidents.

037470
DERAILMENT AT TYSELEY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, May 1968, p 397

An express passenger train comprising 12 coaches hauled by a Type 4 diesel-electric locomotive was approaching Tyseley North signalbox on the down main line at 60 to 65 mile/h when the bracket on the locomotive supporting part of the a.w.s. equipment became loose. The wheels of the rear bogie of the locomotive and of all 12 coaches derailed. Examination of the fractured bracket bolts confirmed that high stress fatigue failures had occurred in the four bolts. Use of maximum tightening torque of 758 lb-ft is essential to achieve the longest life under fatigue loading conditions. It was also recommended that the bracket design should be re-examined to see if longer bolts could be used.

037471
DERAILMENT NEAR HITHER GREEN

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 124, Oct. 1968, p 753

An express passenger train, consisting of two six-coach diesel-electric sets, derailed near Hither Green at about 70 mph, when the leading pair of wheels of the third coach struck a wedge-shaped piece of steel that had broken away from the end of a running rail, and became derailed. The initial derailment was caused by the fracture of a rail as the train was passing over it. The fracture was caused by excessive working of the joint resulting from unsatisfactory support conditions including: inadequate clean ballast under the two original concrete joint sleepers; the absence of a rubber pad under the rail seat; and substitution of a wood sleeper for the running-off concrete sleeper which cracked because the pad was missing. Due to unsatisfactory track maintenance, a speed restriction of 60 mph was placed on the track.

037477
DERAILMENT NEAR AMBLE JUNCTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, May 1968, p 353

The train, travelling at 75 mile/h, became derailed at a broken rail. A piece had broken away from the head of the six-foot rail at the running-on end. The rail had also broken completely about 8 in. from the end. All eight keys for four sleepers on the approach side of the joint, and the cess rail keys for the first four sleepers beyond the joint, were out and lying beside their chairs. Examination of the broken rail stated that the 95 lb/yd bullhead rail had broken to detach a piece of the head and a section of the web and foot. Both fishing surfaces were highly polished, indicating that the four-hole fishplate had been working for some considerable time. The small flaw at the upper fillet radius of the rail end would be impossible to detect with the Audigage instrument because of its small area. Similarly a crack less than 1/4-in. in extent is unlikely to be found at the bolt hole.

037478
COLLISION AT ST. ANNE'S PARK

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, May 1968, p 353

A collision between two passenger trains in the Western Region of British Railways was the direct result of irregular block working on the part of the signalman at Bristol East Depot Main Line. This accident would not have occurred if full block controls including one acceptance control had been installed on the down line. This control requires the berth train circuit at the outermost stop signal to have been occupied and cleared before a second line clear can be given.

037651
NIGERIAN DERAILMENT REPORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 107, Nov. 1957, p 529

The accident report findings for a derailment of a Nigerian Railway passenger train between Lalupon and Odo-Oba, on September 29, 1957, are summarized. The accident was fatal to 66 of the 370 passengers. Seven cars out of the 16 derailed due to track erosion. The track buckled under the weight of the locomotive. Erosion was caused by a sudden flood following several days of heavy rain. As a result of the investigation, main lines sections subject to folding will be patrolled four times a night.

037659
ACCIDENTS ON INDIAN RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 109, Nov. 1958, pp 561-562

The review on railway accidents issued recently by the Indian Railway Board explains how railway accidents take place, and what steps are taken to prevent these. The peak figure since 1947 is 24,120 accidents of all kinds, in 1948-49. This has been reduced steadily to 9,011 in 1957-58. Comparisons in the review with the railways of other countries show that operation in India is not fraught with greater risk than on large railway systems elsewhere. In an analysis of the causes of 277 "serious accidents" on the Indian railways since 1941-42, it is stated that 41.8 percent of the accidents were caused by the failure of railway staff. One step taken to reduce the number of accidents is a general tightening-up of supervision in the civil and mechanical engineering and operating departments, including greater vigilance with regard to floods and washaways.

037694
THOUGHTS OF A CURVE DERAILMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 74, Apr. 1941, 3 pp, 1 Fig, 1 Phot

The derailment of the New York Central New York to Chicago express on April 19, 1940, at Little Falls curve is described. The train was about half-way around the curve travelling 14 mph in excess of the stipulated limit when derailment occurred. Speed alone was not responsible for the accident. A locomotive inspector had instructed the driver to brake. It is believed that the driver either became confused and closed the throttle or applied the brakes which slowed the locomotive much slower than the remaining train and caused the jack-knife action between the engine and tender.

037776
INTERIM REPORTS ON DERAILMENTS AT LICHFIELD, SOMERTON AND SANDY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Apr. 1970, pp 314-315

This is an accident report of three derailments in England which occurred during June-July, 1969. All took place in welded rail and all were caused by distortions or buckling of the rail. No definite conclusions as to the cause of the incidents aside from an inherent track weakness were reached. Causes for track distortions, during the period 1958 to 1968, are reviewed.

037777
ASHCHURCH: DERAILMENT AND COLLISION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Mar. 1970, p 237

The derailment was due primarily to the excessive speed of the goods train. Responsibility must rest with the driver who drove his train well in excess of the permitted maximum of 35 mile/h. The derailment was initiated by one of the loaded mineral cars near the front. These cars are normally stable up to 45 mile/h. As several of the cars derailed they collided with four cars of an express passenger train. The condition of the track contributed to the accident but had the goods train been driven at its correct speed or even up to 45 mile/h derailment would most probably not have occurred. Speed was estimated at 50 mile/h.

037779
TANK WAGON FIRE AT CRICH JUNCTION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Jan. 1970, p 37

The train consisted of ten 100-ton Class A tank wagons loaded with light distillate feed stock with an empty coal wagon as a barrier at each end, drawn by a Class 48 diesel locomotive. The cause of the fire was brake block sparks during braking that ignited vaporized oil spilt from unsecured hatches. The subsequent heavy braking by the driver after he first saw the wagons on fire caused more oil to spill and so increased the extent of the fire. Out-of-place hatch lids may have been the prime cause of spillage rather than oversight in fastening. It is now the rule that hatches shall be secured after loading before the wagons are moved forward, as well as an independent inspection after securing before despatch.

037805
DERAILMENT DISEASE HITS CANADA

Railway Gazette International (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Apr. 1971, pp 121-122

The results of a special inquiry into derailments in Canada, from 1967 to 1969, points to the need for government-imposed safety standards similar to the U.S. Railroad Safety Act of 1970. The predominate causes of freight train derailments are the combination of higher speeds, heavier axleloads, ageing rolling stock, inadequate track maintenance, and the uncertain area of vehicle/track interaction.

037813
DERAILMENT AT BERKHAMSTED

Reed, WP, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Dec. 1969, p 915

Two derailments are described, one at Berkhamsted and another at Auchencastle in June 1968. The prime cause of both accidents was attributed to track instability. At Berkhamsted the rail had not been made stress-free at 75 degrees F after the laying of continuous-welded track in freezing conditions, though the temperature at the time of buckling was not sufficiently high as to cause unacceptable expansion pressure within the rails. The bad welded joint and reverse curve alignment were also contributory causes to the disturbance of the track. At Auchencastle the speed may have been over the limit but track stability should have been sufficient to have withstood the effect of the vehicles at that speed. To increase the stability of continuous-welded sleepered track further investigation should ensure that compressive stresses are never more than the planned maximum, to reduce maximum compressive stresses and to improve and maintain lateral stability.

037818
DERAILMENT NEAR STEVENTON

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Apr. 1967, p 273

A train, consisting of 35 short-wheel-base cars and a brake van, was travelling 50 mph when the 16th car derailed. Tests were conducted under load of the main bearing springs and revealed that the permitted 5/16 in variation between the free camber of the four bearing springs was exceeded. Such imbalance might allow the car to leave the rails at a minor track irregularity. Imbalance was augmented by lateral oscillation which developed in the empty, short-wheelbased car.

037819
DERAILMENT AT READING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, June 1967, p 433

A train travelling 15 mph between Reading General and Reading West stations derailed when a cess-side rail containing three wheelburns broke. A previous report by the Audigage ultrasonic flaw detector operator indicated two wheelburn cracks 1/4—and 1/2-in. long in the side of the rail head. It was concluded that a transverse brittle fracture occurred during passage of a previous train at the location of a wheelburn. Fatigue flaws at the wheelburns had been propagated by many thousands of loading cycles until the vertical flaws extended to cover about half the cross section of the rail head.

037821
DERAILMENT AT HATFIELD

Olver, PM, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, June 1967, p 474

Details of a derailment that occurred at Hatfield England in January 1966 are presented. This accident developed when the trailing bogie of the sixth coach of a seven-coach train derailed after dislodging a fractured piece of railhead. It was concluded that the increased vertical deflection at the joint coupled with the small fatigue crack at the bolt hole caused the brittle fractures. It was noted that insufficient care was taken during relaying operations in November 1965 in matching the fishplates used at the joint with the worn fishing surfaces of the expansion switch stockrail and the adjacent closure rail. To reduce the risk of fatigue failures, work hardening of bolt holes is being introduced on switches and crossings.

037822
DERAILMENT NEAR SITTINGBOURNE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, July 1967, p 513

The train comprising 24 empty continental ferry vans and a brake van, became derailed on plain track approximately one mile west of Sittingbourne Station. The train was running at 55-60 mile/h when it derailed, a speed substantially in excess of the 45 mile/h limit. Since the intermittent side-cutting of the high rail contributed to this derailment, the possibility of reducing it by making some change in train behavior over the curve deserved consideration. Train behavior itself should be altered if the cant were reduced to three-fourths inches at which equilibrium speed would be 39 mile/h. The fast trains which appeared to cause the intermittent side-cutting would then run more firmly against the outer rail and the intermittent side cutting would be checked.

037838
DERAILMENT AT ROTHWELL HAIGH

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, Aug. 1966, p 627

Derailment of a train comprising three empty six-wheel milk tank wagons marshalled next to the 2,500 hp Type 4 diesel-electric locomotive, and eight passenger coaches two of which were sleeping cars is described. It was travelling at about 60 mile/h. The rolling of the leading tank wagon as it approached Rothwell Haigh may have synchronized with the natural slight impact of the first common crossing, and its pattern could have matched the reversals in cant through the obtuse crossings, thus accentuating the roll. The tendency under the influence of the roll would be to lift and the falling cant gradient of the crossing was 1 in 93 for about 3 feet, it did so lift coming down on its next roll on the head of the rail at the point of derailment.

037841
SAFETY ON THE INDIAN RAILWAYS

Langley, CA, British Railways Board

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, June 1966, pp 473-475, 7 Tab

This is primarily a review of the safety record of Indian Railways. This analysis, for 1962-63, 1963-64, and 1964-65, differentiates between significant and other accidents, such as collisions at level-crossings, fires in trains, and running into cattle and other obstructions. Accidents caused by train-wrecking are included under derailments. Partings of trains which have not resulted in collisions or derailments are excluded, as are other types of failure. In general, there was a substantial drop in accidents in recent years following a big rise in traffic over the last decade and a half. Detailed data are presented throughout the article.

037842
DERAILMENT AT HEST BANK STATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, June 1966, p 459, 1 Phot

Derailment at Hest Bank Station is described. The sleeping car express became derailed over water troughs when travelling at 70 mile/h, and broke into three portions. The cause of the accident was a broken rail, a portion of the cess rail about 13 feet long. The fracture had occurred 15 feet from the nearest weld apparently started as a transverse crack through the rail head, underneath an old wheelburn, subsequently turning horizontally in the direction of travel along the web until it had turned down to the foot and up to the head leaving a piece of rail head 4 feet 7 inches long detached. An ultrasonic flaw detector examination five months prior to the derailment failed to detect the vertical crack in the railhead. The final failure occurred because of low temperature on the night of the accident which caused a tensile stress to be set up in the long welded rail, causing an increase in the stress concentration round the edge of the fractured zone.

037853
ACCIDENTS ON BRITISH RAILWAYS IN 1961

Langley, CA, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 117, Nov. 1962, pp 510-511

The annual report for 1961 on British railways safety is summarized. In many categories there are failures to maintain the high standards of the previous few years. Accidents attributed to human error decreased in 1961. The conclusions of the report are: existing safety policies are in need of review and updating; the Rule Book needs clarification; and high standards of discipline and morale among all railway personnel must be stressed.

037885
ACCIDENTS ON RAILWAYS, 1948

Mount, A

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 91, July 1949, p 22

In all, there were 1293 train accidents on British Railways in 1948. Causes were listed as: failure of the human element, 639, defective apparatus, 188, other (track obstructions, passenger or other person misconduct), 466. The report, from which this article was taken, contains a number of summarized tables which cover the past 34 years and gives the total casualties in all movement on rail, with information about traffic carried, staff employed, etc.

037948
ACCIDENTS ON THE RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 83, Dec. 1945, p 653, 1 Tab

A condensed accident report is presented, showing passenger deaths and injuries by year, from 1938 to 1944 in Great Britain.

037953
MINISTRY OF TRANSPORT ACCIDENT REPORT

McMullen, D, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, June 1953, pp 714-715, 1 Fig, 1 Tab

This article reports on the derailment of the Thames-Clyde express on April 18, 1952. The train derailed when a detached brake rod on the tender of the leading engine caught the points equipment and forced open a closed switch. Damage was considerable but without injuries or death. Circumstances are discussed in considerable but without injuries or death. A second accident is also mentioned; this one on October 25, 1952 near Crewkerne. The cause was attributed to a detached brake hanger which sought a check rail. One serious injury resulted. Details are given.

037954
MINISTRY OF TRANSPORT ACCIDENT REPORT

Reed, WP, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, May 1954, pp 613-614

This accident report relates to the derailment of a passenger train at 55 mph on straight track near Kingsbury. It was concluded that the engine was hunting on the approach to the point of derailment and for some distance past it and that this distorted the track. The hunting was caused, it is considered, by the significant variations in cross level some distance back, followed by lesser ones coinciding with the period of hunting of the engine, and partly by uneven loading of its bogie and coupled wheels which, with the tender axle side play, made it less stable.

037956
MINISTRY OF TRANSPORT ACCIDENT REPORT

Walker, RJ, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street,

London EC4, England)

Vol. 95, Aug. 1951, pp 220-221, 1 Fig

An accident occurred on May 12, 1950, on the Chesterfield-Lincoln line when a passenger train became totally derailed. The derailment was caused by the condition of the track and to a lesser extent by that of the engine. The principal fault in the track was the rapid and very considerable reversal of cross-level. Side cutting of rails suggested that side to side oscillation of engines was usual as they passed through the junction and it may have persisted for some time. A feature of this derailment was that the track had been inspected within the previous week. All concerned were experienced men, but their standards of maintenance were not perhaps as high as they should have been, and they allowed themselves to fall into an error of judgment. Further, the engine was allowed in traffic with three broken springs.

037957
MINISTRY OF TRANSPORT ACCIDENT REPORT

McMullen, D, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Aug. 1951, pp 246-247, 1 Fig

This accident report describes a mishap which occurred on October 23, 1950 near Kirkbridge. The incident involved the derailment of a passenger train at 45 mph. There were two fatalities. The cause was attributed to faulty track, causing the engine to roll badly. In addition to poor cant, the track was found to be too flexible with short light rails poorly seated in the chairs. Details are given.

037958
ACCIDENTS ON BRITISH RAILWAYS IN 1950

Wilson, GRS, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1951, p 537

The number of train accidents declined from 1,176 in 1949 to 1,156 and compared favourably with the 1946-1950 average of 1,250. The improvement would have been greater but for the increase in accidents at level crossings, although casualties there did not rise in proportion. Collisions and derailments for which signalmen were responsible were 34—small compared with the amount of traffic handled safely daily. A serious aspect of the report is in the position it reveals regarding shortage of permanent way staff and the loss of men from other departments, such as locomotive running or signal and telecommunications.

037959
DERAILMENTS IN INDIA

Latham, WG, Madras & Southern Mahratta Railway
Isaacs, EW, East Indian Railway

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 95, Nov. 1951, pp 592-593

The results of an 18-month derailment study during 1949-1950 are summarized. Primarily a statistical analysis, the derailments are categorized according to: (1) gauge, (2) type of train or yard, (3) railway, (4) month of occurrence, (5) cause, (6) time of day or night, and (7) whether at a large station. Further, the derailments are analyzed by principal causes (1) track defects, (2) locomotive defects, (3) carriage and wagon defects, (4) faults of traffic staff, (5) faults of power staff, (6) obstructions, and (7) miscellaneous causes. Specific findings for 12,993 derailments during the 18-month period revealed the following: 56 percent were due to traffic staff faults and 8.3 percent to track defects, 7.6 percent resulted from carriage and wagon defects, and another 7.6 percent from obstructions on the track; 6.5 percent were caused by faults of the locomotive staff, and 1.3 percent by locomotive defects. The remaining 12.7 percent are classed as "miscellaneous causes."

037960
MINISTRY OF TRANSPORT ACCIDENT REPORT

Wilson, GRS, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, July 1952, p 77

The derailment of passenger train travelling at 65 mph near Weedon, London is described. The accident occurred as the train exited from the transition of a curve, at which time a defective bogie became derailed causing the engine to plung down a 12-feet embankment. Several people were killed. Details are provided.

037961
MINISTRY OF TRANSPORT ACCIDENT REPORT

Langley, CA, Ministry of Transport, England

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 97, Aug. 1952, pp 191-192, 2 Fig

An accident which occurred in Glasgow on November 14, 1951 is reported. The train went out of control on a down gradient, which averages 1 in 43, and collided with eleven empty passenger cars travelling through a scissors crossover. There were several injuries and extensive damage. The runaway was due to vacuum brake failure. Details of the investigation are reported.

037982
THE INCEPTION OF THE "SAFETY" MOVEMENT

Pole, FJC

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 81, Dec. 1944, pp 546-547, 6 Phot

A historical review of the pioneering efforts of the Great Western Railway in campaigning for accident prevention is recalled. This campaign relied heavily on published magazine articles on the subject to achieve its goal. Early efforts are described.

039485
DERAILMENT AT CHIPPING SODBURY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, Jan. 1968, p 73

On September 20, 1966, the train consisting of 46 empty six-wheel milk tank wagons and two bogie brake vans, and travelling along the down main line at a speed well above the maximum of 50 mile/h allowed for empty milk tanks derailed when the trailing wheels under the 30th tank wagon became derailed. The train ran on for 1-1/2 miles to Chipping Sodbury Station where the derailed wheels struck the connection just short of the platform, causing the rear section of the train to become detached and derailed. Calculations suggested that the train speed was 60 to 65 mile/h when the brakes were applied. The cause of this derailment was excess of speed. The milk tank left the rails because of its inherent instability at speeds above its limit rather than any specific fault in the milk tank itself or any serious imperfection in the track.

039489
DERAILMENT NEAR WARRINGTON

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 125, Mar. 1969, pp 237

This accident report details a derailment which took place at Warrington when 11 coaches were derailed as a rail joint became disconnected. The nuts were loose and finally ran off the bolts. As a result of the incident, improved inspection procedures are called for the ensure that all bolts are tightened plus specifications for bolts now call for 1/4 inch longer bolt to accept a Parlox nut, and 11 thread per inch instead of 9 as previously required.

039490
PREVENTION OF DERAILMENT OF GOODS WAGONS ON DISTORTED TRACKS

International Union of Railways, Office for Research and Experiments, Utrecht, Netherlands

ORE Pub-24, Jan. 1967, pp 27-29

Question B55.

A mathematical study is presented to determine the critical value of relative wheel unloading of the leading wheel of a freight car on a track twist. Also determined are the maximum track twist which can safely be negotiated by a vehicle and the measures which need to be taken to adapt freight cars to meet the standard without modification of the torsional stiffness. The standard adopted by the Specialists Committee B55 of the ORE is a maximum permissible relative wheel unloading equal to 0.6, at a maximum permissible track twist of 7 percent.

039497
DERAILMENT AT CHEADLE HULME

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 121, Apr. 1965, p 33

The train which consisted of a steam locomotive and nine coaches ran on to a temporary underline bridge immediately before Cheadle Hulme Station, at a speed in excess of the 10 mile/h restriction, burst the track, derailed, and parted between the fourth and fifth coaches. Two children and a railway representative were killed and 27 injured. Standard indicators had been provided at the beginning and end of the restriction but the warning board near Branhall Loop was non-standard. The train ran on to the bridge where the speed restriction was 10 mile/h at a speed of at least 45 mile/h. The warning board was not as conspicuous as it should have been. Such boards should be of standard design and brightly painted. The weakest point of the temporary bridge design was shown to be the fastening of the track to the waybeam by transoms and clamps to every other sleeper.

039568
SAFETY ON THE RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 100, Mar. 1954, p 289

In 1868-74 the passenger fatality figure was 1 in 10,000,000 passenger journeys, against 1 in 35,000,000 today, representing a considerable improvement in the light of increased traffic, heavier loads, and higher speeds. This is attributable to the application of technical safeguards including obligatory block telegraph working, interlocking, and automatic continuous brakes, for all passenger lines and trains. The importance of well-drawn rules and of having properly trained and conscientious staff in the signalboxes is also stressed.

039577
MINISTRY OF TRANSPORT ACCIDENT REPORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 101, Aug. 1954, pp 246-248, 1 Fig

This accident report covers a passenger train derailment in a tunnel at 65 mph. Minor injuries were reported. The rail breakage which caused derailment was traced to a defective rail end caused by corrosion fatigue cracks at joints of stress concentration around bold holes.

039605
BURSTING A CROSSING

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 96, Apr. 1952, p 425

The Doncaster derailment attracted great attention, not only because of the resultant casualties but also from the fact that the train had just started and was not traveling at any speed. The train was passing through a scissors crossover, up slow to up main, where superelevation had to be such that the run-up of the cant was very steep-- in certain circumstances a disagreeable necessity. Of recent years a speed limit of 10 mph has been in force over the slow line approach from the station and through this connection, but unfortunately, as in so many places, *it has been indifferently observed*. The conclusion, supported by practical tests, was that the train concerned passed at from 20 to 25 mph. There was no reason for supposing that the condition of either locomotive or train contributed to the accident. It was concluded, from a review of all those cases and every relevant fact revealed by the inquiry, that the disaster was initiated by the bursting of the crossing. All crossings form inherently weak points in the track and their components are subject to constant shock.

039630
THE U.S.A. ACCIDENT SITUATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, Aug. 1943, p 201

In 1941, 5,086 persons were killed and 37,811 were injured on the lines covered by the report, the figure for fatalities shows an increase of 10-28 percent over 1940 nearly the same percentage increase 10-87 as in the number of train-miles the total for which was 969,000,000—making a fatality rate of 5.25 to one million train-miles. These injuries increased, however, by 27.78 percent to 39 in every million train-miles, a higher rate than for the previous three years. The distribution of casualties by types of accidents shows that the highest figures were caused by accidents at level crossings and to persons who were struck or run over at other points. Over 3,600 train accidents in 1941 were attributed to defects of some kind, and over 4,000 to negligence.

039654
FROM DISASTER—SAFETY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 352

Most of the major British accidents from 1840 to 1940 are described in a book "Red for Danger", by L.T.C. Rolt. The book is a record of gloom; however looked on as a record of the history that has produced modern safety devices the book is understandable and very readable. The critics main disappointment in the book is that the safety devices developed to prevent accidents were not incorporated in the same book.

039659
MINISTRY OF TRANSPORT ACCIDENT REPORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Oct. 1955, pp 484-486, 1 Fig

A ten-coach passenger train derailed on January 23, 1955, due to excessive speed on a curve on a substitute route while engineering work was being performed on the main-line, loss of life, passenger injuries and property damage were heavy. The accident was blamed on the driver; however, lack of speed restriction signals contributed to the accident.

039683
ACCIDENTS ON BRITISH RAILWAYS IN 1959

Langley, CA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 113, Oct. 1960, pp 418-420, 3 Fig, 1 Tab

There were a total of 1154 accidents in 1959. Of these, 609 were attributed to the human element, 113 were caused by technical defects, and 432 resulted from other causes. Within the causes of the human element category there were 276 collision, 119 derailments, 174 running into obstructions, 7 fires, and 2 miscellaneous accidents. In the technical defects category there were 12 collisions, 69 derailments, 14 running into obstructions, 13 fires and 5 miscellaneous accidents. The other causes category accounted for 130 collisions, 27 derailments, 205 running into obstructions, 42 fires, and 28 miscellaneous accidents.

039928
AN UNUSUAL AMERICAN ACCIDENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 98, Apr. 1953, p 389, 1 Ref

The highlights of a train accident which occurred at Washington Union Station are reported. This train the "Federal" express composed of 16 coaches, entered the station out of control and collided with the buffer-stops at 35 mph. As a result, the train broke through into the main concourse of the station, demolishing the stationmaster's office and a bookstall, and was prevented from continuing into the main waiting room only by the collapse of the concourse floor. The accident was caused by the angle cock of the compressed air brake connection between the third and fourth coaches having been turned almost completely off.

039951
ACCIDENTS IN 1954

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Oct. 1955, p 468

The number of train accidents increased slightly in Great Britain, over 1953; however, there were no passenger fatalities and the total fatalities in all rail movements was the lowest recorded, 0.5 per million train miles. The total main-line train mileage decreased slightly over 1953. The progressive decline in cases due to failure to obey signals was maintained. An encouraging trend was again recorded in accidents resulting from technical defects, probably reflecting better attention to detail in routine maintenance and examination. Warnings to children in schools and at home, and improved fencing of the lines, have led to a continual decline in the number of trespassers killed or injured by contact with live rails. Accidents at grade level crossings continue to be a problem. New signalling methods are briefly introduced.

039954
MINISTRY OF TRANSPORT ACCIDENT REPORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, Apr. 1956, pp 207-208, 1 Fig

A fully-braked screw-coupled freight train, consisting of 34 cars and a caboose, derailed June 21, 1955, at a running speed between 40 to 45 mph. The derailment occurred at the 21st car, which had faults in its spring attachments. A drawing shows the securing spring shoes of the type that failed on the derailed car. The springs were of the ordinary laminated type designed to bear on the axlebox centers, with their two ends bearing against steel shoes fastened to the underside of the wooden solebar. It was concluded that looseness of the spring shoes combined with uneven loading would have permitted excessive oscillation and diagonal pitching and that this motion caused the derailment.

039958
MINISTRY OF TRANSPORT ACCIDENT REPORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, June 1956, pp 526-527

An accident occurred at Wormit, May 28, 1955 when the train from Tayport became derailed on a sharp curve in a short tunnel at the approach to the station. The train was running at the speed of 50-55 mph which caused the tender to begin to overturn and scrape against the tunnel wall. The derailment was attributed to excessive speed.

039960
MINISTRY OF TRANSPORT ACCIDENT REPORT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Aug. 1956, pp 240-241, 1 Fig, 1 Phot

The accident occurred at Milton, near Dideot, November 20, 1955 when the excursion train consisting of 10 screw coupled coaches, drawn by a standard "Britannia" Class "7" mixed-traffic 4-6-2 engine became derailed from excessive speed at the sharply curved facing crossover. The engine went down the embankment, followed by the three leading coaches, and overturned; the five following vehicles were derailed. Four of the first five coaches were demolished or heavily damaged and 11 of the 293 passengers lost their lives; 157 were injured. The article goes on to discuss the accident in detail.

039992
DERAILMENT TEST WITH EXPERIMENT TRACK

Oki, H, Japanese National Railways

Japanese Railway Engineering (Japan Railway Engineers'

Association, P.O. Box 605, Tokyo Central, Tokyo, Japan)
Vol. 8, No. 4, Dec. 1967, pp 14-17, 2 Fig, 4 Phot

This article discusses the phenomenon JNR calls "derailment between stations." This occurs when many causal factors together result in the derailment of rail vehicles. To investigate the causes, the JNR is utilizing an abandoned rail site to gather data by duplicating these incidents.

040022
RESEARCHES ON INCREASING THE FATIGUE STRENGTH OF PRESS-FITTED AXLES

Nishioka, K, Sumitomo Metal Industries, Limited
Komatsu, H, Sumitomo Metal Industries, Limited

JSME Bulletin (Japan Society of Mechanical Engineers, 1-24 Akasaka, 4-Chome, Minato-ku, Tokyo 107, Japan)
Vol. 14, No.3, July 1971, p 712

Fatigue tests with 50 mm dia. press-fitted specimens, heat-treated by Tufftride process or other processes, were made to determine the influence of those treatments upon fatigue strengths, sigma(sub omega 2) and sigma(sub omega 1). These are fatigue strengths based upon complete fracture of the shaft and initiation of minute fatigue cracks in fretted region. Main results obtained as are as follows: tufftriding is strongly effective to increase sigma(sub omega 1) as well as sigma(sub omega 2); if the superficial compound layer of iron and nitrogen is removed, sigma(sub omega 1) is lowered but sigma(sub omega 2) does not change; specimens, heated in Argon gas at the same temperature as Tufftride process followed by quenching in water, have the same sigma(sub omega 2) as that of Tufftrided ones. It is concluded that the increases of sigma(sub omega 1) and sigma(sub omega 2) by Tufftriding are due to the hard compound layer and the compressive residual stresses.

040200
HOW HIGH CAN TRAIN SPEED BE INCREASED? A REVIEW OF PRESENT AND FUTURE

Matsudaira, T, Japanese National Railways

Japanese Railway Engineering (Japan Railway Engineer's Association, PO Box 605 Tokyo Central, Tokyo, Japan)
June 1966, pp 131-134, 5 Fig

The effect of wave propagation in air and on the rail is discussed as a theoretical limit for train speed. As practical limits to speed, the deflection by the pantograph to the wire at point of contact is described. By this principle the critical speed of the New Tokaido Line (NTL) train has been calculated as 400 km/h. Adhesion force is plotted versus tractive resistance for a 12-car NTL train, which gives the limit to speed as 370 km/h. Vibration limits speed to 230 km/h on straight track due to passenger comfort. The problems concerning curved track are also briefly discussed.

040234
NUMBER OF TRAIN ACCIDENTS BY GENERAL CAUSES EXPRESSED AS PERCENT OF TOTAL

Abex Corporation, Valley Road, Mahwah, New Jersey, 07430
Sept. 1971, 1 pp, 1 Tab
Unpublished Data

The total train accidents in the United States from 1935 to 1969, are divided into the percentage caused by the following factors: negligence of employees, defect in or failure of equipment, defects in or improper maintenance of way and structures, and all other causes. The first two categories together accounted for about 70 percent of the accidents through 1960. These two causes dropped as a percentage of the total to only 55 percent in 1968 and 1969.

040560
WHEN AND WHERE DID TRAIN ACCIDENTS OCCUR? (REPORT 4)–STATISTICAL ANALYSES OF DERAILMENT ACCIDENTS OF FREIGHT TRAINS

Maruyama

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 9, No. 2, June 1968, pp 120-121

Thirty freight train derailment accidents, which occurred from 1953 to 1967, were analyzed by regression analysis using 15 variables describing track conditions, train consists and driving technics. The variables included: the view of the tracks at the derailed position, the radius of the curve at the same position, the vertical view of the tracks, the slope of the tracks, the weight of the rail per unit length set at derailed position, the direction of derailment, the interval of the derailed car wheel shafts, the shock absorbing equipments in the coupler of the derailed car, the suspension mechanism for wheels, the running condition of the train when it derailed, the weight of loaded goods, the location of the derailed car in the train, the total number of cars in the train, the scheduled velocity of the derailed train, and the year when the derailment happened.

040562
THE ANALYSIS OF TRAIN ACCIDENTS BY MULTIPLE REGRESSION

Ishii, H Urabe, S

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)
Vol. 9, No. 1, Mar. 1968, pp 54-57, 5 Tab

Data on train accidents, occurring in train stations from 1958 to 1962, are analyzed using multiple regression analysis to express the accidents by a linear combination of up to ten of a possible 31 variables describing the accident situation. The variables used describe the accommodations at each station, number of trains, speeds of trains, etc. Results are tabulated.

040797
PANEL DISCUSSION–C&NW WAGES WAR AGAINST TRAIN ACCIDENTS

Waugh, TL, Chicago and North Western Railway
Hoffman, RP, Chicago and North Western Railway
McKerr, JD, Chicago and North Western Railway
Ingram, CW, Chicago and North Western Railway

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)
Vol. 70, 70-621-121969, pp 936-945

This paper surveys the creation and current operation of the C&NW, Accident and Loss Prevention Department. Topics include procedures for analysis of derailments, review of hot box and dragging equipment detector systems and implementation and rules education. The first year after creation of this department, the costs of our train accidents were down over 30% from the previous year of 1966. Even more encouraging was the fact that losses resulting from human failures decreased over 90%.

033079
SPEED CONTROL OF FREIGHT CARS BY CAR-RETARDER IN CLASSIFICATION YARD

Higashi, A, Japanese National Railways
Nagasawa, K, Japanese National Railways
Nakamura, M, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Quart Rpt, Dec. 1966, pp53-54

Concern has been shown for the automation of classification yards of railways in many countries. In Japan, the research on the automation of classification yard has been carried out in the Automation Laboratory of the RTRI for the last few years. In the meantime, various important equipments for this purpose, such as radar speed-meter, treadle, fullness–and weight-measuring devices have been developed. A special-purpose digital computer for automatic yard control (YAC computer) was installed at Ohmiya Yard, and the speed control of freight cars using car retarders was investigated.

033089
A FIELD EXPERIMENT ON THE "TRAIN DRAFT"

Shiotani, M, Japanese National Railways
Makino, K, Japanese National Railways
Nishizawa, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Quart Rpt, July 1960, pp1-5

There exists a gusty wind when a train passes called "train draft". The velocity of this wind is supposed to increase as the train speed increases. This factor is of importance to safety of railroad maintenance workers as train speeds increase. The article discusses the phenomenon, and the means used to measure the methods of measuring the wind velocity. The results of a model experiment are compared with one in the field.

033092
TEST FOR IMPROVEMENT OF LUMINOUS INTENSITY OF SIGNAL LANTERN

Tsuchiya, Y, Japanese National Railways
Ishibashi, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 1, No. 3, Quart Rpt, Sept. 1960, p62

Projectors with high pressure mercury vapor lamps were introduced in the flood lighting of the shunting yard. The increase in the level of illumination produced by their higher luminous output than the formerly used incandescent lamp projectors, though advantageous to general shunting task, has caused some difficulty in recognizing the light of the signal lantern. To investigate the visibility of the signal hand-lantern, laboratory and field tests were carried out, with the conclusion that the beam candlepower of the lantern should be considerably increased.

033143
LINEAR-MOTORIZED CAR BOOSTER-RETARDER L4

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 4, Quart Rpt, Dec. 1969

Intended to contribute to automatization of yard work on sorting tracks, this system catches automatically freight cars, which run into sorting tracks at widely varying speeds, boosts, retards, releases them at a safe coupling speed or stops them. It is program-controlled or remote-controlled by radio.

033168
AERODYNAMIC DRAG OF TRAINS

Hara, T, Japanese National Railways
Ohkushi, J, Japanese National Railways
Nishimura, B, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 8, No. 4, Quart Rpt, Dec. 1967, pp226-229, 5 Ref

Aerodynamic drag of trains on the new Tokaido line was measured by means of the new practical method which was proposed in the previous report by one of the authors. All the drag coefficients ever obtained by authors, i.e. those mentioned above and those measured previously on the lines with narrow gauge, are shown collectively. The sum of the aerodynamic drag of the train on the new Tokaido line and their mechanical resistance is compared with the total running resistance measured by Nishiola. They agree well.

033170
FEASIBILITY OF LINEAR MOTOR FOR CAR-RETARDER OR CAR-ACCELERATOR AT MARSHALLING YARDS

Mitomi, T, Japanese National Railways
Usami, Y, Japanese National Railways
Ishihara, M, Japanese National Railways
Kojima, N, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 2, Quart Rpt, June 1968, pp91-95

Control of wagon speed is one of the most important factors in the automation of marshalling yards. This paper is a report of the basic test about the feasibility of linear motor as a speed control machine, which can accelerate as well as retard the freight cars. As the result of these fundamental experiments, thrust of about 50 kg can be expected at the wheel-journal position as a retarder in the case of using 50 cycle power source. It will increase in accordance with the decrease of cycles.

033196
THE PERIOD OF REGULAR INSPECTION OF FREIGHT CARS–ESTIMATION OF THE DISTRIBUTION OF PERIODICAL CAR KILOMETERS AND A STATISTICAL ANALYSIS OF THE PERIOD OF REGULAR INSPECTION

Katsuki, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 2, Quart Rpt, June 1964, pp37-42

To study the period of regular inspection, it is necessary to know by some means or other the amount of work done by each car. Hence we first analyze the flow of freight cars and then estimate the distribution of periodical car kilometers. Also, it is necessary to have rationalized car inspection from the standpoint of discrimination between groups of freight cars with different distribution of periodical car kilometers and different periods of regular inspection.

033199
HYDRODYNAMICS OF PHENOMENA DUE TO PASSING-BY OF TWO TRAINS

Kawaguchi, M, Japanese National Railways

Railway Technical Research Institute (Japanese National

Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 3, Quart Rpt, Sept. 1964, pp30-33

The steady flow of a perfect fluid past an obstacle has been investigated by many authors, but there have been few works on the unsteady flow due to the motion of many bodies. Such a flow became necessary in connection with the construction of the new Tokaido truck line where trains will run at the speed of 200 km/h. The unsteady flow of a perfect fluid is caused by the motion of two circular cylinders and of two spheres which pass by each other, in order to estimate the pressure variation when the two high-speed trains pass by each other.

033287
PROCEEDINGS OF SEMINAR ON RAIL CAR UTILIZATION

Bonham, FS, Monsanto Company
Phillips, EA, Union Tank Car Company
Sulik, LR, Dow Chemical Company

Manufacturing Chemists Association, 1825 Connecticut Avenue, Washington, D.C., 20009

Nov. 1967, 66pp

Seminar Proceedings.

It was the purpose of this seminar to explore the newest techniques in rail car and systems design along with railroad programs which provide the greatest degree of rapid recovery of use of rail cars. The effective adaptation of almost instantaneous data retrieval is one method explored as a means of more fully utilizing available rail car capacities. Other means included more efficient use of railcars while in the hands of shippers, reduced warehousing use of existing cars and better designed cars and systems. All of these methods were discussed in this seminar with the hope that it would provide all interested in reduced distribution costs with a greater knowledge of the latest tools available to move the goods of commerce faster and more efficiently. Specific presentations included: Planning for Improved Rail Fleet Utilization; Designing for Improved Car Utilization; Inventory Control of Rail Equipment; and use of a Computer Based Information System to Reduce Total Distribution Costs.

033413
CONTROL OF ROLLING STOCK MAINTENANCE

Harada, R, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 10, No. 4, Quart Rpt1969, pp8-11

Computerization in the field of rolling stock maintenance began with a set of punch card system installed in 1955 at the Naebo Workshop to make tabulations in the accounting and supplies business. Tendency arose in JNR to switch the accounting of workshops from PCS to EDPS and develop it for application to work planning and administration in general. Since then a study was continued about shop-in-planning, work process planning and data transmission system among other things. The team was to push ahead the use of EDPS for the repair and inspection of rolling stock at the 27 workshops throughout JNR, as a sub-system of the JNR's total system which would eventually be constructed.

033418
AUTOMATIC INSPECTION AND REPAIR OF WHEEL SETS

Otokonzawa, S, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 7, No. 1, Quart Rpt, Mar. 1966, pp22-24

For the inspection and repair of wheel sets, the workshop facilities are being consolidated by adopting a flow pattern system and providing semi-automatic equipment. This rationalization project is being carried out one by one at the 26 workshops of JNR of which four have the new equipment already in operation. The equipment has, indeed raised the quality of the inspection and repair work of the wheel sets, and enabled better maintenance to be made at smaller expenses. Manual handling has been eliminated, thereby reducing the physical labour of workers by a considerable degree.

033454
RAILWAY BREAKDOWN SERVICES

Cameron, KRM

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 31971, pp213-285

The author discussed the changed conditions brought about by the streamlining and rationalization of the railway system, the newer and more sophisticated locomotives and rolling stock, and the changing pattern of traffic. What effect on breakdown practice has been brought about by the extension of overhead electrification? What features are considered necessary in a modernized design of breakdown crane? What new problems have arisen in breakdown train practice due to the newest forms of rolling stock? Is the powered jacking system the answer? Are breakdown trains in need of modernization, or is there a greater need for a development of more road vehicles for this work? What is the impact on staffing of breakdown trains in the light of changed railway and social factors?

037680
ROLLABILITY OF CARS

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 621961, pp 799-802, 1 Tab

Potomac Yard tests were conducted with cars obtained from the yard which were hard rollers. The rolling resistance of the car as received in the yard was compared with that after certain changes were made for improvement. A total of 408 test runs were made, utilizing 7 freight cars. Observations made during the testing were skewed trucks on tangent track; dragging brakes; wind up to 12 mph; poor center plates; comby wheels; hollow wheel treads; wheel diameter difference of 3/8 in.; and side bearing clearance from tight to 1/2 in. Changes made intended to improve rolling resistance were: grease outer rail on curves; apply regular grease on center plate; moly grease on center plate; add liners for side bearing clearance; grease side bearings; add nylon moly content liners in center plate; add brass liners in center plate; and tighten brake rods for rod eccentricity. Significant differences in the average rolling resistance were reported following the changes.

037737
BALANCED TRAINS

Macomber, F, Kearney (AT) and Company, Incorporated

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 2-9, 14 Fig, 3 Tab

The potential of balanced unit trains operating on a shuttle basis between pairs of cities is discussed. To obtain the ultimate in utilization of such trains, they must shuttle between the cities at desirable times, say 10:00 p.m. and also undesirable times, say 10:00 a.m.

Studies showed that a single engine unit hauling 20 trailers of special light weight permanently coupled cars and operated by a three man crew could compete with the highway under most conditions and usually provide a wider margin of profit than the highway operation.

037740
LONG TRAIN OPERATION

Robinson, AC, Detroit, Toledo and Ironton Railroad Company

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 10-12

The operation of long length heavy tonnage consists is predicated by traffic patterns. Most of the basic technology to effectively move long trains exists today; although it has not been fully implemented. The use of radio control slave units, approximately 2/3 of the way back in a consist, has relieved to a large extent excessive drawbar force and braking problems. To efficiently handle trains of from three to well over five miles in length obviously requires adequate assembly, departure, passing and arrival track capacities. Some properties are presently blessed with the track capacities required, and long train consists present little difficulty. Where these facilities do not already exist, there must be sincere justification for this physical facility expenditure. Expanded use of integral trains, unit trains and the consolidation of traffic through mergers and operating agreements will bring a marked increase in the number of long trains being operated.

037741
SHORT TRAIN OPERATION

Norwood, JB, Denver and Rio Grande Western Railroad

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 13-17

The experiences of the Denver and Rio Grand Western in operating short trains is reviewed. The policy was that the railroad would run tonnage as it showed upon connections.

037742
SIMULATION OF OPTIMUM TRAIN OPERATION

Eberhardt, JS, Burlington Lines

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 18-22, 10 Fig

The author discusses the concept and development of computer simulation models to study vital issues and policies which would affect the entire railroad network. The issues for which it is hoped models can be developed, include train lengths, scheduling and blocking.

037876
RAIL BRAKES FOR SHUNTING YARDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 76, Apr. 1942, p 432, 3 Fig

The Marchais brake is hydraulically operated, and the braking effort is made proportional to the weight of the cars. The construction, principles of action and control system for the Marchais rail brake are shown. This braking system has been installed at the Rennes yard of the French National Railways.

039501
AREAS OF CONCERN FOR FREIGHT CAR ENGINEERING

Radford, RW, Canadian National Railways

Dresser Transportation Equipment Division, 2 Main Street, Depew, New York, 14043

Tech Proc, Sept. 1969, pp 16-25, 19 Fig, 12 Phot

Technical Proceedings from 1969 Railroad Engineering Conference.

The aims of containerization are to provide cheaper, safer and quicker transportation for commodities which can be placed in standard size boxes. To obtain maximum benefits, special equipment is necessary and economically justified. The size of the containers, loading and securing methods, and size and capacity of the cars are described. A series of tests were made to determine the source and methods to eliminate the poor ride qualities of 60 feet container cars used on the Canadian National Railways. The tests were run over the same track at a range of speeds. The acceleration was measured in the vertical and lateral directions. Track hunting was apparent above 45 mph. The results of the tests are shown.

039631
CONTINUOUS MEASUREMENT AND CONTROL OF THE SPEED OF WAGONS SHUNTED OVER HUMPS

International Union of Railways, Office of Research and Experiments, Utrecht, Netherlands

ORE Publ 23, July 1966, pp 18-19, 1 Phot

Question D74.

The classical automatic marshalling yard with retarders, weigh rails, wagon rollability measurement, doppler radar speed measurement computers, etc. falls short of what is required. Six new systems being developed in Europe are briefly described. These systems will be evaluated by comparing the following quantities: installation costs, system capacity,. annual maintenance costs, and shortcomings.

039647
ROLLING STOCK WHEEL TREPANNING MACHINE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, p 280, 1 Phot

The machine has four identical spindles mounted in separate heads, two with horizontal adjustment, and two with vertical adjustment. The spindles can be readily arranged to deal simultaneously with two, three, or four holes, and to cover a wide range of wheels of varying diameters. Cutter spindle speeds range from 12 to 69 rpm. suitable for dealing with holes from 1-1/2 to 6 in. dia. The drive is by means of two separate 15-hp constant-speed motors with worm reduction gears and two eight-speed change gearboxes. As well as trepanning the large sprag holes, the machine is also capable of drilling smaller holes in disc wheels.

039655
EASIER MAINTENANCE CONTROL FOR RAILWAYS

Margo, BA

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, pp 359-360, 5 Tab

A small Canadian railway has initiated a planned maintenance system to detect excessive maintenance costs. The system is designed to point out when equipment should be replaced rather repaired. This method is applicable to anything that has to be maintained; locomotives and rolling stock; roadbeds and tracks; machine-shop equipment; buildings and their components (floors and roofs); paving of roads, and so on. Tables are shown as examples of the system. A measure of operating conditions are established using a Table of Wear Points. This Table shows arbitrary values for various degrees of operating conditions. Multiplying these wear points by each other a wear factor can be arrived at. History cards are kept on each piece of equipment to accumulate the wear factors.

039669
BRAKING PRACTICE AND DEVELOPMENTS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, Jan. 1960, pp 96-97

The article describes features which are standardized and in widespread use by British Railways and certain designs still under investigation. The object was to provide a picture of developments taking place in the country for the non-expert in matters of braking. Elementary considerations of energy absorbtion and the forces acting on a wheel during braking, followed by a concise statement of the limiting factors involved are considered.

039701
RUNNING TESTS OF A FLAT CAR TRAILER CARRIER AND A THREE LEVEL AUTO CARRIER ON THE BURLINGTON RAILROAD

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

ER-17, Res Rpt, Feb. 1962, 59 pp, 44 Fig, 4 Tab, 4 Ref, 1 App

This test report discusses the program and results which investigated dynamic action for a flat car trailer carrier and a tri level auto carrier. In addition to the interaction of the cars, clearances, stability and riding quality were also tested.

040014
THE EVOLUTION OF BRAKING FOR FAST TRAINS IN RELATION TO THE RISE IN SPEED

French Rail News (Federation des Industries Ferroviaires, 12 rue Bixio, Paris 7e, France)

No.2. 1970, pp 22-24, 5 Fig, 2 Phot

The cast iron brake block can be retained up to 200 km/h by a suitable arrangement of the signalling. In the field of the very high speeds, 250/300 km/h, it is necessary to resort to the combined systems. The test results of the electromagnetic brake up to 270 kmh are shown. Due to the frequent need for braking in high speed travel electrical control of braking will necessarily replace air brakes. A combined disc-cast iron block brake system was tested at 250 km/h and results are discussed. Hydraulic brakes and Foucault current brakes are considered.

040106
BUFFER LOCKING ON REVERSE CURVES

Green, JIT, British Iron and Steel Research Association

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 120, Nov. 1964, pp 903-904, 1 Fig, 1 Tab

Calculation of the minimum reverse curves, which cars entering freight yards will pass around without the buffers of adjacent cars becoming locked, is made. The formula incorporates the following variables: length of car over buffers; wheelbase; throw of buffers in inches on a curve; diameter of buffers; and length in feet of straight track joining reverse curves. The valves for a number of steel-carrying cars used on the British Railways are shown.

040148
STUDIES ON INTERVAL DISTANCE BRAKING WITH PRIMARY AND SECONDARY RETARDERS IN THE HUMP INSTALLATIONS IN TRAIN YARDS

Koenig, H, Bauabteilung der Generaldirektion derr SBB

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 19 No.1,2, Feb. 1970, pp 13-20, 3 Fig, 2 Tab, 6 Ref

One important problem of the automation of train hump yards is the automatic control of the speed of all cars in the distribution track zone between the hump and the last of the distribution switches. The results of the studies of this problem are described, which the Swiss Federal Railways researched with the aid of their Computer-Program. The basic observations of the free-running of cars in the distribution zone were considered, which required the distinction between "free-rollers" and "hard-rollers". To equalize this situation, the "hard-rollers" required acceleration and the "free-rollers" required deceleration or braking. In addition, the basic considerations of braking in the distribution zone required studies to attain the desired speed interval braking of the various types of rolling cars. A detailed description of the programmed braking is given, as well as its application to these hump yard operations.

040167
VENTILATION RESEARCH PROGRAM AT CASCADE TUNNEL, GREAT NORTHERN RAILWAY

Aisiks, EG, Parsons, Brinckerhoff, Quade & Douglas, Inc.
Danziger, NH, Parsons, Brinckerhoff, Quade & Douglas, Inc.

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 711969, pp 108-128, 8 Fig, 3 Tab, 10 Ref

A test and research program was conducted in April 1966 in the Great Northern Railway's Cascade Tunnel to ascertain the effects of diesel-powered trains moving through the tunnel from the standpoints of ventilation and engine heat dissipation. The test program included establishing measurement stations in the tunnel and on a locomotive consist, recording the pressures, air velocities and temperatures at these stations, analyzing the results and using an analytical approach previously developed to predict the effects of train movements through a tunnel. The test program was generally successful and fielded the desired results. A comparison of predicted and observed results confirmed the validity of the analytical approach used.

040192
SD-45 LOCOMOTIVE DYNAMIC BRAKE TRAIN HANDLING TESTS ON PENNSYLVANIA RAILROAD

Klinke, WR Buesing, EJ

General Motors Corporation, 3044 West Grand Boulevard, Detroit, Michigan, 48202

898-68-132, Test Rpt, Aug. 1967, 76 pp, 39 Fig, 1 Tab, 8 Phot, 7 Ref, 2 App

Because of a major derailment near Johnstown, Pa., a series of dynamics brake handling tests were conducted between Harrisburgh and Pittsburgh, on severe grades and curves. The trains in which the test unit and the adjacent long overhang boxcar operated were varied in nature, ranging from tonnage trains while operating in a two-unit consist to trailer trains and PR trains in four—and eight-unit consists.

In general, with the loaded long overhang boxcar leading the train, the records indicate that at no time did the danger of derailing due to drawbar forces exist. No instances in the entire test program exhibited lateral force levels which would be of concern with respect to derailment. The boxcar was loaded with freight during all of the tests.

040487
AUTOMATIC TRAIN OPERATION ON LONDON TRANSPORT RAILWAYS

Maxwell, WW, London Transport Railways
Ware, DK, London Transport Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 56, No. 6, Paper No. 686, 66-67, pp 593-612, 7 Fig, 4 Ref

The paper reviews some experiences with the original trains and equipment and describes changes incorporated in the Victoria Line equipment. London Transport expects to obtain the following advantages and benefits from their system of automatic train operation: regularity of service due to the consistent driving technique; minimizing of energy consumption; proper observations of speed restrictions; possibility of making up time and closing up the service by selective elimination of coasting; opportunity of introducing one-man operation.

040490
THE COMPUTATION AND ANALYSIS OF LOCOMOTIVE PERFORMANCE

Bonavia, PC

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 320, Part 6, 67-68, pp 645-657, 6 Fig, 4 Phot

Management needs the type of service which can be provided by an effective technical records and statistics section in the field of modern locomotive engineering. The computerized system described is designed to pinpoint repetitive locomotive failures and equipment reliability trouble areas. Locomotive failure data as soon as reported, are examined against the locomotive history card. After the fault has been traced and rectified, the actual cause of failure is detailed on a casualty report form. This information, together with reports received from depots of failed components found outside or during routine examination, forms the basis of the system. All these reports are now passed to a data processing center where the aim is to produce a statistical guide for the engineers.

040493
CONTAINER DESIGN

Wilcock, H, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 4, Paper No. 694, 67-68, pp 303-335, 22 Fig

The application of containers to railroads is reviewed. Topics include container design, size, strength, handling methods and equipment, standardization activities, materials of construction, testing, and safety factors.

040546
DEVELOPMENT OF RAILWAY TECHNIQUE AND OPERATION

Koster, JP, Netherlands Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 301, Part 5, 64-65, pp 379-404, 1 Fig, 14 Phot

Recent operational statistics for the Dutch Railways are discussed. An extensive program to reduce operating costs is described. Technical improvements in testing equipment, automatic coupling, traffic control systems, and directions of future research are outlined.

033282
LOADING METHODS

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 19104)

Railroad Environment: A Guide for Shippers and Railroad Personnel.

Discusses the various types of loads, such as free floating loads, controlled floating loads, wall anchored loads and describes the characteristics of each. Also discusses the means to be used to minimize shifting and consequently, intrinsic damage to the loads.

033283
INSTRUMENTATION

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 19104)

Railroad Environment: A Guide for Shippers and Railroad Personnel.

The instrument in general use on railroads for measuring longitudinal shocks is the single plane impact register. This device consists of a weight resistricted from movement in all planes except longitudinal, where it is restrained by a spring. A stylus is attached to the weight and marks the weights movement on a paper chart fed continuously by a clock mechanism. For accurate measurement of impact shocks or vibrations, accelerometers must be used. Accelerometers should be linear within a range of plus or minus 25 G's, and capable of withstanding occasional shocks to 50 G's. Accelerometers measure the apparent weight of the body to which they are attached, 1 G is a force equal to the weight of the body.

033343
DESIGN OF LOADS FOR RAIL SHIPMENT

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 79104)

Railroad Environment: A Guide for Shippers and Railroad Personnel.

In providing protection against shock and vibration in the vertical direction, the shipper may be guided by his experience in material storage. This publication provides a guide on how this knowledge should be applied. Topics include: protection from lateral shock and vibration, longitudinal restraint required for various types of cars, a description of commodity categories and strength of tie-down materials.

033344
LONGITUDINAL SHOCK AND VIBRATION

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 19104)

Railroad Environment: A Guide for Shippers and Railroad Personnel.

All longitudinal shock involves impact between two cars, and generally the cars are either traveling in the same direction or one is standing. For most commodities, impacts at speeds of less than 5 mph, even with standard draft gear, do not contribute to damage. The railroad yard is the source of most impact damage, whether the cars are flat switched, or sorted by modern gravity systems. Use of long travel shock absorbers can do much to reduce shock forces. Again we must stress the importance of low speed switching and good loading practices. Railroads must continually police their systems to maintain switching speeds of less than 6 mph.

033345
VERTICAL SHOCK AND VIBRATION

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 19104)

Railroad Environment: A Guide for Shippers and Railroad Personnel.

Shock forces resulting from over the road operation are seldom severe in the vertical plane, about 2 G maximum. During impact between two cars, there is a force couple due to differences in the horizontal level of the couplers, and the center of gravity of the cars. The coupling causes the cars to dip vertically downward at the striking end and to rise at the opposite end. Other causes of vertical shocks are; column loading due to angle of contact, eccentricity of load contact, strength of the sill, and body camber, all of which tend to force the cars out of vertical alignment. Relative vertical accelerations for various modes of transportation are shown. The vertical vibration of a standard freight car running over main line track in fair condition will seldom exceed 1 G. About 2 G's is the maximum vibration to be experienced anywhere on a railroad.

033346
LATERAL SHOCK AND VIBRATION

Railroad Environment (Penn Central Company, 6 Penn Center Plaza, Philadelphia, Pennsylvania, 19104)

Railroad Environment: A Guide for Shippers and Railroad Personnel.

Brief description of lateral shock and vibration are given. During impact, lateral shocks result from forces exerted in vertical and longitudinal planes, and are generally less than 1.0 G's and have a time duration of less than 0.02 seconds. Due to the short time duration of these shocks, protection against lateral vibration should be sufficient to protect the lading. Lateral vibrations are generally associated with and are caused by out of phase vertical vibrations. They may also be excited by turnouts (switches) on unelevated tracks, rails out of alignment, or worn truck parts. They are seldom due to curves. Except in special cases, lateral vibration forces are not a direct cause of damage.

039920
REDUCTION OF DAMAGE CAUSED BY COUPLING IMPACT

Meyer, WJ, Pullman-Standard Car Manufactoring Company

American Society of Mechanical Engineers, Railroad Discussion Group, Cleveland, Ohio

Tech Rpt, May 1953, 34 pp, 14 Fig

This paper develops some of the early concepts of a major cause of damage in railroad cars namely switching impacts and the resultant energy that must be absorbed by either the car and its lading or by an impact control device such as draft gear or sliding centersill device. This analysis led to the concept of reduction of coupling force through increase of travel and therefore, duration of impact. It was felt that by these means coupling force can be reduced and consequently, damage would be reduced as well. The concept developed in this paper is still generally accepted and is reflected in the qualification test of all modern underframes.

040237
TEST CONDUCTED BY GENERAL MOTORS PROVING GROUNDS NOISE AND VIBRATION LABORATORY, REPORT NO. 22050

Isaacson, RD

General Motors Corporation, Technical Center, Chicago, Illinois

PG-22050, Test Rpt, Oct. 1966, 31 pp, 23 Fig, 3 Tab

The objective of this test was to obtain data during a typical tri-level shipment known to cause automobile frame damage. The rail car chosen was NIFX-13551 which was a split deck, low tri-pack car with side cushions. The top level, front auto position was chosen as the location for the automobile because of a high failure rate among autos shipped in this position. The "T" hook, was used and standard tie-down procedure was followed in securing the automobile to the rail car. The instrument car was coupled directly to the tri-level rail car containing the test automobile. Large strains were recorded on a number of gages immediately after tie-down. Strains greater than 1500 KE generally result in yielding of the material for the type of steel used in automobile frames. The value was exceeded at each tie-down hole on initial tie-down.

040326
THE HYDRACUSHION CAR

Mac Curdy, WK, Thermo Materials, Incorporated
Hermes, RM, Stanford Research Institute

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

58-RR-2, Conf Paper, Apr. 1958, 4 pp, 5 Fig, 1 Tab

Contributed by the Railroad Division of the ASME for presentation at the ASME-IEEE Joint Railroad conference, Cleveland, Ohio, April 9-10, 1958

The unique constructional features of the Hydracushion car are outlined and manufacturing, operating, and maintenance experience with such cars is reported. In the Hydracushion car a hydraulic buffer has been combined with a sliding-still cushion-type underframe to control the flux of energy to the car lading. The Hydracushion car was completed in May, 1956. After testing it was inspected. A few minor structural changes of the cars on a production basis offered no particular problems. No maintenance problems have developed on any of the cars. That the hydracushion mechanism does meterially reduce damage to lading is shown.

040327
CUSHIONING REQUIREMENTS FOR ADEQUATE LADING PROTECTION

Peterson, WH, Pullman-Standard Car Manufacturing Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

59-A-312, Conf Paper, Dec. 1959, 12 pp, 14 Fig, 7 Phot, 2 Ref

Contributed by the Railroad Division of the ASME for presentation at the Annual Meeting, Atlantic City, N.J., November 29-December 4, 1959.

The problem of lading damage is approached from the standpoint of what is required to eliminate coupling impact damage to a critical class of lading under present railroad operating conditions. A series of full-scale exploratory impact tests were conducted in which a wide range of load subdividing and underframe cushion travels were studied using removable bulkheads and an adjustable cushion fixture in the test cars. The results show that to evaluate the lading protection ability of cushioned cars on the basis of the percentage reductions in coupler force or car-body accelerations along, or because some seemingly high cushion capacity has been provided, can be very misleading when resilient types of lading are considered. When 30 in. of cushion travel are used, the optimum potential of cushioning is realized and load subdividing and other means of securement are unnecessary.

040328
PERFORMANCE TESTS OF LONG TRAVEL CUSHION UNDERFRAMES

Van Der Sluys, W, Pullman-Standard Car Manufacturing Company
Nanos, WP, Pullman-Standard Car Manufacturing Company
Marshall, MG, Pullman-Standard Car Manufacturing Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

63-RR-3, Conf Paper, Apr. 1963, 15 pp, 16 Fig, 5 Phot, 1 Ref

Contributed by the Railroad Division of the ASME for presentation at the ASME-IEE Railroad Conference, Atlanta Georgia, April 25-26, 1973.

In 1962 it was decided to evaluate experimentally the order of difference to be expected from sliding center-sill cars having sill travel of 20 in. and sill travel of 30 in. Also, the possibility of developing new criteria for judging the comparative performance of freight cars during impact was to be studied. The results of this investigation are reported in the paper. The test car used was a 50 ft 6 in., 70-ton insulated box car. The test car was used as a standard car during all impacts. The striking cars were PS-3 all-welded hopper cars loaded with sand to the full 50-ton rail capacity. At impact speeds below 5 mph for the 20-in. cushion or 6 mph for the 30 in. cushion, end-wall lading forces are negligible since floor friction is sufficient to accelerate the lading as required. At some point over these impact speeds, depending on impact intensity, the lading will be compressed against the end wall with a force which is at least twice as great and possibly many times as great for the 10-in. as for the 30-in. cushion. The unit end-wall force will be much higher for light loads than for heavy loads.

040330
PERFORMANCE OF TOFC-COFC ARRANGEMENTS IN YARD-TYPE IMPACT TESTS

Van Der Sluys, W, Pullman-Standard Car Manufacturing Company
Spence, JH, Pullman-Standard Car Manufacturing Company
Marshall, MG, Pullman-Standard Car Manufacturing Company

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

66-WA/RR-1, Conf Paper, Dec. 1966, 12 pp, 14 Fig, 1 Tab, 10 Phot, 2 Ref

Contributed by the Railroad Division of the ASME for presentation at the Winter Annual Meeting and Energy Systems Exposition, New York, N.Y., November 27-December 1, 1966.

As shipment of trailers and containers by rail continues to increase, there is a growing tendency not to provide special handling, and, ultimately, complete mixed service through hump years is desirable. For this reason the cushion arrangements to provide protection to the lading during arrangements available, but until recently no direct comparison had been made by tests of cushion effectiveness. The purpose of this paper is to present this factual comparative test data, to relate this to the normal railroad operation, and to indicate cushion requirements, limitations, and related problems in moving toward unrestricted handling of piggyback and container cars. Cushion effectiveness should be measured using endwall force in string impact tests with a carton load. The 12-in. nominal travel, shear rubber pull-up stand is a major improvement over the cushioning of the commonly used wind-up stand. Unrestricted handling through hump yards will require car-body cushioning approaches 30 in. or on-deck cushions with somewhat lower travels for adequate lading protection.

040380
SHOCK AND VIBRATION ON RAILROAD MOVEMENT OF FREIGHT

Simmons, LC, New York Central System
Shackson, RH, New York Central System

American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017

Paper, Dec. 1964, 6 pp, 8 Fig, 2 Tab

One of the more pressing problems concerning rail movement of freight is the cost of securing lading to the car and protecting it properly from impact shock. The highway truck has an advantage in this regard because friction between rubber tires and pavement govern the maximum longitudinal forces developed, except for dock impacts. Rail, however, has the advantage in vertical and lateral shock and vibration control and, with proper design and operation, can meet the track's longitudinal conditions. Adverse criticism has been received by the railroads because of their past reluctance to take the necessary steps to reduce lading damage. We now have the hardware to provide this protection, and the rail industry as a whole is rapidly applying it to its more critical loads. The purpose of this paper is to acquaint the shipper with the railroad environment and with the characteristics of the equipment available for securing lading.

040784
COMPUTERIZED CLEARANCES ON THE NORTHERN PACIFIC RAILWAY

Shoemaker, DH, Northern Pacific Railway
Knittel, RH, Atchison, Topeka and Santa Fe Railway
Harmon, DE, Southern Railway

AREA Bulletin (American Railway Engineering Association, 59 East Van Buren Street, Chicago, Illinois, 60605)

Vol. 691968, pp 831-835

A series of three brief summaries of experiences with computerized clearances on the different railroads are presented. The printed output of these programs usually contains the reproduction of the load configuration, routing, car identification, direction of movement, and precise messages stating: 1) the location, by number and route, at each point where a load is to be restricted in speed, 2) the location at points where the load fouls and is to be rejected, 3) alternate routing, and 4) a summary message advising how the load may be handled or a message rejecting the load.

033195
EVALUATIONS OF TRAIN RIDING COMFORT UNDER VARIOUS DECELERATIONS

Urabe, S, Japanese National Railways
Nomura, Y, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 5, No. 2, Quart Rpt, June 1964, pp28-34

When a train runs on the track at high speed, passengers are subjected to various forces which are produced by the change of its speed. In general, the riding comfort felt by them is evaluated in terms of this change. Determine the allowable limits of the train riding comfort for passengers, obtain the data on their feelings and evaluate them quantitatively under various conditions. Also intended to calculate significant differences between individual passengers.

033217
PRESENT STATUS OF STUDY AND PROBLEMS ON SUPER-HIGH-SPEED TRAIN

Hara, T, Japanese National Railways

Railway Technical Research Institute (Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 9, No. 3, Sept. 1968, pp163-167

From June 1966 to August 1967, seminars were held for the study of the super-high-speed train systems in RTRI to grasp the present status of study and to ascertain the problems in future on this subject. Materials and discussions in the seminar are arranged and described in this report. Topics of social and economic aspect, power requirements, suspension systems, propulsions systems, current collection, tunnel ventilation, are discussed.

033356
FIELD MEASUREMENTS OF TRAIN DRAFTS

Fukuchi, G, Japanese National Railways

Permanent Way (Japan Railway Civil Engineering Association, Kyodo Bldg, 18-7 Hagashi-Uyeno 2 Chome, Daito-ku, Tokyo 110, Japan)

Vol. 4, No. 2, June 1961, 2 Ref

Why does the train draft become a problem for us? In other words, for what purpose or purposes are they studied? The answer is that we want to know whether the human body standing near a railway suffers any danger from the passage of the train and to clarify to what extent the structures near the railway are influenced by train drafts.

033455
TRAIN FORMATIONS AND MAINTENANCE REQUIREMENTS FOR URBAN RAILWAYS

Bruce, JG

Railway Division Journal (Institute of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, No. 3, 3 Ref, pp286-339

A 'Metropolitan Railway' means something more than a suburban railway for the conveyance of passengers to and from work as it must pass through the central area of the city it serves with a portion of the route either underground or elevated above street level in the congested areas. A metropolitan railway can probably be best described by what it does not do. It seldom, if ever, participates in the carriage of freight, a timetable is not required by the travelling public because the service is frequent, and as the passenger journeys are relatively short seats are not provided for everyone wishing to travel. It would seen that for most Metropolitan Railways systems a conventional railway system provides the best solution, but that network standardization and compatibility of rolling stock is of secondary consideration. While this is true to a limited extent this paper is an endeavour to define some of these limitations, and examines some of the auxiliary problems involved. It is essential that a very adequate liaison should exist by the maintenance engineer, with design, inspection, material control, and supply sections, so that material shortages for maintenance do not occur. Much equipment on rolling stock is of a specialized character that manufacturing know-how is an important factor in the provision of spares, and although the principle of competitive tendering to get the minimum price must be acceptable, service reliability must come first. Service reliability and the maximum train availability are the rolling stock engineer's reasons for existence, but he is unable to achieve his aims in isolation. The operator can help by ensuring that train diagramming provides adequate maintenance cycling. Planners can help by providing a train formation which has the maximum flexibility, the detail designers can further assist by ensuring the maximum interchangeability of unit parts. The supplies organization can help by ensuring that adequate spare materials are available and the main overhaul works can also help by making sure that spare units are always available at the running sheds.

037462
REAL PROSPECTS FOR INCREASED SPEEDS ON THE RAILWAYS

Kracke, R

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 17, No. 3, Mar. 1968, pp 65-76, 8 Fig, 3 Tab, 25 Ref

A comparison is made of door-to-door times for automobile, train and plane travel between cities separated by up to 200 Km, 200 to 400 Km, and 400 to 800 Km. The potential for the railways to offer service more competitive in elapsed time to that of air travel is explored. The increase in speed must take into account passenger comfort as well as safety. The closer spacing of ties will improve the riding qualities and provide more favorable stresses in the track structure. The use of curvature of 2400 m radius in switch turnouts to permit speeds up to 140 Km/h is possible. Signalling developments are also considered. The prospects for higher speeds in passenger service on the railways are necessary.

037474
HIGH SPEEDS RECENT EXPERIENCE IN ECONOMICS AND IN PRACTICE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, July 1968, pp 545-546

A thorough examination of current problems and evaluation of feasibility and economic justification of speeds over 200 km/h discussed by 500 delegates to the IRCA-UIC symposium at Vienna and of the 27 papers presented and discussed, 17 dealt with experience and design development obtained in revenue earning services and then examined the immediate future or long-term problems. Brief summaries of the topics presented are reviewed in this article.

037748
AUTO-PEOPLE OPERATION

Lawson, KL, Federal Railroad Administration

Engineering & Operations Interface (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1967, pp 45-49, 6 Phot

The concept of the auto-train is examined including its background, service aspects, equipment involved, and procurement process. The idea was to transport primarily vacationers and retirees to destinations where their own car would be useful. The trains consist of auto cars, a service car at each end of the train and a locomotive at each end. Service and auto car are double decked. Service was planned for a 780 mile trip from Washington, D.C. to Jacksonville, Florida. At the time of this article, design work was two thirds completed.

037763
SNCF PROBES THE 200-300 KM/H SPEED BAND

Nouvion, FF, French National Railways

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, Aug. 1970, 5 pp, 6 Fig, 1 Tab, 1 Phot

Recent tests at high speeds have shown that ample adhesion exists to overcome train resistance at 300 km/h and no technical factors need prevent commercial operation on steel rails at this speed. High speed running does not seem to produce any particular wear of parts other than wheels, although a close eye is kept on the friction linings that damp the pantograph. For the track, the SNCF does not consider it economically desirable to raise maintenance standards beyond those now considered necessary for speeds of 150 km/h. The policy is to build the rolling stock in such a way as to exert no greater forces on the track at high speeds than the trains of 20 years ago caused at the lower speeds then prevailing. Ride quality and current collection are discussed.

037791
HIGH SPEEDS DISCUSSED AT VIENNA IRCA/UIC SYMPOSIUM

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 124, July 1968, pp 485

Article highlights the topics discussed at the symposium on high speeds at Vienna, 1968. The symposium was divided into five sections. The first dealt with traction and rolling stock problems; the second concerned problems of fixed installations; the third was devoted to non-conventional techniques; the fourth covered general problems and the economic aspects of high speeds on existing tracks; and the fifth examined these problems and aspects in relation to non-conventional solutions and new lines of approach.

037804
DESIGN STANDARDS FOR EUROPE'S FIRST 250 KM/H RAILWAY

Robert, G, Italian State Railways

Railway Gazette International (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 126, July 1971, pp 269-272, 4 Fig, 2 Phot

This article is concerned with changes made in the rail line which runs from Rome to Florence, Italy, so that speeds of 250 km/h may be attained. Problems include the rough terrain such that 31% of the route will be tunnel and 13% will be over viaduct. Details of bridge design, electrification, as well as characteristics of tunnel design and roadbed construction are discussed in relation to the requirements of high speed operation.

039013
UNITED STATES DEPARTMENT OF COMMERCE AUTO-ON-TRAIN PROJECT EQUIPMENT PREVIEW

Klauder (Louis T) and Associates, Philadelphia, Pennsylvania

Aug. 1966, 33 pp

The train will be designed to offer passenger train comfort, conveniences, and speed to the occupants of any of the common types of automobiles, including sedans, the various coupe models, and station wagons (except Volkswagen's 'Microbus'). Van and camper models in general cannot be accomodated on account of their height. In effect, the passenger brings his own seat aboard when he drives on and no other general seating is proposed. The situation is analogous to a drive-in theater.

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039637
HIGH PASSENGER TRAIN SPEED IN FRANCE

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, Feb. 1955, p 213

The achievement of the French National Railways in attaining in February 1954, the world record speed of 151 mph on a test run between Dijon and Beaune is recognized. The routine speeds achieved in France in interurban service are mentioned. It is possible to reach almost all the principal cities in France at average speeds of over 60 mph from Paris, the list including Bayonne, Bordeaux, Dijon, Lille, Lyons, Marseilles, Nancy, Nantes, Nice, and Strasbourg; also Brussels in Belgium. The high speed trains are more expensive to ride than the slow trains. The high speed trains are mainly used at rush hours.

039649
HIGH-SPEED PASSENGER TRAINS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Sept. 1955, p 297

Diesel and electric locomotive-powered, interurban train service is described for several countries including France, Germany, Norway, Sweden, and Great Britain. The commuter units in countries other than France and England are many times only three to four cars in length. In France powerful electric locomotives concentrate the maximum possible amount of traffic in single trains of great length and weight, but frequently average 70 mph from start to stop.

039663
LIGHTWEIGHT TRAINS IN U.S.A.

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 104, Apr. 1956, pp 227-228, 3 Phot

Several American railways will place in service lightweight stock based on the design of the Talgo trains which have been operating for some years on the Spanish National Railways. The Talgo type trains under construction are designed specially to meet the requirements of American Railways. A prototype has been tested and reported to run smoothly at up to 90 mph. Trains will be made up of three-car units and will be reversible. Depending on interior arrangements, the cars will accommodate 84-96 passengers. The overall width is 10 feet 2 inches and length 34 feet 6-1/2 inches. The vehicles are designed to withstand a buffing load of 800,000 lb.

Tightlock couplers are fitted. The weight per passenger averages 700-800 lb., less than half that of American carriages of conventional design.

039665
AMERICAN LIGHTWEIGHT TRAINS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Dec. 1956, p 690

The designers of rolling stock in the U.S.A. are following two distinct trends. On one hand, the double-deck "dome" coaches with central dome section for scenic observation have developed on some lines to coaches in which the upper deck runs from end to end. The other trend is that of the ultra-lightweight coach, lower in height and very considerably lighter than the previous standard vehicles, and, in most cases embodying radical departures from standard designs. Specific trains mentioned are the "Aerotrain," the "Jet-Rocket", the "Train X", the "Hot Rod", and the "Pioneer III", among others. All are designed toward improved passenger service in order to cut down the severe losses being sustained in passenger operation.

039690
LENGTH OF RAILWAY TRANSITION SPIRAL ANALYSIS AND RUNNING TESTS

Schinke, R Ferguson, R

Association of American Railroads Research Center, 3140 South Federal Street, Chicago, Illinois, 60616

ER-37, Tech Rpt, Nov. 1963, 48 pp, 20 Fig, 7 Tab, 20 Ref, 1 App

The report discusses the results of tests performed to determine the needed length and elevation of transittion spirals. Thus a test using a locomotive and passenger car with instrumentation and individuals is an attempt to correlate recorded data of ride quality and that observed by human beings.

039998
PASSENGER RIDE COMFORT ON CURVED TRACK

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

AAR-MR-227, Tech Rpt, Apr. 1954, 95 pp, 50 Fig, 3 Tab, 9 Ref

The objective of this study was to obtain data for formulating recommendations on (1) the permissible speed of rolling stock on curves, (2) the length of transition curves for passenger comfort, and (3) the clearance requirements on curved track. The first test was run on the L&N Railway using the C&O track inspection car and making use of 20 observers to obtain a correlation between passenger reaction and the amount of unbalanced centrifugal force on curves as determined by measurements of the lateral acceleration. Results of this test indicated the importance of the tilting of the car in reducing the effective elevation of the track insofar as passenger comfort was concerned. Results from a second series of tests made it possible to establish a very satisfactory relationship between passenger reaction and the amount of lateral acceleration so that in subsequent tests it was not necessary to use passenger observers. Tests on permissible speed have indicated that for the types of modern equipment having soft springs and no provision for restricting the roll of the car body on curves the present AREA limitation of 3 in unbalance should be continued. Upon this basis the permissible speed on a curve is equal to the calculated equilibrium speed for the actual elevation of the curve plus 3 in. For cars having stiffer springs, outside swing hangers or roll stabilizers reducing the amount of roll with unbalanced elevation, the tests have shown that a permissible unbalance on curves of as much as 4-1/2 in. can be tolerated by the more favorable types of equipment. A new and different procedure is recommended for determining the length of transition curves. The formula recommended, L(sub min) = 4.88 V, gives a minimum length of spiral about 2/3 of that of the present AREA recommendation. However, this should be considered as a minimum length and a longer length is desirable if practical. With respect to clearance the test data gives displacement characteristics due to tilting of the car body on the springs of the various types of passenger cars included in the tests as related to the unbalanced elevation. A method for determining the angle of lean from static measurements of any particular type of car is also explained.

040009
ROCKET TRAIN-CUSHION RAIL

Mann, WM

Mechanical Engineering (American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017)

Dec. 1971, p 40

Cushion rail is a module-carrying vehicle designed to use wheels at low speeds, with an airfoil design to provide a lifting factor at high speeds, using "slippers" at its cruising speeds of 400-450 mph. Never stopping to pick up passengers, cargo, or mail, it would slow down to 100 mph as it ties in with a series of shuttle systems utilizing small module-carrying vehicles, synchronized in speed, locked together, on parallel tracks. The vehicle will resemble an aircraft more than a rail car and will be built to aircraft standards. It will be "locked" into track slots by means of "feet" that resemble pontoons. Cushion rail requires only 5 percent consumption of fuel for takeoff purposes and uses electric motors in the cities. Sound deflectors attached to the track make the system an ideal one for high speeds at ground level.

040015
TRAFFIC IN A CURVE WITH RAILWAY COACHES FITTED WITH INCLINABLE BODIES

French Rail News (Federation des Industries Ferroviaires, 12 rue Bixio, Paris 7e France)

No.3, 1970, pp 40-42, 8 Fig, 1 Tab

Further tests of the pendular type coach have been effected, during which the body has been given a boost to speed up the time taken for it to get the correct inclination when negotiating connecting transition. This is done by means of a hydraulic ram monitored by a accelerometer detecting, permanently, the non-compensated acceleration. Another arrangement is being worked out with a coach for which the axis of oscillation is below the center of inertia of the body. Tests are described which show that it is possible to get a coach to negotiate a curve with 0.3 insufficient cant, which is considerable, by employing assisted pendular motion. The first tests have shown that the assisted pendular motion gives considerably improved smooth riding while negotiating the transition as compared with natural pendular motion.

040029
SEWAGE TREATMENT ON THE GERMAN FEDERAL RAILWAY

Albrecht, J, Bundesbahn-Zentralamt, Minden

Eisenbahntechnische Rundschau (Hestra-Verlag, Darmstadt, West Germany)

Vol. 20, No. 4, Apr. 1971, pp 154-159, 3 Fig, 3 Tab, 5 Ref

This article describes the particular characteristics of the sewage and effluent which has to be handled by the German Railways, and the conditions under which it can be disposed of into the drains. The limits of the various types of contaminants are tabulated, and are dependent on the system of drainage to which the effluent is to be directed. A description of the methods of treatment for the various contaminants is detailed.

040111
ENERGY REQUIREMENTS OF HIGH-SPEED TRAINS

De Koranyi, L, General Electric Company

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 122, July 1966, pp 533-537, 6 Fig, 2 Tab, 14 Ref

The significance of air resistance increases with the value and the duration of the applied maximum speeds. For multiple-unit trains the practical degrees of streamlining are: none for conventional rapid transit; medium or low for super rapid transit; and high or medium for corridor trains. Power and energy requirements are strongly affected by loaded car weight, not only during acceleration but also at maintained top speed. The maximum power requirement for propulsion is proportional to the product of maximum accelerating rate and highest speed at which still applied. Kinetic energy is a significant part of the total energy requirement. Extremely high train resistance, low balancing speed and high power requirement at top speed result from abnormally strong winds in open air. Air resistance is especially high in long single track tunnels.

040114
MEASURING RIDING QUALITY

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 123, Jan. 1967, p 28, 2 Fig, 1 Phot

Ganz-Mavag has developed a single instrument that will give an instantaneous scale reading of horizontal and vertical ride index values, and will total up fatigue units on decatron valve counters. It also produces a trace recording of the ride. Accelerometers measure the vertical and lateral accelerations. Conversion of the signals generated by the accelerometers into instantaneous mean values of riding quality is performed by electronic circuits, as is the generation of fatigue unit impulses. Another test has to be performed with the speed of the test train rising from zero to the maximum value uniformly over the length of the test section. To obtain a final result it is necessary to obtain mean values from the information recorded on the charts during these tests.

040154
SOME PROBLEMS IN VEHICLE RIDING

Cox, ES, British Railways

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckhingham Gate, London SW 1, England)

Vol. 51 N, 83, Paper No. 625, 61-62, pp 574-659, 14 Fig, 6 Tab, 14 Phot, 18 Ref

This is an integrating paper, which seeks to survey the field. It emphasises that sound suspension design only meets part of the problem, and refers to the many aspects of mechanical inter-action and wear which are just as important. The practical application of the theoretical and development work which has been undertaken by a number of groups on British Railways is described, and six particular riding problems are analyzed and the steps taken to deal with them are outlined.

040507
URBAN RAILWAY ROLLING STOCK

Watts, PH

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 57, No. 317, Part 3, 67-68, pp 228-249, 1 Fig, 6 Phot, 1 App

Equipment on the urban systems in Rotterdam, Hamburg, Stockholm, Gothenburg and London is described and compared. Maintenance facilities and routine maintenance techniques are discussed for most of the railways.

040542
THE PROBLEMS OF HIGH SPEED TRANSPORT ON FRENCH RAILROADS

Nuvion, F, French National Railways

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Part 51970, pp 595-615, 17 Fig, 1 Phot

Speed increases to 125 miles/hour has had hardly any influence on the cost price per kilometre of the locomotive-coach-track ensemble. Design features for trucks to permit the speed increase are discussed. High-speed adhesion test results are shown, indicating where slipping begins. High speed requires great power The amount of this power varies, for a given speed with the geometrical dimesnions of the train. As the length of the train plays an important part, it is preferable that the whole length should be available to passengers. Current collection test results are shown as a function of speed.

040544
IMPRESSIONS ON THE NEW TOKAIKO LINE, JAPANESE NATIONAL RAILWAYS. BASED ON A RECENT VISIT TO JAPAN

Burley, W

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 54, No. 302, Part 6, 64-65, pp 585-595, 1 Fig, 7 Phot

The trains are made up of 12 coaches, but can be expanded to 15 to 16 as demand increases. The track is designed for high speed running. Track centers are widened to lessen the air impact effects as trains pass. Gradients are limited to 1.5 percent, minimum radius of curved track is 220 years, and maximum cant is 7.08 inches. Welded rail is padded by rubber and fastened to concrete cross ties with spring clips. Signals controlling train speed and operation are transmitted from a Central Train Control Office to the cab. Train brakes and speed are automatically controlled to eliminate collisions. The driver can assume control to counteract adverse environmental conditions. Revenues are described.

040555
THE PROBLEM OF ROLLING STOCK CLEANING IN WORKS AND DEPOTS

Silverlock, PR

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 1, Part 11970, pp 91-145, 5 Fig, 17 Phot, 4 Ref

The paper examines some of the problems in cleaning the mechanical and electrical equipment as well as the underframe during overhaul. It also describes the development that has taken place in servicing at the running depots to maintain a high standard of cleanliness of both the interior and exterior of the vehicles. The evolution of exterior washing machines to the present-day high-speed automatic machine is described. The mechanizing of chemical cleaning are discussed. The assistance for vehicle designer can give by simplifying and streamlining the exterior and interior of vehicles to assist in the use of cleaning machines is suggested.

037736
MARKETING ASPECTS OF NEW CAR DESIGN TRENDS

Tatham, CC, Jr, Pullman-Standard Car Manufacturing Company

Engineering Exchange Forum (Symington Wayne Corporation, 2 Main Street, Depew, New York)

Tech Proc, Sept. 1966, pp 2-5

Various activities are incorporated into a marketing effort for new car designs. These include: market research, sales forecasting, sales and service engineering, customer relations, advertising and occasionally product development. The author demonstrates how the marketing function influences car design at Pullman-Standard.

037901
AN INSTRUCTION CAR FOR CARRIAGE AND WAGON STAFF

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 93, Aug. 1950, p 214, 2 Phot

The car interior is divided into three compartments, the two larger being 18-feet long, with a small compartment 5 feet 6 inches long with a lavatory at one end. One of the larger compartments is equipped with seating, and lantern stand and screen and it can be used as a lecture room. On one side of the lecture room is a full-scale working model of an automatic vacuum brake of the type fitted on standard bogie coaching stock vehicles. On the opposite side is an electrical panel including all types of switchgear as well as dynamo regulators and other electrical equipment. In the second large compartment are displayed all types of steam heating, water, lavatory and gas fittings, door locks, sections of wheels and tires. The small compartment contains a pressure water boiler of the type now used in buffet and tea cars arranged to facilitate instructions.

037934
RAILWAY STANDARDS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 88, May 1948, pp 536-537

Highlights of a paper presented to the Institution of Locomotive Engineers are given. The focus is on standardization–its benefits and difficulties. Ranging from storekeeping methodologies to commentary upon standardization procedures, the article stresses "standardization in relation to general design."

039644
TRAINING AND EDUCATION OF RAILWAY STAFF

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 103, Aug. 1955, pp 186-188

In recent years, most railways have provided organized facilities for vocational training. Training practices in Britain, Germany, France, Holland, Belgium, Switzerland, Italy, Spain, Russia, Poland, and India are described briefly.

039666
TRAINING OF LOCOMOTIVE ENGINEERS

Nesbit-Hawes, R Parker, GF Peyton, PGC

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Nov. 1956, p 633

Three papers are described which, respectively, discuss (1) the need for a higher degree of scientific education for locomotive engineers, (2) the availability of training in mechanical and electrical engineering of the British Railways, and (3) the method of recruitment and training as mechanical engineers to fill executive posts.

039667
SELECTION TESTS FOR RAILWAY STAFF

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, May 1956, pp 307-308

The use of psychological tests for staff selection, in general, and for specific job requirements are described. Cited are their use by various National railways such as the French, Dutch, Swedish and U.S. to determine speed of reaction, intelligence, memory, visual and auditory acuity, as well as other factors affecting employee capability.

039670
MOBILE TRAINING CAR FOR MOTIVE POWER STAFF

Bhattacharya, Eastern Railway of India

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 112, Jan. 1960, pp 107-108, 1 Fig, 2 Phot

The training car is equipped with mechanical drawings, models, diagrams and charts and books, to provide instruction in repair, maintenance, and servicing of locomotives. The interior contains a 28-seat lecture room and associated demonstration equipment as well as provision for living quarters of the attendant.

039908
MARKETING INPUT

Sullivan, JR

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 2-6

Proceedings of 1968 Railroad Engineering Conference.

The need for the railroad industry to become customer oriented rather than hardware oriented is discussed. The needs of the railroad and the shipper do not coincide, but frequently car manufacturers can provide alternatives to answer the specialized needs of each group. Attention to the recruitment of quality personnel for the marketing and planning functions is stressed for the rail industry.

039909
CAR USER INPUT

Hansen, EG, Du Pont de Nemours, EI, and Company

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 7-12, 13 Fig

Proceedings of 1968 Railroad Engineering Conference.

The presentation is concerned with the approach by DuPont as a shipper. The consideration by the shipper in the selection and design of freight cars is discussed and may be summarized by considering: the lowest physical distribution cost combined with safety; low designs must take into account restrictions in car movement which would result in higher costs; and the designs must consider the future not restricted by old conditions and practices. The mix of railway cars in the DuPont fleet is described.

039910
FINANCIAL INPUT

Weigel, GK, Illinois Central Industries

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 12-15

Proceedings of 1968 Railroad Engineering Conference.

The article is primarily concerned with the economic crises within railroads. The problems of buying versus not buying new equipment are discussed, as well as the need to determine real costs for equipment and services in order to make better decisions regarding railroad purchases.

039911
OPERATIONS INPUT

Spicer, JH, Canadian National Railways

Car Design Inputs (Dresser Transportation Equipment Division, 2 Main Street, Depew, New York)

Proceeding, Sept. 1968, pp 16-18

Proceedings of 1968 Railroad Engineering Conference.

The means to satisfy the demands of shippers, namely known time intervals for the delivery of goods, competition price, and no damage to goods, is suggested in this presentation. New and exotic car designs are adding to the already complex problems of car distribution and costs to correct these problems, the needs of marketing, equipment, maintenance, and transportation should be investigated as part of an overall systems approach rather than by departments.

040067
CYBERNETICS OF RAILROADS

Affanaciev, NP

Railroad Transport (Railroad Transport Editorial Board, USSR, 3A Sadovaya-Chernogryazskaya, Moscow 174, USSR)

Feb. 1964, pp 9, 1 Ref

The problems of cybernetics application were divided into five groups and were discussed in five sections of the first international symposium on application of cybernetics on railroads. (1) systems approach to the automation of transport processes, (2) automation of specific transportation functions, (3) application of EDP to administrative and accounting work, (4) computerized mathematical methods for solution of transportation problems, (5) equipment and facilities for assembly and transmission of information to computer centers.

040333
COMPARISONS OF LABOR PRODUCTIVITY ON THE RAILROADS OF THE U.S.S.R. AND U.S.A.

Oparin, ER

Railroad Transport (Railroad Transport Editorial Board, USSR, 3a Sadovaua-Chernogryazskaya, Moscow 174, USSR)

Mar. 1964, 10 pp, 1 Tab

A considerable number of comparisons are put forth about labor productivity between the two countries. In the U.S.S.R., productivity of railroads is measured by tariff-ton-kilometers, while in the U.S.A., by ton kilometers, by measuring actual route miles traveled. Therefore, it would be correct to compare ton-kilometers of the U.S.A. with actual net ton-kilometers of U.S.S.R. railroads. On the railroads of the U.S.S.R., work output is expressed in ton-kilometers per employee connected with operations—there is no comparable index calculated in the U.S.A. On the basis of calculations, the level of work output on the U.S.S.R. railroads is about 25 percent lower than in the U.S. Comparison between specific groups of employees in the U.S. and U.S.S.R. is included.

040495
TRAFFIC-ORIENTED TRAINING FOR LOCOMOTIVE ENGINEERS

Thorley, WGF, British Railways Board

Institution of Locomotive Engineers Journal (Institution of Locomotive Engineers, Locomotive House, 30 Buckingham Gate, London SW1, England)

Vol. 58, No. 324, Part 4, 68-69, pp 305-384, 10 Fig, 29 Phot, 7 Ref

There is a need for improvement in the detail design of locomotives and their auxiliary equipment in order to enhance their performance in the various environments and conditions in which they operate. Many shortcomings in design only become apparent when the locomotive is actually at work in traffic and it is concluded that the young locomotive engineer destined to become a designer should undergo a planned period of induction to locomotive operation by riding with the driver working all types of trains at all hours and all seasons. The suggested areas of training include determination of trailing loads and point to point times, methods to avoid wheel burns, making enroute repair to loose or detached parts, use of hand brakes, use of speed indicating to loose or detached parts, use of hand brakes, use of speed indicating gear, fire hazards, use of warning devices, lay-out of the cab and instrument panel, use of the windscreen, use of route indicators, use of heating and ventilation systems, use of the driver's safety device, and re-railing locomotive.

040527
THE RAILWAY IN TRANSPORT

Johnson, H, British Railways Board

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)

Vol. 2, Pt 1, 1971, pp 5-18

The purpose of this paper was to outline the role of the railways in this country and provide some thoughts on future developments. A general survey of the following topics is undertaken: The Transport Problem; The Railway—A Commercial Business; Freight; Passenger; Technology; Higher Speeds; The Track; Information and Control; The Technical Role of the Engineer; and The Scope of the Engineer.

039966
BRITISH RAILWAY SAFETY LEGISLATION

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 105, Nov. 1956, pp 581-583

The origins and functions of the Railway Inspectorate in Great Britain are discussed. Included are the first Acts of Parliament; the Act of 1871 (accident reporting); the 1900 Act (Railway servants); the 1933 Act (road and traffic); the composition and function of the Inspectorate, technical requirements and accident investigations.

037665
THE IMPORTANCE OF RESEARCH AT THE GERMAN FEDERATED RAILWAYS' CENTRAL OFFICE AT MUNICH FOR ENGINEERING AND DEVELOPMENT

Hegenbarth, F

Jahrbuch Des Eisenbahnwesens (Hestra-Verlag, Holshofallee 33, Postf 4164, 6100 Darmstadt, West Germany)

1967, pp 141-166, 8 Fig, 30 Phot, 41 Ref

The achievements are described of the German Federated Railways in Research and Development in the following fields: preventive measures toward noise suppression in railway vehicle bodies; problems of mechanical engineering and material chemical composition technology of locomotive components; research in lubricants for all classes of rolling stock equipment, journal bearings and diesel engines, paints for vehicles, corrosion inhibitors for diesel engine cooling water, fire resistance of plastic materials used in railway vehicle construction; problems of the railroad track and right of way; the influence of stray electric currents on signals and communications as well as the electrolytic action of buried pipes and conduits; and, high frequency technology for remote communications and signal installations.

039555
RESEARCH ON INDIAN RAILWAYS

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 99, Sept. 1953, pp 312-313

The main objectives of the Indian Directorate of the Railway Board, located at Lucknow, are maximum safety in rail travel, sufficiency in equipment, and economy. The Lucknow center carries out research on fuel, the dynamic effects of vehicles on track and bridges and riding quality and performance lists on locomotives and carriages. The sub-center at Lonavla is carrying out research on soil mechanics and foundation engineering problems; chemical and metallurgical studies on lubricants, paints, water softeners, and other aspects are being undertaken at Chittaranjan.

039642
U.S.A. RAILWAY TECHNICAL DEVELOPMENT

Railway Gazette (Temple Press Limited, 161-166 Fleet Street, London EC4, England)

Vol. 102, June 1955, pp 704-705

The U.S. railroad equipment and technology in 1940 and 1953 are compared. Rail usage in 1953 was declining due to highway and air competition. The types of locomotives in use in both years are compared. American track design is compared to British technology. Closer spacing of ties in the U.S. allows the track to carry heavier axle loads; however, ballast maintenance is more expensive due to the spacing. The C.T.C. signaling installations are described.

Subject Term Index

This Subject Term Index includes all of the subject terms that have been assigned to the abstracts listed in this Special Bibliography. Subject terms are listed alphabetically. Under each subject term are posted the reference numbers for the abstracts. These numbers consist of two digits that identify the subject area according to the RRIS classification scheme and six digits that identify the individual abstract under the subject area. When postings in the index are read from left to right and then from line to line, the reference numbers are in the same order as the abstracts are in the main body of this publication.

It is often useful to coordinate two or more terms in the search for abstracts on a particular subject. For example, if it is desired to locate abstracts of articles that deal with the impact of electrification on signaling and communications, the subject term Electrification should be coordinated with the subject term Signaling and the subject term Communications.

Subject terms are also useful if it is desired to review all of the abstracts pertaining to a certain area that is not a specific subject area in the RRIS classification scheme. Thus, the subject term Commuter Services will give reference numbers for all abstracts pertaining to railroad commuter services even though the main thrust of the documents may lie in other subject areas such as Vehicles and Components, Propulsion Systems, or Passenger Operations.

Author Index

The Author Index lists authors of reports included in this publication. Under each name are posted the reference numbers for the abstracts for which this person has been named as author or co-author. These numbers consist of two digits that identify the subject area according to the RRIS classification scheme and six digits that identify the individual abstract under the subject area. When postings in the Index are read from left to right and then from line to line, the reference numbers are in the same order as the abstracts are in the main body of this publication. Names are listed alphabetically.

Source Index

In this Source Index, the first line of each entry is the name of the source as it appears in the RRIS file. Sources include corporate authors, publishers, and publications. Under each source name are posted the reference numbers for the abstracts of documents from that source. These numbers consist of two digits that identify the subject area according to the RRIS classification scheme and six digits that identify the individual abstract under the subject area. When postings in the Index are read from left to right and then from line to line, the reference numbers are in the same order as the abstracts are in the main body of this publication. Names are listed alphabetically.

THE National Academy of Sciences is a private, honorary organization of more than 800 scientists and engineers elected on the basis of outstanding contributions to knowledge. Established by a congressional act of incorporation signed by Abraham Lincoln on March 3, 1863, and supported by private and public funds, the Academy works to further science and its use for the general welfare by bringing together the most qualified individuals to deal with scientific and technological problems of broad significance.

Under the terms of its congressional charter, the Academy is also called upon to act as an official—yet independent—adviser to the federal government in any matter of science and technology. This provision accounts for the close ties that have always existed between the Academy and the government, although the Academy is not a governmental agency and its activities are not limited to those on behalf of the government.

The National Academy of Engineering was established on December 5, 1964. On that date the Council of the National Academy of Sciences, under the authority of its act of incorporation, adopted articles of organization bringing the National Academy of Engineering into being, independent and autonomous in its organization and the election of its members, and closely coordinated with the National Academy of Sciences in its advisory activities. The two Academies join in the furtherance of science and engineering and share the responsibility of advising the federal government, upon request, on any subject of science or technology.

The National Research Council was organized as an agency of the National Academy