

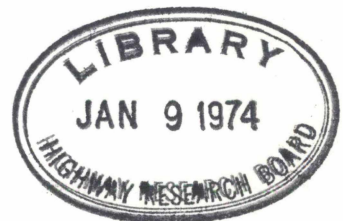


# RAILROAD RESEARCH BULLETIN



**DEVELOPMENTAL ISSUE**  
**Autumn 1973**

**U.S. DEPARTMENT OF TRANSPORTATION**  
**Federal Railroad Administration**



**Prepared under contract by:**

**Railroad Research Information Service**

**National Academy of Sciences-National Academy of Engineering**

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Railroad Research Information Service

**RAILROAD  
RESEARCH  
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Developmental Issue

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This publication contains 1,297 abstracts of journal articles and research reports selected by RRIS from the current railroad literature and 150 summaries of ongoing research activities in the railroad field.

PB 226 784

RRIS Publication No. 7301

**Railroad Research Information Service**

**National Research Council**

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Railroad Research Bulletin, Autumn 1973

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# Foreword

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 those who have need for railroad research information. Two types of information are stored in the RRIS file: summaries of ongoing and recently completed projects, and abstracts of reports and articles that are within the RRIS scope and objectives. The abstracts and summaries are arranged in

separate sections of the book.

This book is the first issue of the RRIS Bulletin, which RRIS plans to publish semiannually. This book contains abstracts and summaries that were added to the RRIS file during the preceding six months.

In addition to acquisition and selection, RRIS work includes the classification, indexing, storage, retrieval, and dissemination of summaries 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 Service (MRIS).

# How to Use This Volume

This volume is divided into sections containing (a) abstracts of documents, (b) summaries of ongoing research, and (c) indexes by subject, author, and source.

If you are interested in reviewing reports on completed research and other published documents, turn to the Abstracts section, which begins on page 1. The material in this section is arranged by subject according to the numbered subject areas listed on page vi. The subject area name is given at the top of each page and the corresponding number appears in the upper left or right corner of the page.

If you are interested in summaries of ongoing research projects, turn to the Summaries section, which begins on page ix. These summaries are also arranged by subject according to the numbered subject area, but each subject area number is followed by the letter A (for active) to designate that it is an ongoing project. As before, the subject area name is given at the top of each page and the number appears in the upper left or right corner of the page.

If you can identify your interest by subject, turn to the Subject Term Index on page 311. Each term in the Subject Term Index is followed by a series of accession numbers. These consist of two digits that identify the subject area and six digits that identify the individual abstract under the subject area. If an A follows the subject category digits in the accession number, this indicates that the particular item is a summary of an ongoing research report. Find the terms

you are interested in, note the accession numbers under the terms, and turn to either the Abstracts section or the Summaries section, depending on whether there is an A in the accession number. The items are arranged in order of ascending accession number in their respective sections.

If you are looking for abstracts of articles or reports written by a particular author or summaries of projects being conducted by a particular investigator, turn to the Author Index on page 335 and look for the person's last name in the alphabetized listing. Note the accession numbers printed under the name you are interested in and turn to the Abstracts or Summaries section to find the corresponding material.

If you are interested in abstracts of articles or reports that appeared in a particular publication or were published by a particular publisher or if you are interested in summaries of research projects being conducted by a particular performing organization, turn to the Source Index on page 347 and look for the organization in the alphabetized listing. Note the accession numbers printed under the organization you are interested in and turn to the Abstracts or Summaries section to find the corresponding items.

The subject areas used in this volume are described on the following page. Examples of abstracts and summaries showing the pertinent parts are given on subsequent pages, followed by abbreviations used in this book and information on availability of documents.



# RRIS Classification Scheme

All material in the RRIS file is classified according to the RRIS classification scheme given below. In this publication, the abstracts of completed reports and articles are printed in the first section, beginning on page 1, and the summaries of ongoing projects are printed in the second section, beginning on page 273. Within each section, the items are arranged by subject area according to the RRIS classification scheme. The subject area number appears at the upper, outer corner of each page; in the ongoing projects section

the subject area number is followed by the letter A (for active).

The RRIS classification scheme has been revised and expanded since the previous RRIS publication, *Special Bibliography: Safety-Related Technology*. The principal changes are the separation of the former Track and Structures subject area into two subject areas—00, Right-of-Way, and 01, Track—and the provision of a separate subject area, 13, for Electrification.

00	Right-of-Way	19	History
01	Track	20	Freight Transport Demand Analysis
02	Train-Track Dynamics	21	Freight Operations
03	Vehicles and Components	22	Logistics and Physical Distribution
04	Propulsion Systems	23	Passenger Operations
05	Braking Systems	24	Industry Structure and Company Management
06	Signals, Control, and Communications	25	Government Policy, Planning, and Regulation
07	Human Factors	26	Bibliography and Documentation
08	Rail-Highway Grade Crossings		
09	Materials Science		
10	Environmental Protection		
11	Advanced Systems		
12	Safety		
13	Electrification		



# 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	U.S. Department of Transportation
ECMT	European Conference of Ministers of Transport
EI	Engineering Index
Fig	Figures
FRA	Federal Railroad Administration
FY	Fiscal year
IEEE	Institute of Electrical and Electronic Engineers
IRCA	International Railway Congress Association
IRF	International Road Federation
IRRD	International Road Research Documentation
NAE	National Academy of Engineering
NAS	National Academy of Sciences
NRC	National Research Council
NTIS	National Technical Information Service
OECD	Organization for Economic Cooperation and Development
ORE	Organization of Research and Experiment of UIC
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
RTAC	Roads and Transport Association of Canada
Tab	Tables
TRRL	Transport and Road Research Laboratory
TSC	Transportation Systems Center
UIC	International Union of Railways
UITP	International Union of Public Transport
UMTA	Urban Mass Transportation Administration

# Sample Abstract

Abstracts are classified 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 (page vi). 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; these are shown as the Reference number on the sample abstract. In general there are gaps between the numbers of successive abstracts.

Reference number → 039249

Title → HAZARDOUS MATERIAL TANK CARS—TANK HEAD PROTECTIVE SHIELD OR BUMPER DESIGN

Author → Everett, JE Phillips, EA

Publication source → Association of American Railroads, Chicago, Illinois

Publication data → Final Rpt, Aug. 1971, 187 pp

Supplementary notes → Contract DOT-FR-00035

Abstract → The objective of the study program is to design a railroad tank car head protective device which will reduce the frequency of head punctures in accidents. Accident data were reviewed in detail for the years 1965 through 1970 to correlate head damage frequency and severity with various types of tank cars, to determine distribution patterns of damage over tank car head surfaces, and to assess the costs to the railroad shipping industry of head punctures. Full scale head impact tests, previously run were also reviewed. From these two reviews, design criteria were established and used to reduce an initial compilation of 74 concepts to a group of 15, which when applied to various classes of cars, comprised a semi-final total of 42 combinations, or schemes, as referred to in this report. Designs for these 42 schemes were then detailed and cost estimated. Next, a comprehensive cost/benefit analysis was applied. Three schemes appear attractive for the non-insulated pressure cars of the DOT 112A or 114A type. A recommended test program is outlined, and a preliminary estimate of its cost is given. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-202624

Availability → TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
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PB-202624

# Sample Summary of Ongoing Research

The ongoing project summaries found in the section beginning on page 273 describe research projects currently in progress or recently completed. Each record describes who is performing the project, who is funding it, and how the research goal is to be attained. A project summary is not a document surrogate; that is, there is not necessarily a full report published on the project. The summaries use the following format, although it should be noted that each record may or may not contain all of the individual elements described below.

Accession number → 038703

Project title → DOT/TSC RESEARCH AND DEVELOPMENT TUNNELING PROGRAM

Agency performing the work → PERFORMING AGENCY:  
Foster-Miller Associates, Incorporated, 135 Second Avenue, Waltham, Massachusetts 02154

Project investigators → INVESTIGATORS:  
Putkian, J., TMP, Tel. 617-4942019

Project sponsors → SPONSORING AGENCY:  
Transportation Systems Center, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

Contract monitor → RESPONSIBLE INDIVIDUAL:  
Putkin, J., Tel. 617-4942019

Project data → STATUS: Obligated    START DATE: July 1972    COMPL. DATE: June 1973    TOTAL FUNDS: \$339000    FUND TYPE: PPA    CONTR. NO.: PPA-OS-333/2

Supplementary note → The Federal Railroad Administration is responsible for this contract until completion.

Project summary → The objective is to conduct an engineering study of the development and use of an automatic sensor system to detect incipient failure modes and alert train crews in time to prevent a significant number of major derailments from occurring.

Source of this summary → ACKNOWLEDGEMENT:  
Federal Railroad Administration



# Availability of Research Reports

An availability statement is usually included with each abstract giving the address to which the user can write to obtain a copy of the document.

A large number of the documents are available from two primary sources, and to save space and reduce printing cost these sources are abbreviated, as follows:

NTIS    National Technical Information Service  
         5285 Port Royal Road  
         Springfield, Virginia 22151

ESL     Engineering Societies Library  
         United Engineering Center  
         345 E. 47th Street  
         New York, N.Y. 10017

NTIS prices are given after each abstract for which NTIS is identified as the source. ESL prices at date of this publication are \$3.00 handling charge per item or article plus 25 cents per page of photoprint or 5 cents per page of microfilm.

When ordering from any source, please give full information on the item wanted. When ordering from NTIS, be sure to give the NTIS accession number (PB plus six digits) as well as the title and other information.

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

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

# Journals Available From Libraries

Many railroad journals are available from libraries. In the list below, the availability of a journal from a library is indicated by the presence of the effective date at which the collection began.

Journal Title	Engineering Societies Library	Northwestern University Transportation Library
American Railway Engineering Association Bulletin	1900-date	
Civil Engineering (ASCE)	1930-date	1971-date
Container News		1968-date
Cross Tie Bulletin		1958-date
Eisenbahntechnische Rundschau		
Elektrische Bahnen	1925-1928, 1969-date	
Ferrocarriles Y Tranvias	1932-1939, 1943-1946	
French Railway Techniques	1969-date	1967-date
Glaser's Annalen	1877-1941, 1947-date	
High-Speed Ground Transportation Journal	1967-date	1967-date
IEEE Spectrum	1964-date	
Indian Railway Technical Bulletin		
Ingegneria Ferroviaria	1946-date	1966-date
Institute of Mechanical Engineers, Railway Engineering Journal	1970-date	
International Railway Journal		1961-date
Japanese Railway Engineering	1970-date	1970-date
Journal of Engineering for Industry (ASME)	1959-date	
Journal of Transport Economics and Policy		1967-date
Kurzauszuege Aus Dem Schrifttum Fuer Das Eisenbahnwesen		1962-date
Machine Design	1929-date	
Mechanical Engineering (ASME)	1906-date	
Modern Railroads		1953-1955, 1957-date

# Journals Available From Libraries (Cont.)

Journal Title	Engineering Societies Library	Northwestern University Transportation Library
Permanent Way	1958-date	
Proceedings of the Air Brake Association	1897-1937	
Proceedings of the American Association of Railway Superintendents	1918, 1924-1933	1949-1962, 1964-date
Proceedings of the IEEE	1913-date	
Progressive Railroading		1962-date
Rail Engineering International	1972-date	1973-date
Rail International	1970-date	1970-date
Railway Age	1870-date	1918-date
Railway Gazette International	1907-date	1957-date
Railway Locomotives and Cars	1832-1867, 1887-date	1972-date
Railway System Controls	1970-date	1971-date
Railway Technical Research Institute (JNR) Quarterly Report		1961-date
Railway Track and Structures	1909-date	1916-date
Revue Generale Des Chemins De Fer	1878-date	1966-date
Selection of International Railway Documentation		1964-date
Technical Proceedings—Dresser Annual Railroad Engineering Conference	1973-date	1968-1969
Transportation Engineering Journal (ASCE)	1969-date	1969-date
Transportation Journal		1962-date
Transportation Research	1968-date	1968-date
Transportation Science	1968-date	1968-date
Tunnels and Tunnelling	1970-date	



# Rapid Transit

The scope of RRIS includes rail rapid transit. Items in the RRIS file are classified according to the RRIS classification scheme and there is no separate RRIS classification for rapid transit material. However, all items pertaining to rail rapid transit can be identified by referring to the subject term Rapid Transit Systems in the subject term index, under which are listed the accession numbers of such items.

# RRIS Mailing List

RRIS maintains a mailing list of persons who wish to receive RRIS announcements, etc. If you received this book by mail from RRIS, your name is on the RRIS mailing list. If you would like to have your name placed on the RRIS mailing list, please complete the form below and mail it to:

J.H. Seamon, RRIS Manager  
National Research Council  
2101 Constitution Avenue, N.W.  
Washington, D.C. 20418

(If you do not wish to cut the book, a photocopy of the form may be used.)

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Name (limit 30 characters)

Company/Agency (limit 23)

Street Address/PO Box (limit 23)

City (limit 15); State (2); ZIP

037191

**PLANNING 63 ST. EAST RIVER TUNNEL FOR NEW YORK**

Maervis, AC

Tunnels and Tunnelling (Lomax Erskine and Company, Limited, 8 Buckingham Street, London WC2 N6LA, England)

Vol. 2, No. 2, Mar. 1970, pp 73-77

The two-level, four-track 63rd Street tunnel is the keystone of an extensive massive 1.3 billion dollar program of underground railway improvements that is being undertaken by the Metropolitan Transportation Authority and the New York City Transit Authority. This program will also provide a new high-speed route from the Bronx along Second Avenue to midtown and downtown Manhattan, a superexpress line in Queens and other rapid transit extensions to benefit Brooklyn, Midtown Manhattan and Queens. Typical cross section of river trench section of the tunnel is shown and planned technique for sinking the concrete tubes into the bed of the river is discussed.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 38442

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037198

**CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS**

Janin, JJ LeSciellour, GF

ASCE Journal of the Construction Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 96, No. C01, Paper 7382, June 1970, pp 61-74

Special problems in the construction of subsurface structures for a new rapid transit railroad line in Paris, France. Consolidation of soils was provided by chemical grouting. Grouting technique was also used to consolidate the foundations of a bridge, over the tunnel. Silicate and resin grouting provided the consolidation without recourse to compressed air or dewatering. A classification of modern chemical grouts is given with their limits of injectability. Elaborate grouting procedures prove their efficiency in supplementing or replacing modern tunneling methods.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 38532

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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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173637

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039037

**GEOLOGIC SKETCH OF THE PROPOSED NORTHEAST CORRIDOR HIGH-SPEED GROUND TRANSPORT SYSTEM**

Withington, CF

Geological Survey, Washington, D.C.

May 1966, 30 pp

From a geologic viewpoint, it can be concluded that the rocks of the Crystalline terrain are most suited for underground or surface construction, followed by the rocks of the Triassic terrain. Underground and surface construction in the Appalachian terrain can be recommended with limitation; extensive tunneling in sediments of the Coastal Plain terrain is not recommended because of difficulty of tunneling, but can be effected in underlying crystalline rocks. Subsurface and surface geologic mapping utilizing drilling and geophysical methods is strongly urged before a final route selection is made. Highly detailed engineering geologic studies will be required of the actual route selected before design and construction can begin; feasibility studies and preliminary route selection will require extensive compilation of existing geologic data and mapping at adequate scales. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173511

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039039

**JET DELIVERY OPTIMIZATION**

Bowles Engineering Corporation, Silver Spring, Maryland

BEC-R-4-23-68, Final Rpt, Apr. 1968, 119 pp

Contract 7-35381t

The report investigates several ways of improving water jet delivery in order to increase the efficiency of hydraulic tunneling and mining. These approaches are directed toward the reduction of water jet velocity decay by suppressing pressure disturbances and turbulence which cause jet breakup, by such means as the use of turbulence suppressing chemical additives, the design of a minimum transverse turbulence nozzle, and the suppression of air shear on a free water jet by providing the jet with a moving air sheath. In addition, an investigation is made of the use of a Fluidic Jet Modulator to generate liquid slugs which would produce high pressure impulsive shocks when impacting upon a rock face. A survey is made of the various modes of rock fracture in order to relate the results of the investigation to the problems of tunneling or mining. An evaluation is made of each of the separate studies as to its applicability to tunneling and its technical and economic feasibility. Finally, a system is proposed which incorporates the most effective results of the investigation. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178437

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PB-178437

039040

**HYPERVERLOCITY JET DRIVER STUDY**

Neradka, V Walston, W Turck, R

Bowles Engineering Corporation, Silver Spring, Maryland

BEC-R-22-68; Final Rpt, May 1968, 87 pp

Contract 3-0055ct

See also PB-178 437.

This study investigates analytically a concept for accelerating liquid slugs to high velocities by the use of supersonic gas nozzles. This technique is of interest for developing economic methods for cutting rock during tunnel construction. The merits of this concept are based on the fact that only moderate gas pressures are required to accelerate liquid slugs to velocities which have been demonstrated as suitable for fracturing rock material. To obtain these velocities by liquid nozzles alone, very high hydraulic pressures would be required. This concept, therefore, amplifies the pressure which is used to accelerate the slug to a high value delivered to the face of the rock material. The concept for mechanizing this augmentation is a hypervelocity gun comprising of a constant area section tube for accelerating the slug to sonic speed and a diverging area tube for further accelerating the slug to supersonic gas speeds. Analyses are performed to evaluate the lengths and acceleration times for both sections of the gun under different conditions of supply pressure and temperature and slug sizes. An important aspect of this concept is the requirement to control the hypervelocity jet driver repetitively at a controlled frequency and slug size. The design considerations for such a jet driver control system are considered and a preliminary concept is presented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178506

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NTIS, Repr PC: \$6.00, Microfiche: \$0.95

PB-178506

039056

**A STUDY OF EXTERNAL AUGMENTATION OF THE VELOCITY OF FLUID JETS**

Bowles Engineering Corporation, Silver Spring, Maryland

BEC-R-12-21-67, 1967, 40 pp

Contract 7-35380t

In order to make tunneling operations for future transportation systems economically feasible, a new method must be developed to provide a major step forward in tunneling speed and ease of operation. Attention was directed to tunneling by water jet techniques which promise to overcome the inherent slowness of conventional tunneling methods. Previous work indicates that at high velocities, water jets produce much the same effect on rock as do explosives. A major problem of hypervelocity jet production is dealt with in this effort, that being to provide hypervelocities without requiring extremely high pressures. A new technique involving the impacting of two relatively slow-moving slugs of water to produce a very small but effective fast jet was studied by analysis and very low pressure experiments. The analysis included the effect of slug profile, prediction of fast jet velocity as a function of the slug face impact angle, fast jet mass, optimum slug length, and time between slugs. Special test fixtures were built and tested to experimentally verify the theoretical results. These tests included the high speed photography of the collapse transient, impacting of wax targets and velocity measurement by streak photography. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-177595

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PB-177595

039065

**LASER ASSISTED ROCK FRACTURE**

Moavenzadeh, F Williamson, RB McGarry, FJ

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R67-3, Res Rpt, Jan. 1967, 63 pp

Contract C-85-65t

The report presents information obtained from initial experiments involving the use of a laser to degrade and deteriorate hard rock samples. The work is being done within the context of a continuing search for more efficient means of excavation and tunnelling in hard rock. The techniques discussed herein should be considered in the context of making hard rock more easily removed by reducing its strength. The laser appears to have an unusual potential for this application. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-174245

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PB-174245

039072

**FEASIBILITY OF FLAME-JET TUNNELING. VOLUME I. SUMMARY REPORT**

United Aircraft Corporation, Research Laboratories, East Hartford, Connecticut

Vol. 1, UACRL-G910560-10, Sum Rpt, May 1968, 52 pp

Contract DC-7-35126

See also Volume 2, PB-178 199.

Analytical system studies were made to determine the configuration of a flame-jet tunneling system and its expected performance. These studies examined the flame-jet tunneler design, haulage system, power system, and shoring and lining problem areas. Similar studies considered in detail various aspects of the environmental control problem, including a determination of the environmental heat, fumes, and noise created by the flame jets, the design of air and water supplies to modify this environment, and possibilities for crew protection against a hostile environment. Three possible alternative modes for life support were designed and evaluated, and one was chosen as the recommended system. Studies were also made to determine the overall cost of flame-jet tunneling, based on the detailed cost estimates made in the component subsystem studies. Total costs of flame-jet tunneling are developed and compared with conventional methods. In an experimental program, a series of tests was made on two 'control rocks' to determine the effect of various burner parameters on spalling rate. For comparative purposes, information was developed on conventional tunneling methods. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178198

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PB-178198

039073

**FEASIBILITY OF FLAME-JET TUNNELING. VOLUME III. CONVENTIONAL TUNNELING METHODS**

United Aircraft Corporation, Research Laboratories, East Hartford, Connecticut

Vol. 3, UACRL-G910560-60-10, 6705-6803, May 1968, 116 pp

Contract DC-7-35126

Prepared in cooperation with Fenix and Scisson, Inc., Tulsa, Okla. See also Volume 1, PB-178 198.

The report has been divided into two sections: (1) Methods for Conventional Tunneling and Shaft Sinking; (2) Boring Methods for Tunneling and Shaft Sinking. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178200

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

**039074**

**FEASIBILITY OF FLAME-JET TUNNELING. VOLUME II. SYSTEMS ANALYSIS AND EXPERIMENTAL INVESTIGATIONS**

United Aircraft Corporation, Research Laboratories, East Hartford, Connecticut

Vol. 2, No. 1, UACRL-G910560-10-V2, Tech Rpt, May 1968, 380 pp

Contract C-7-35126

See also Volume 3, PB-178 200.

The feasibility of flame-jet tunneling is considered analytically from three points of view, namely technical (or operational), environmental, and economic. An experimental program was performed to provide cutting capabilities of flame-jets in rock types expected on the Northeast Corridor. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178199

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PB-178199

**039079**

**HIGH SPEED GROUND TRANSPORTATION TUNNEL DESIGN AND COST DATA**

TRW Systems Group, Washington Operations, Washington, D.C.  
06818-W454-R0-11, Mar. 1968, 265 pp

Contract C-353-66.

Prepared in cooperation with Harza Engineering Co., Chicago, Ill.

Five important components of costs of tunneling, shafting and construction of terminals were identified. These cost components significant to tunneling, that is, those that account individually for more than approximately 5 percent of the total cost, are: (1) Excavation; (2) Muck loading, transport and disposal; (3) Tunnel supports; (4) Tunnel lining; and (5) Interface load supports. Similar cost components of shafting and terminal construction were identified. Five characteristics of the HSGT system and three groups of geologic conditions of the site that materially affect the cost components of tunneling, shafting and terminal construction were identified. These significant HSGT characteristics and site conditions are: (1) Tunnel and shaft diameter; (2) Terminal size; (3) Depth; (4) Shaft spacing; (5) Interface loads; and (6) Rock types grouped according to their excavation, supporting and water transmission characteristics. The rock types were delineated according to these groupings on maps of the project area. A study of the unit costs of work was made for each cost component, and the cost data were applied to determine the cost of an arbitrary tunnel system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178201

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**039090**

**ROCK FRACTURE RESEARCH**

Moavenzadeh, F Williamson, RB Wissa, AEZ

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

RR-R66-56, Res Rpt, 6511-6609, Nov. 1966, 94 pp.

Contract C-85-65t

The results of flexural tests on granite, marble, gneiss, and schist beams are presented in terms of the maximum stress and the work expended to cause failure. The extent of side cracking is measured by quantitative microscopy and is used to calculate a corrected fracture surface work. Thermal cycling of unnotched beams to 540C, 1280C, and 1800C is found to cause extensive cracking, and the resulting decrease of strength can be measured. The use of surface-active agents to reduce the work necessary to cause failure is found effective. A one percent water solution of aluminum chloride at 90C produces a fifty percent reduction in the fracture surface work value of granite, compared to the room temperature-dry condition. A mechanism of stress-activated corrosion may be the principal cause of this reduction in strength.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173638

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**039104**

**MODELING A JOINTED ROCK MASS**

Nelson, RA Hirschfeld, RC

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts MIT-DSR-76112

R68-70, Res Rpt, Sept. 1968, 233 pp

Contract C-85-65t

The ultimate goal of the study of jointed rock is to provide fundamental understanding of the mechanics of jointed rock, which is a crucial part of hard-rock tunnel design of the type that might be required for underground high-speed transport systems. The jointed-rock modeling material was selected to meet similitude requirements between the model and a typical field prototype rock and to ensure that it would be possible to make homogeneous, reproducible model specimens. A universal mold was designed for manufacturing specimens having different joint spacings and orientations. Strength tests were performed on the models in a triaxial cell. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-180248

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**039106**

**REVIEW OF EFFECTS OF HYPERVELOCITY JETS AND PROJECTILES ON ROCK**

Clark, GB Haas, CJ Brown, JW Muir, CD

Missouri University, Rolla, Rock Mechanics and Explosives Research Center, Rolla, Missouri

Final Rpt, June 1968, 415 pp

Contract DC7-35511

New methods are being continuously sought which will radically increase the rates of tunnel excavation. Attention has turned to the use of hypervelocity impact as a means of cutting and breaking rock, as well as the use of lasers, electric current, explosive drilling, high frequency vibration, etc. The information in this report was assembled and analyzed to give a state of the art summary of hypervelocity techniques which show promise for use in cutting and breaking rock. These include the use of water jets, metallic jets and hypervelocity projectiles. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-179022

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039107

#### ROCK TUNNELING WITH HIGH SPEED WATER JETS UTILIZING CAVITATION DAMAGE

Kohl, RE

Hydronautics, Incorporated, Laurel, Maryland

713-1, Final Rpt, June 1968, 52 pp

Sponsored in part by Department of Transportation, Washington, D. C., Office of High Speed Ground Transportation.

A test apparatus, capable of producing a 1/4-inch diameter jet up to 500 ft/sec was designed and built. Initial tests with this facility produced erosion intensities of 37 watts/sq. meter. This value was encouraging and demonstrated that the technique had potential. As a result a three-month extension of the contract was granted so that the operating parameters could be optimized thereby maximizing the erosion intensity. During this period the erosion intensity was improved from 37 watts/sq. meter to 670 watts/sq. meter. In addition those relationships such as the time dependence of erosion intensity and its variation with jet velocity were determined. The information was obtained for both a 1/4-inch and 1/8-inch nozzle. Once the behavioral relationships were established attention was directed to means by which the erosion intensity produced could be efficiently used. As a result a nozzle to specimen distance adjustment technique and specimen rotation technique were developed which improved volume removal by two orders of magnitude. Finally, the effect of heat treatment on reducing the strength of rock was briefly examined. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-179076

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039108

#### CRACK INITIATION AND PROPAGATION IN ROCK

Forootan-Rad, P Moavenzadeh, F

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R68-29, Res Rpt, May 1968, 127 pp

Contract C-85-65t

Theories of crack initiation, propagation and bifurcation in perfect solids based on energy equilibrium criteria, elasticity theory considerations and particulate body mechanics are reviewed. Modifications of these and their applicability to rock are discussed. Different testing methods used to study the fracture characteristics of rock are

reviewed; a bending method was chosen as most suitable for the purpose. A literature review on the effect of heat treatments on rock weakening are discussed. The principles of a continuous duty, high powered gas laser as a heat source are described. The values of the fracture surface energy were determined for four different geometries of a granite specimen; the results show that if a stable fracture is obtained, the value is independent of geometry. Results of the heat treatment and laser treatment studies on marble and granite show the thermal exposure causes a decrease in the value of ultimate flexural strength because of intergranular and transgranular cracks induced in the specimen. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-178987

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039113

#### THIN DISK TECHNIQUE FOR ANALYZING ROCK FRACTURES INDUCED BY LASER IRRADIATION

Moavenzadeh, F Williamson, RB McGarry, FJ

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R68-21, Res Rpt, May 1968

91p

Contract C-85-65t

The report presents results to date in the study 'Laser Assisted Rock Fracture.' Thin disc samples of marble and granite have been irradiated for short intervals with unfocused 10.6 micron (infrared) radiation from a carbon dioxide-nitrogen-helium gas laser. The specimens were exposed to laser radiation of different power levels over various areas of one side. Thermo-sensitive paints applied to the face indicated the radial temperature distribution across the specimen, and the initiation of the crack was detected using electrically conductive silver paints on the other face. Good agreement was found between the experimental data obtained from the temperature at failure and the calculated thermal stresses developed in the specimens. The results indicated that failure occurred when the induced thermal stresses exceeded the tensile strength of the rock. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-179205

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039137

#### DESIGN OF TUNNEL LINERS AND SUPPORT SYSTEMS

Deere, DU Peck, RB Monsees, JE Schmidt, B

Illinois University, Urbana, Department of Civil Engineering, Urbana, Illinois

Final Rpt, Feb. 1969, 419 pp

Contract DOT-3-0152

Contents: Introduction; Fundamentals of tunnel support design; Existing theories, design methods, and practices; Tunnel support systems in soil and soft rocks; Tunnel support systems in rock—Factors influencing behavior; Tunnel support systems in rock—Design procedures; Potential developments of tunnel support systems; Shotcrete.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183799

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PB-183799

**039144**

**ROCK BREAKAGE BY LIGHT-GAS GUN PROJECTILES**

Gregson, VGJ Singh, MM

IIT Research Institute, Chicago, Illinois

IITRI-D600-FR-06, Final Rpt, 6802-6901, Jan. 1969, 129 pp

Contract DOT-3-0171

The report discusses hypervelocity impact on rock targets using a light-gas gun with Zelux projectiles (solid and water-filled). The specific energies for rock breakage range from 120 to 260 joules/cc (1,400 to 3,200 ft-lb/cu in.) for Indiana limestone, and from 80 to 120 joules/cc (900 to 1,500 ft-lb/cu in.) for Milford Pink granite. Rock descriptions and strength properties are included. Previous work on basalt by Gault (NASA) and Moore (USGS) is included. The specific energies compared to specific energies incurred by other potential drilling techniques indicates that high velocity solid impact is a potential method to increase drilling rates. A potential method is developed to calculate hydrodynamic crater volumes for given impact energies. The general problem is outlined whereby the strong shocks generating the hydrodynamic crater can be extended to include spall and fracture effects. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184191

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**039149**

**ROCK PROPERTIES RELATED TO RAPID EXCAVATION**

Missouri University, Rolla, Rock Mechanics and Explosives  
Research Center, Rolla, Missouri

Final Rpt, Mar. 1969, 358 pp

Contract DOT-3-0143

The purpose of this report is to present an evaluation of rock property measurement in relation to the problems of rapid excavation, to summarize recent theory and representative data, to point out their usefulness and limitations, and finally to indicate some of the pressing needs for further research and development. In most cases the investigators in specific areas of research have presented complete analyses of their work. Where possible, further analysis has been made, primarily in terms of application of results of research. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184767

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PB-184767

**039176**

**SOME DESIGN CONSIDERATIONS IN THE SELECTION OF UNDERGROUND SUPPORT SYSTEMS**

Peck, RB Deere, DU Monsees, JE Parker,  
HW Schmidt, B

Illinois University, Urbana, Department of Civil Engineering,  
Urbana, Illinois

Final Rpt, 6902-6911, Nov. 1969, 179 pp

Contract DOT-3-0152

Guidelines for the design of supports for underground openings in both soil and rock are presented and discussed for several specific situations. The design and construction of both shafts and tunnels are examined. The problems that may occur because of unusual or variable geologic conditions are outlined and the effects of these geologic anomalies on the construction scheme are indicated. Other situations considered include multiple parallel tunnels and crossed tunnels as well as intersections and enlargements of tunnels. Support systems and construction methods which can be easily modified to adapt to variable conditions and requirements are also discussed. The cost of tunnel support systems is evaluated and compared to the total cost of the tunnel. The cost relationships are illustrated by numerous detailed cost estimates of tunnels in both soil and rock. Finally, the problems of ground movements around soft ground tunnels are discussed and methods for predicting the magnitude of settlement over soft ground tunnels are presented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190443

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**039191**

**A COMPUTER-ASSISTED METHOD FOR OPTIMIZING ROUTE PROFILES**

TRW Systems Group, Redondo Beach, California

06818-W004-RO-00, Final Rpt, Dec. 1969, 89 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems  
Engineering Study.

The report describes an heuristic approach to estimate the cost of constructing a route along a given path. Specifically, a computer program is developed to perform cost computation for a given road profile, taking into account the earthwork as well as elevated structures and tunnels. The user inputs the trial profiles, the constraints, and the changes. Use is made of a time-sharing remote terminal so that the user can interact with the computer to manually perform the optimization. The program performs all cost calculations, accepts data and modifications, edits road profiles and prints out diagnostics when necessary. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-191118

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PB-191118

**039240**

**A SYSTEMS STUDY OF SOFT GROUND TUNNELING**

Brandt, CT Stone, RB Smith, AR Willis,  
BH Pastuhof, A

Fenix and Scisson Incorporated, Tulsa, Oklahoma

DOT-FRA-OHSGT-231, Final Rpt, 6902-7005, May 1970, 439  
pp

Contract DOT-FR-9-0034

Prepared in cooperation with Little (Arthur D.), Inc., Cambridge,  
Mass.

A fundamental investigation of soft-ground tunneling operations was made to identify and assess the potential technical and economic feasibility of new tunneling system concepts. Quantitative estimates were made of costs and rate of advance of different candidate system concepts relative to an assumed set of tunneling conditions. The

magnitude of R and D effort required to achieve cost reductions and performance improvements over the 1970 to 1985 time period was estimated. The study concludes that the major restraints to reducing costs and increasing performance in soft ground tunneling over the 1970 to 1985 time period will result from the lack of any effective method for handling bouldery ground and from the lack of a method for rapid installation of the permanent tunnel liner continuously and concurrently with the advance of the face. With a 15-year R and D effort of \$35 to \$70 million, these problems could be substantially overcome and current tunneling costs could be expected to decrease by 40-65% and advance rates could be expected to increase by a factor of from 4 to 8. Cost differences among the more promising alternative system concepts were found to be small relative to the range of uncertainty associated with the cost forecasts. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-194769

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#### 039244

#### MECHANICS OF JOINTED ROCK: EXPERIMENTAL AND THEORETICAL STUDIES

Einstein, HH Bruhn, RW Hirshfeld, RCT

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R70-62, Intrm Rpt; 6809-6912, Aug. 1970; 122 pp

Contract C-85-65t

See also report dated Sep 68, PB-180 248.

The stress strain behavior of intact rock and the phenomena of friction along a single plane as well as the relation to the underlying mechanisms are reviewed. The behavior of the modeling material is consistent with that of most brittle rock. Results of the tests with jointed models which are also supported theoretically, show that the transition from brittle to ductile behavior coincides with the transition from sliding along a pre-existing joint to fracture through the intact material. Multiple joints have a systematic influence on strength and deformability depending on joint orientation, joint spacing and number of joint sets. The study of analytical methods shows that the finite element technique with the feature of special joint elements is well suited for the analysis of jointed rock masses. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-195917

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#### 039246

#### DESIGN OF A WATER CANNON FOR ROCK TUNNELING EXPERIMENTS

Cooley, WC Beck, FL Jaffe, DL

Terraspac Incorporated, 5400 Pooks Hill Road, Bethesda, Maryland

TR-2, Final Rpt, 7005-7101, Jan. 1971, 76 pp

Contract DOT-FR-0-0017

A detailed design is presented for manufacturing a high pressure pulsed water cannon for rock-breaking experiments in a tunnel or quarry at jet pressures up to 1,000,000 psi. The test system includes a trailer for carrying the water cannon, and a separate dolly for the power system and controls. The water cannon incorporates components of a Terrapak hydro-pneumatic actuator and is designed to

fire one pulse every 5 minutes, but can be modified to fire 20 pulses per minute with a pulse energy of 93,500 ft. lbs. This report covers the system analysis, design studies and detailed design of the water cannon system and discusses fabrication, operation and test procedures. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-198050

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#### 039260

#### EMBANKMENT SUPPORT FOR A RAILROAD TEST TRACK. DESIGN STUDIES

Dietrich, RJ Salley, JR

Shannon and Wilson, Seattle, Washington

Final Rpt, Aug. 1971, 167 pp

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)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-202808

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PB-202808

#### 039263

#### EXPLORATORY SOIL BORINGS AT TWO LOCATIONS FOR THE U.S. DEPARTMENT OF TRANSPORTATION. DESIGN STUDIES

Eidt, JT Marks, BD Stewart, JF

Hemphill Corporation, Tulsa, Oklahoma

Final Rpt, Aug. 1971, 75 pp

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)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-202271

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#### 039272

#### TUNNELING COST ANALYSIS

Spittel, LA Willyard, JC

RMC, Incorporated, Bethesda, Maryland

RMC-UR-151, Final Rpt, Mar. 1971, 160 pp

Contract DOT-FR-0-0040

The report provides the Office of High Speed Ground Transportation with a review and analysis of tunnel construction costs. The data for all cost analyses in the report were obtained from historical records of tunnel owners, contractors, and equipment and material



manufacturers throughout the United States. The report proper includes discussions regarding the data gathering process, the methods of analysis employed, and the tunneling cost estimating relationships. Also, included is a brief review of the cost impact of differences in tunnel design and construction policies. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201363

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PB-201363

**039273****THE EFFECTS OF SOIL PARAMETERS AND BOUNDARY CONDITIONS ON THE CONSOLIDATION OF AN ELASTIC LAYER**

Christian, JT Boehmer, JW

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts, 02139

R70-50, Final Rpt, 6810-7001, Aug. 1970, 124 pp

Contract C-85-65t

The behavior of a linearly elastic layer consolidating under influence of a strip surface load is investigated by means of a previously developed finite element program. Several parameters affect the results of such calculations; included among these parameters are: the Poisson's Ratio, the ratio of horizontal to vertical permeability, boundary conditions with respect to displacement, boundary conditions with respect to drainage, and relative load width. The interaction of these is complex, but some have a larger effect than others. A smooth bottom boundary and bottom drainage cause considerable change in the pattern of pore pressure dissipation. Increased horizontal permeability speeds consolidation but not as much as would be expected intuitively. When the load width is narrow, the horizontal permeability has a larger effect. Poisson's ratio does not markedly affect the rate of consolidation provided scaling is done on the basis of the constrained modulus or the in-plane bulk modulus. (DOT abstract)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201550

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**039297****INNOVATIONS IN TUNNEL SUPPORT SYSTEMS**

Parker, HW Semple, RM Rokhsar, A Febres-Cordero, E Deere, DU

Illinois University, Urbana, Department of Civil Engineering, Urbana, Illinois

FRA-RT-72-17, Final Rpt, 6910-7103, May 1971, 263 pp

Contract DOT-FR-0-0023

Innovations in the design and construction of tunnel support systems and applications of new materials for tunnel supports are presented in the report. Medium-to-large transportation tunnels in both soil and rock are considered. While primary emphasis is given to support systems for machine-bored tunnels, improvements in conventional tunnel supports are also included. The Extruded Liner System, which can place a lining by slipform methods immediately behind a boring machine, is described in detail. The lining material which now makes such a system practical is wire-fiber reinforced concrete made with high, very-early strength regulated-set concrete. Modifications of segmented-type linings are suggested to extend their range of applicability, and better ways of erecting them are indicated. Polymer concrete is the most promising new material for segmented

linings. Square tubular and circular pipe sections are shown to be structurally superior to wide flange sections for steel frame tunnel supports subjected to a complex set of loads from directions largely governed by the joint pattern in the rock mass. New materials for sprayed support systems and semiautomatic mechanization of sprayed support systems are evaluated. Guidelines for selection of the most economical tunnels are presented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204437

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**039349****THE USE OF LIME-SOIL STABILIZATION AS A CONSTRUCTION EXPEDIENT**

Neubauer, CH

Air Force Weapons Laboratory, Kirtland AFB, New Mexico AF-5713

AFWL-TR-69-183, Tech Rpt, 6903-6912, June 1970, 120 pp

The early strength deformation properties of 'uncured' lime-soil mixtures, and of the natural soils were investigated. Based on the literature pertaining to early strength effects of lime-soil stabilization and the laboratory investigation of this study it was found that a substantial gain in stability is realized by the addition of lime to a fine-grained cohesive soil. This gain in stability is reflected by the combined immediate gain in modulus of deformation and shear strength of the 'uncured' lime-soil mixtures. This gain in stability can be attributed to the immediate cation exchange, and flocculation and agglomeration processes that take place when lime is mixed with a fine-grained cohesive soil. The laboratory results were further considered in developing a correlation of the cone penetrometer test results to shear strengths and to moduli of deformation. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-872157

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**039822****QUARTERLY REPORTS: RAILWAY TECHNICAL RESEARCH INSTITUTE, VOLUME 12, NUMBER 3, 1971**

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

Vol. 12, No. 3, Sept. 1971, 62p

See also Volume 12, number 2, PB-202 469.

Contents: Surface-stratum failure of sandy slope; Horizontal load test of vertical H-type piles; Dynamic response of railway bridge to the passage of a railway car; Erosion control chemical materials; Eddy current rail brake set; Development of a snow loader; Grouts for prepacked concrete; Air-hole heat transfer in a traction motor; Automatic train positioned stop system; Performance test of type DE 50 diesel-hydraulic locomotive; Cold pressure welding of trolley wire; Evaluation of atmospheric factors.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204475

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PB-204475

**040968**  
**PROBE DRILLING FOR RAPID TUNNELING**

Williamson, TN Schmidt, RL

American Inst of Mining, Metallurg & Petrol Engrs, 345 East  
 47th Street, New York, New York, 10017

Vol. 1, 1972, pp 65-87

Notification of this article, Proceedings of the 1st North  
 American Rapid Excavation and Tunneling Conference, AIME,  
 appeared in the Bureau of Mines--New Publications, January  
 1973, Monthly List 693.

This paper describes one of several research projects funded by  
 the Advanced Research Projects Agency to extend the technology of  
 rapid underground excavation. This study and field research effort are  
 to investigate alternative means to determine rock and geological  
 conditions in advance of a tunnel boring machine (TBM). Approx-  
 imately 1 year of a planned 3-year program has resulted in the defin-  
 ition of three candidate drill systems. Hardware has been assembled  
 to field test these candidates and testing has begun.

**ACKNOWLEDGEMENT**

Bureau of Mines

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Inst of Mining, Metallurg & Petrol Engrs, 345 East  
 47th Street, New York, New York, 10 Repr PC: Req Price

**040969**  
**RESEARCH AND DEVELOPMENT--KEY TO ADVANCES  
 FOR RAPID EXCAVATION IN HARD ROCK**

Olson, JJ Atchison, TC

American Inst of Mining, Metallurg & Petrol Engrs, 345 East  
 47th Street, New York, New York, 10017

Vol. 2, 1972, pp 1393-41

Notification of this article, Proceedings of the 1st North  
 American Rapid Excavation and Tunneling Conference, AIME,  
 appeared in the Bureau of Mines--New Publications, January  
 1973, Monthly List 693.

The purposes of this paper are (1) to show the potential ability  
 of technologic forecasting to meet future demands in rapid excavation  
 through the acceleration of excavation rates by research and devel-  
 opment in several related technologic fields, (2) to provide a brief  
 review of the initial development of the ARPA (Advanced Research  
 Projects Agency) Rock Mechanics and Rapid Excavation program,  
 (3) to draw attention to the research projects completed or under-  
 way in the FY 1970-72 ARPA program and explain where information or  
 program results can be obtained, (4) to summarize the progress and  
 accomplishments of applied research contracts in the rock disintegra-  
 tion element of the ARPA program, and (5) to discuss the research  
 directions planned for the remaining years of the program.

**ACKNOWLEDGEMENT**

Bureau of Mines

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 47th Street, New York, New York, 10 Repr PC: Req Price

**041098**  
**ROCK FRACTURE BY ELECTRO-HYDRAULIC EFFECTS**

Kinoshita, T

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

Vol. 13, No. 1, Mar. 1972, pp 11-15, 10 Fig, 1 Phot

Rock breaking with electro-hydraulic effects was studied. An  
 experiment was performed by using a ready-made electro-hydraulic  
 metal forming device. The rock breaking effects of electro-hydraulics  
 and its application in undersea water and tunneling operation were  
 discussed. It was concluded that this method has many advantages in  
 rock breaking, if used in the field of undersea operation and  
 tunneling.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
 Repr PC: Req Price

**041099**  
**MODEL EXPERIMENTS ON LATERAL RESISTANCE OF  
 FOOTING FOUNDATION IN COHESIVE SOIL**

Moiyama, S

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

Vol. 13, No. 1, Mar. 1972, pp 15-17, 5 Fig

In the design of a footing foundation, the lateral load must be  
 considered as well as the vertical load. A series of model experiments  
 in cohesive soil were carried out in order to make clear the problem  
 concerning the lateral resistance in front of a footing foundation. As a  
 result, the maximum lateral resistant forces agreed roughly with the  
 Rankine's passive earth pressures. The lateral displacements to attain  
 the maximum resistant forces were checked in connection with the  
 depths and the cone-penetration resistances of the ground.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041100**  
**MODEL EXPERIMENTS ON LATERAL RESISTANCE OF  
 FOOTING FOUNDATION ON SAND**

Muromachi, T Moriyama, S

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

Vol. 13, No. 1, Mar. 1972, pp 17-19, 5 Fig

In the design of a footing foundation, stability analysis for the  
 lateral load is as important as that for the normal load. In practical  
 design in the present stage, however, lateral resistant forces are rarely  
 taken into consideration. It depends on the fact that the actual resis-  
 tant forces of a footing foundation have so far not been fully investi-  
 gated. In order to improve the point, a series of fundamental model  
 experiments were carried out in respect to the front resistance of a  
 footing foundation on sand. It was made clear from these experi-  
 ments that the front resistance of a footing nearly equals to Ran-  
 kine's passive earth pressure, and it needs a certain amount of lateral  
 displacement, which corresponds to the soil strength and the depth of  
 foundation, for this resistance to attain its maximum value.

**ACKNOWLEDGEMENT**

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**041101**  
**MEASUREMENT OF DYNAMIC EARTH PRESSURES**  
**ACTING ON MODEL WELLS IN WEAK GROUND**

Nasu, M    Saski, O

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

Vol. 13, No. 1, Mar. 1972, pp 19-21, 4 Fig, 1 Tab

The dynamic earth pressures acting on the model wells measured when they were sunken in situ in weak ground and forcedly vibrated are described. The frequency of resonance in the dynamic earth pressure is different from that of the top plate's displacement and varies with soil property. The dynamic K-value seems to be minimum at resonance. A static horizontal loading test was also carried out. The dynamic K-values are from one to three times the static K-values.

**ACKNOWLEDGEMENT**

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**041102**  
**SOME KNOWLEDGE OBTAINED FROM SEISMIC**  
**SURVEY IN TUNNEL**

Asano, G    Higuchi, I    Tanaka, T

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

Vol. 13, No. 1, Mar. 1972, pp 22-24, 3 Fig, 1 Tab

Seismic survey is now regarded to be one of the most useful exploration methods in the region of engineering geology, especially in tunneling. In the past, the seismic survey has been carried out almost exclusively from the ground surface above a tunnel, but the authors have tried it experimentally in tunnels to examine the natural characters of rock in situ. The present report purports to describe the measured results of seismic surveys in the tunnel which may be used for a more accurate survey and an analysis of problems in rock mechanics concerned with the geological and physical properties of rock in situ.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041103**  
**ON THE CHECK SYSTEM FOR GEOLOGICAL SURVEY**  
**OF TUNNELS**

Takahashi, H

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

Vol. 13, No. 1, Mar. 1972, pp 24-25, 1 Fig

Development of engineering practices in tunneling has gradually reduced the range of geologic conditions which make construction works impossible. Therefore, for the higher reliability a pre-estimation of geologic conditions has come to be demanded. In each stage of geological surveys, the following items should be included where the surveys are correspondingly stepped up. What subjects are clear and what are not? What subjects must be examined next? What methods are there to examine these? Consequently, data for execution schedule of the construction and criteria on results of geological surveys are summarized.

**ACKNOWLEDGEMENT**

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**041104**  
**NEW METHOD FOR COLLECTING DUST USING**  
**ELECTROSTATIC FORCE**

Misawa, S    Takahashi, A

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

Vol. 13, No. 1, Mar. 1972, pp 26-31, 13 Fig

A method for collecting dust by depositing it on a tunnel wall making use of electrostatic force is presented. This device is proved to be effective to remove every dusts (drilling, blasting, mucking, dry shotcrete, carbons of ultra-fine particles) produced in the tunnel. It is believed that this device will make a great contribution to health of workers and the improvement of working efficiency due to the increase of sight distance during tunnel excavation.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041106**  
**STATISTICAL ANALYSIS OF EMBANKMENT SLOPES**  
**DESTROYED IN TOKACHIOKI EARTHQUAKE**

Takei, M

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

Vol. 13, No. 1, Mar. 1972, pp 31-35, 4 Fig, 5 Tab

The Tokachioki earthquake, which occurred on 16 May 1968, caused considerable damage to the earth structures on the Tohoku Line, and the failed section represented 29% of the total length (67 km) of the existing and newly constructed lines. This report relates to the discriminant analysis carried out on the damage of embankment slopes on the basis of the Survey Report of the failed embankments, in particular, those between Hachinohe and Noheji. The essential tool of the analysis is linear discriminant functions derived from the quantification theory.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041112**  
**STABILIZATION OF SOIL BY CEMENT**

Kamiura, M

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

Vol. 13, No. 1, Mar. 1972, pp 52-54, 2 Fig, 1 Tab

The process of stabilization of soil by cement was investigated using seven additives that were different in their reactivity to soil and cement. The experimental results of development of mechanical strength strength-fall after immersion in water, permeability test and microscopic observation show that cement reacts, first, with fine parts of soil and after curing for more than three weeks, the reaction products give secondary bond-strength to the soil cement by pozzolanic reaction. Therefore, in order to ameliorate the properties of soil cement, it is necessary to examine fine parts of soil by X-ray analysis



and strength-fall by immersion in water.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041113**

**EXPERIMENTAL STUDY ON APPLICATION OF STATIC CONEPENETROMETER TO SUBSURFACE INVESTIGATION OF SOFT SUBSOILS**

Muromachi, T

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

Vol. 13, No. 2, June 1972, pp 61-66, 12 Fig

The application of the Static Conepenetrometer to subsurface investigation of soft subsoils was analyzed experimentally. The fundamental relation between the cone bearing value and the cohesion, angle of shearing resistance, sensitivity ratio and the effective overburden pressure of the soil in situ was derived, assuming that the three dimensional failure surface fits the test results. Since the relation varies in accordance with the vertex angle, base area, sleeve length of a cone and also with the penetrating speed, the degrees of influences of these factors were measured through the experiments. On the basis of these data, the correct interpretation and the effective way to make use of the penetration resistance of a static conepenetrometer were studied.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041114**

**GROUND SUBSIDENCE DUE TO EXCAVATION AND EARTH-PRESSURE BEHAVIOUR IN TUNNELS**

Shimada, T Izuka, A Takagi, M

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

Vol. 13, No. 2, June 1972, pp 66-70, 4 Fig

During the excavation of a tunnel in the soft ground of thin earth covering, the subsidence of ground and strong earth-pressure on the tunnel often cause major difficulties. Now JNR has experienced and is experiencing construction of several tunnels with a thin earth covering which is expected to subside due to excavation. This report purports to describe the mode of subsidence of ground and earth-pressure, and some proposals of safeguard for such tunnelling.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041115**

**RUNNING SAFETY TEST OF CAR AGAINST DERAILMENT OVER AN ANGULAR BEND**

Itoh, F Okuda, T Hirata, G Arai, S Fujita, R

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

Vol. 13, No. 2, June 1972, pp 70-76, 15 Fig, 3 Tab

On a long span suspension bridge, the tracks at main towers or on abutment sections have heavy angular bends owing to the deflection of cables and the stiffening girders under temperature change, train load, strong wind, etc. This report describes the derailment tests which have been carried out on KARIKACHI Test Track to check the running safety of car over an angular bend.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041145**

**SUSQUEHANNA HITS PC HARD-TWICE**

Dick, MH

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 11, Dec. 1972, pp 28-31, 3 Phot

Floodwaters of Hurricane Agnes caused the Susquehanna River to wash out about one third of Penn Central's Shocks Mill Bridge. The 66 year old bridge, a 2,200 foot long double track structure, consisted of 28 stone arch spans. An appraisal indicated that foundation scour caused settlement and tilt of Pier 14, one of three heavier anchor piers in the bridge, which disturbed the restraining force against thrust of adjacent spans, and produced a domino effect with adjacent spans collapsing. Reconstruction of the masonry arches would have been too costly and time consuming, and time factors also ruled out through-truss construction. The decision was made to use steel deck girder construction on concrete piers. It was necessary to remove some of the remaining stone arch spans, back to anchor Piers 7 and 21. These piers were strengthened to withstand the thrust from the remaining arch spans. This was done by installing post-tensioned cables down through each pier and into bedrock. These piers were also adapted to serve as abutments for the deck girder spans.

**ACKNOWLEDGEMENT**

Railway Age

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**041223**

**FROST ACTION IN SOILS**

Miller, RD Anderson, DM Tice, AR Williams, PJ Brandt, GH McGaw, R Penner, E Dunn, JR Hudec, PP Laba, JT Aziz, KA

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 293, ISBN-0-309-02065-4, 1972, 95 pp

Prepared for presentation at the 51st Annual Meeting of the HRB.

Eight papers describe the continuing struggle to overcome frost problems: 1) freezing and heaving of saturated and unsaturated soils; 2) predicting unfrozen water contents in frozen soils from surface area measurements; 3) use of the ice-water surface tension concept in engineering practice; 4) chemical additives to reduce frost heave and water accumulation in soils; 5) frost heaving versus depth to water table; 6) influence of freezing rate on frost heaving; 7) frost and sorption effects in argillaceous rocks; 8) pressure-time relationship in laterally stressed frozen granular soils.

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Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418, Repr PC: \$2.80

041322

**HOOSAC TUNNEL GETS A NEW STEEL INTERIOR**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 1, Jan. 1973, pp 31-33, 1 Phot

Hoosac Tunnel, completed in 1875, is vital to the Boston and Maine since the bulk of their freight moves through the tunnel. Most of the 4.75 mile tunnel is through solid rock, but about 8,000 feet is through soft rock that was lined with a brick arch. Since the 1950, maintenance has increased on the soft rock portion of the tunnel. A sudden rock fall closed the tunnel. The rock fall was removed, a patch installed and grouted, and the line back in service in just six days. Over the past 10 years, the deteriorating brick arch has been gradually lined with corrugated steel liner plate, and the space behind the plate has been grouted. Last month an additional 54 feet of liner plate was installed to virtually eliminate maintenance problems.

**ACKNOWLEDGEMENT**

Railway Age

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041647

**THE INFLUENCE OF THE CEMENT AND THE PROPERTIES OF CEMENT SUSPENSIONS ON THE INJECTION CAPACITY INTO SOILS 212 UEBER DEN EINFLUSS DES ZEMENTS UND DER EIGENSCHAFTEN DER ZEMENTSUSPENSIONEN AUF DIE INJIZIERBARKEIT IN LOCKERGESTEINSBOEDEN**

Bonzel, J Dahms, J

Beton, Herstellung, Verwendung (Beton Verlag GmbH, Duesseldorfer Strasse 8, Postfach 450, 4 Duesseld Okassel, West Germany)

Vol. 22, No. 4, Apr. 1972, pp 156-166, 20 Ref

Cement suspensions of 19 different cements with water to cement ratios between 0.50 and 2.00 were examined, differing in type, composition, fineness and strength, with regard to their flow, sedimentation and injection behavior.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 017216

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041648

**DEEP-PLOW LIME STABILIZATION FOR PAVEMENT CONSTRUCTION**

Thompson, MR, Illinois University, Urbana

ASCE Journal of Transportation Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. TE2, Paper 8858, May 1972, pp 311-323, 17 Ref

Deep-plow lime stabilization equipment and procedures for treating substantial thicknesses (30 cm-90 cm) of in situ subgrade soil are described. Field study data and results are summarized and potential field applications are considered. It is concluded that deep-plow lime stabilization procedures can be successfully utilized in pavement construction if appropriate consideration is given to stabilization objectives and quality control requirements.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000012

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041651

**RESPONSE OF CORRUGATED STEEL PIPE TO EXTERNAL SOIL PRESSURES**

Watkins, RK, Utah State University, Logan  
Moser, AP

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 373, 1971, pp 86-96, 17 Ref

Full-scale external load testing of buried corrugated steel pipes shows the structural performance limits of the soil-pipe system. The tests indicate that the 3 most important factors influencing performance are the yield point strength of the pipe wall, the soil compressibility and the ring flexibility of the pipe. The empirical relationship of these 3 factors is plotted on a graph.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 016395

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041652

**RIPRAPPED BASINS FOR CULVERT OUTFALLS**

Stevens, MA, Colorado State University, Fort Collins  
Simons, DB  
Watts, FJ

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 373, 1971, pp 24-38, 9 Ref

288 model tests on basins for circular and rectangular culverts were conducted at Colorado State University. The models ranged in size from a 6-by 12-in. rectangular culvert with 1/Min. riprap to a 36-in. diameter pipe with 7-in. diameter rock. A method for the design of rock-riprapped basins for culvert outfalls was developed from a study of the model data. The method and design aids are presented.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 016390

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041654

**FACTORS INFLUENCING THE DESIGN OF EMBANKMENT AND CUTTING SLOPES**

Younger, JS, Pre Constructional Services Limited

Institution of Highway Engineers, Journal of (Industrial Newspapers Limited, John Adam Street, London WC2, England)

Vol. 19, No. 4, Apr. 1972, pp15-25, 33 Ref

Attention is focussed on the use of the computer in connection with "limit equilibrium" approaches to the solution of stability problems, and comment on stress-strain methods of analysis is also made. Consideration is given to the best form of presentation of results particularly with respect to their use during construction in association with instrumented control sections.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 016860

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041656

**SOIL-CEMENT BASES UNDER THIN BITUMINOUS SURFACING**

Obi, BCA, University of Science and Technology, Ghana

ASCE Journal of Transportation Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. TE2, Paper 8871, May 1972, pp 167-176

The deformation properties of soil-cement bases, in particular bases under thin bituminous surfacing, are investigated under repeated dynamic compressive loading. The principal variables considered are stress intensity and frequency, and cement content. Analyses of the compressive strength, Poisson's ratio and modulus of resilient deformation, show that soil-cement bases can be confidently employed under thin bituminous surfacing within stated limitations of minimum critical strength and maximum resilient deformation.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000001

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041658

**LIME RECLAIMS UNSTABLE INTERIOR SUBGRADE DURING CONSTRUCTION**Sheahan, JM, Swindell-Dressler Company  
Siembieda, EJ

Civil Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 42, No. 6, June 1972, pp 74-75

Two acres of unstable subgrade required stabilization while construction was in progress. Four percent monohydrated lime at about 20 lb per sq yd served as the stabilizing agent. After a discharrow scarified the area, 25 tons of lime were spread. A dozer-disc combination worked over the area, and a pneumatic roller performed the sealing.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000521

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041996

**RAILWAY BOX-GIRDER BRIDGE ERECTED BY LAUNCHING**

Durkee, JL, Bethlehem Steel Corporation

ASCE Journal of the Structural Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. ST7, 9028, July 1972, pp 1443-63

The 2110-ft single-track Kansas City Southern Railroad bridge over the Arkansas River near Redland, Oklahoma, is a continuous box-girder structure having nine spans. Approximately 2400 tons of ASTM A588 weathering steel, left unpainted, were used. The 24 individual box units, ranging in length from 42 feet to 117 feet and in weight from 44 tons, were shop-fabricated by welding. Web and flange erection strengthening and stiffening were found necessary. Pier and abutment stresses and stability were reviewed.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 060791

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041999

**MODEL STUDY OF WINDBREAKS ON RAILWAY BRIDGES**

Papesch, AJG, Canterbury University

New Zealand Engineering (Technical Publications Limited, CPO 3047, Wellington, New Zealand)

Vol. 27, No. 4, Apr. 1972, pp 132-139

How the effect of overturning moments caused by strong cross winds can be reduced by positioning barriers of suitable size and construction to shelter the rolling stock from winds. The report deals with a wind-tunnel comparison of various types of wind shield, and the eventual selection of two configurations which could be expected to give a suitable sheltering effect.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 064349

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043508

**SOME METHODS OF TEST AND SURVEY FOR ESTIMATING THE MACHINEABILITY OF ROCKS IN EXCAVATION BY ROCK TUNNELING MACHINES**

Misawa, S Sakurai, T Takahashi, A

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

Vol. 13, No. 4, Dec. 1972, pp 187-191, 9 Fig, 2 Tab, 2 Phot

For the purpose of determining the applicability of Rock Tunneling Machines and estimating the proceeding rate of excavation by the machines and cutter life, several new simple quick tests using boring core were carried out to determine the machineability of the rocks. The measured values in the tests were compared with the experienced machineability which had been determined from the results of excavation so far by the machines. It is proved that a good agreement exists between them and in future we will be able to estimate the machineability of rocks easily prior to construction.

(Author)

**ACKNOWLEDGEMENT**

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043509

**DAMAGE TO RAILWAY EMBANKMENTS IN THE 1968-TOKACHIOKI EARTHQUAKE**

Ikehara, T

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

Vol. 13, No. 4, Dec. 1972, pp 181-186, 17 Fig, 3 Phot

Railway embankments between Shiriuchi and Noheji stations on the Tohoku line suffered severe damage in the 1968-Tokachioki earthquake. The damage was classified into four categories; slope surface flowslide; slope failure; vertical cracking; and subsidence of embankment. The causes of each type of failure are examined with due consideration for mechanical properties of fill materials, distribution of rainfall preceding the earthquake, and the effect of ground shaking, especially the increase of pore-water pressure due to cyclic loading. Some ideas for earthquake resistant design of embankment are presented. (Author)

**ACKNOWLEDGEMENT**

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**043510  
MODEL TEST OF TUNNEL LINING**

Saito, T Shirai, K Iwai, T

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

Vol. 13, No. 4, Dec. 1972, pp 192-193, 5 Fig, 1 Phot

This study purports to examine if steel ribs in lining may be taken as a permanent reinforcement which participates in the bearing capacity of lining as a whole. Loading tests of linings of ideal execution condition were carried out. A cooperative action of concrete and steel ribs or the effect of steel ribs on the bearing capacity of linings were recognized. Strains in H-ribs and adjacent concrete are always nearly equal and proportional before the occurrence of cracks and lining concrete and H-ribs may be considered cooperative. The increase of bearing capacity of lining by introducing H-ribs may be expected within the elastic limit.

**ACKNOWLEDGEMENT**

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**043603  
ESTIMATING PEAK RUNOFF RATES FROM UNGAGED  
SMALL RURAL WATERSHEDS**

Bock, P, Travelers Research Corporation  
Enger, I, Travelers Research Corporation  
Malhotra, GP, Travelers Research Corporation  
Chisholm, DA, Travelers Research Corporation

Highway Research Board, 2101 Constitution Avenue, NW,  
Washington, D.C., 20418

NCHRP Report 136, 1972, 85 pp, 34 Tab

A problem that continues to plague highway agencies is that of selecting optimum culvert sizes for waterways based on (1) estimates of the magnitude and frequency of peak flows from small rural watersheds (less than 25 square miles), (2) the relative cost of facilities necessary to accommodate the estimated flows, and (3) the possible effects of flows in excess of the estimates used for design purposes. Although this report does not resolve the problem, it does provide valuable insight into the difficulties associated with attempts to develop improved methods for estimating peak runoff rates of various return periods for small unengaged rural watersheds throughout the United States. It should be of considerable practical value to agencies that lack well-developed local or regional methods for predicting flood flows and frequencies. Hydrologists and researchers working in this problem area undoubtedly will find the report of interest and value.

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**043774  
ACCELERATED CURING OF SALT-TREATED AND LIME-  
TREATED COHESIVE SOILS**

Drake, JA, Dames and Moore, Incorporated  
Haliburton, TA, Oklahoma State University

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 381, ISBN 0-309-02050-6, 1972, pp 10-19, 13 Ref

Sponsored by Committee on Chloride Stabilization.

This paper describes an investigation to determine elevated temperature and reduced time that would be required for accelerated curing of 2 cohesive Oklahoma soils modified and stabilized with salt and lime and that would produce strength gain and chemical products similar to those obtained by 28-day cure at 80 F and 100 percent humidity. Lime-only treatment data were also collected for comparative purposes. A pilot study at 95 percent humidity and temperatures of 120, 110, 105, and 100 F revealed that a temperature of 105 F best simulated conventional strength time curing conditions. For both soils, at saltlime modification and stabilization treatments, 30 hours of 105-F curing produced equivalent 28-day strength. For lime-only treatment, accelerated curing times varied from 30 hours at modification optimum to 72 hours at stabilization optimum. Differential thermal analysis of conventional-cured and accelerated-cured samples indicated similar mineralogical characteristics existed when equivalent strengths were obtained. A tentative-strength mix design procedure using the technique for accelerated curing is suggested.

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**043775  
SODIUM SILICATE STABILIZATION OF SOILS: A  
REVIEW OF THE LITERATURE**

Hurley, CH  
Thornburn, TH, Illinois University

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 381, ISBN 0-309-02050-6, 1972, pp 46-79, 91 Ref

Sponsored by Committee on Chemical Stabilization of  
Foundations.

This report consists of an annotated bibliography and summary review of the important literature on the use of sodium silicates in soil stabilization processes. Annotations are given for approximately 90 articles published between 1931 and 1965. On the basis of these articles the authors have summarized pertinent information on stabilizer properties, reaction mechanisms, injection methods of soil solidification, properties of stabilizer soil mixtures, and use of sodium silicates as dustproofers and waterproofers and as secondary additives with other stabilizers. There is some evidence that sodiumsilicate stabilization can increase the strength and durability of sandy soils or even relatively nonplastic finegrained soils under mild climatic conditions; however, there is almost no field evidence to justify its use when the stabilized material is subjected to the freezing and thawing cycles typical of temperature-to-cold climates. Sodium silicates with or without the addition of precipitants are of little value in dust-proofing or waterproofing finegrained soils. On the other hand, laboratory tests seem to indicate that sodium silicate used as an additive can improve the strength and durability of soils stabilized with portland cement, lime, or lime-fly ash.

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**043776  
RELATIVE STABILIZING EFFECT OF VARIOUS LIMES  
ON CLAYEY SOILS**

Alexander, ML, California Division of Highways  
Smith, RE, California Division of Highways  
Sherman, GB, California Division of Highways

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 381, ISBN 0-309-02050-6, 1972, pp 27-36

Sponsored by Committee on Lime and Lime-Fly Ash Stabilization.

The relative stabilizing effects of 2 hydrated limes and 3 quick-limes from various commercial producers are discussed. The effects of variations in lime gradation and calcium hydroxide content on the unconfined compressive strength of 3 different soils are presented. The strengths of specimens treated with hydrated lime, even in comparisons based on equivalent  $\text{Ca}(\text{OH})_2$  content. It was also found that the coarser limes tested were more effective than the fine. Correlations are established between lime gradation and compactability and between specimen density and compressive strength.

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043777

**CHARACTERISTICS OF IRREGULARLY SHAPED  
COMPACTION CURVES OF SOILS**

Lee, PY, South Dakota State University  
Suedkamp, RJ, Federal Highway Administration

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 381, IABN 0-309-02050-6, 1972, pp 1-9, 13 Ref

Sponsored by Committee on Compaction.

Although the curve of dry density versus moisture content commonly yielded by the standard AASHTO compaction tests contains a single maximum, some soils have produced more complicated curves. Because these soils have not been well studied, extensive work has been carried out to establish the existence of irregularly shaped curves. The primary effort was focused on examining, from both a macroscopic and a microscopic level, the characteristics that lead to such curves. The investigation has established 4 types of compaction curves: one with a single peak, one with an irregular 1 1/2 peak, one with a double peak, and one that is almost a straight line with no distinct maximum dry density or optimum water content noted. There is a correspondence between the index properties on the modified Casagrande's chart and the kind of curve. The mineral constituents of the soil samples also affect the shape of the moisture-density compaction curve.

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043778

**EFFECTS OF FREEZE-THAW PARAMETERS ON THE  
DURABILITY OF STABILIZED MATERIALS**

Dempsey, BJ, Illinois University  
Thompson, MR, Illinois University

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 379, ISBN 0-309-01994-X, 1972, pp 10-18

A study was conducted to evaluate the effects of various frost-action parameters on the freeze-thaw durability of stabilized materials and to determine which parameters could be modified so that a characteristic freeze-thaw cycle could be adapted to laboratory use. The parameters studied were cooling rate, freezing temperature, length of freezing period, and thawing temperature. The cooling rate was found to be an important factor affecting the freeze-thaw durability of stabilized soils. Lower cooling rates (0.2 to 2.0 F/hr) that correlated best with quantitative field data were generally the most detrimental to durability. A sustained freezing study revealed that the length of the freezing period did not have to be greater than that required to accomplish complete freezing of the test specimen. The

study further indicated that freezing and thawing temperatures should be representative of those for in-service pavement systems. Thawing temperatures for some stabilized materials are important because strength increase caused by a pozzolanic reaction is possible at high temperatures. The number of cycles used in a laboratory freeze-thaw test should be related to geographical location, climatic conditions, and position of the stabilized layer in the pavement system. For Illinois climatic conditions, a laboratory freeze-thaw cycle representative of field conditions would require a completion period of 48 hours.

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043902

**FATIGUE BEHAVIOR OF WELDED BEAMS**

Hirt, MA, Howard, Needles, Tammen and Bergendoff  
Fisher, JW, Lehigh University

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 4-15, 11 Fig, 16 Ref

Sponsored by Committee on Steel Superstructures.

The fatigue behavior of welded steel beams is evaluated by using the fracture-mechanics concepts of stable crack growth. A fracture-mechanics model for cracks originating from the pores in the web-to-flange fillet weld is developed. Estimates of the stress-intensity factor are made that numerically describe the initial flaw condition. With the final crack size known, a theoretical crack-growth equation was derived from the fatigue test data of the welded beams. The derived relationship compares well with actual crack-growth measurements on a welded beam and available data from crack-growth specimens. The regime of crack growth, where most of the time is spent growing a fatigue crack in a structural element, is shown to correspond to growth rates below 10 to the minus 6 power in. per cycle. Few experimental crack-growth data are available at this level. It is concluded that the fracture-mechanics concepts can be used to analyze fatigue behavior and to rationally evaluate the major variables that influence the fatigue life of welded beams.

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043903

**FULL-SCALE TORSION TESTS OF PRESTRESSED  
CONCRETE I-BEAMS**

Buth, E, Texas Transportation Institute  
Furr, HL, Texas Transportation Institute

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 16-28, 15 Fig, 6 Ref

Sponsored by Committee on Concrete Superstructures.

In modern concrete highway bridges, torsional loadings are created in a variety of loading situations both during construction and during the service life of the structure. Overhanging deck forms cantilevered from edge beams are a primary source of torsional loading during construction of a prestressed beam, cast-in-place deck structure. Torsional loads occur, under traffic, in beams in skewed and curved structures and in other more liberal designs. These requirements have emphasized the need for a better understanding of practical methods for analyzing torsional stresses in prestressed concrete beams. A simple method of analysis and a reliable failure or strength criterion, verified by experimental data, is urgently needed.



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**043904**  
**INVESTIGATION OF PRESTRESSED REINFORCED**  
**CONCRETE FOR HIGHWAY BRIDGES**

Sozen, MA, Illinois University  
Siess, CP, Illinois University

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 29-36, 5 Fig, 18 Ref

Sponsors by Committee on Concrete Superstructures.

This report provides a guide to the work accomplished in the course of an extensive research project on the use of prestressed concrete for highway bridges. The project was active over the period 1951-1969. It covered various topics related to flexural strength, shear strength, time-dependent deformations, anchorage-zone stresses, and bond characteristics of prestressed concrete beams. The scope of the analytical and experimental investigations in each area is outlined. The report also contains a list of references where complete information on different phases of the investigation can be found.

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**043905**  
**FACTORS AFFECTING GIRDER DEFLECTIONS DURING**  
**BRIDGE DECK CONSTRUCTION**

Hilton, MH, Virginia Highway Research Council

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 55-68, 11 Fig, 4 Ref

Sponsored by Committee on Construction of Bridges and Structures.

Problems involved in obtaining the desired thickness of bridge decks were investigated. The study, which was limited to decks longitudinally screeded during construction, included a) field measurements of the girder deflections during construction, and b) theoretical frame analysis of the girder deflections under the field-loading conditions. Two simple supported steel-plate spans were investigated. When full-span length longitudinal screeding is used, the finished grade elevations are set on the screeding edge of the machine and remain independent of the bridge girder deflections, and thus the forming elevations, will in turn have a bearing on the final thickness of a bridge deck. In addition, all factors that in effect cause the deck forming to be too high at the time the concrete is screeded to grade have the potential of causing an inadequate deck thickness. The most significant factors were found to be a) plan dead-load deflection values that are in error, b) differential temperatures existing between the top and bottom flanges of the girders during concrete placement as opposed to those that may have existed when the forming elevations were established, and c) the transverse position of the concrete dead loading at the time a final screeding pass is made over a given point on a span.

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**043906**  
**PREFORMED ELASTOMERIC BRIDGE JOINT SEALERS:**  
**INTERIM GUIDE FOR DESIGN AND CONSTRUCTION OF**  
**JOINTS**

Kozlov, GS, New Jersey Department of Transportation

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 69-81, 7 Fig, 2 Tab, 10  
Ref, 3 App

Sponsored by Committee on Sealants and Filler for Joints and Cracks.

As a result of several years of research that culminated in the construction of two experimental bridges, it now becomes possible to present engineers with procedures for the design and construction of adequately sealed bridge joints. These procedures are offered as an interim solution until research provides further evidence or improvements or both. The paper suggests armored joint construction sealed with preformed elastomeric sealers as the most advantageous solution to the problem of sealing joints in bridges.

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**043907**  
**REPAIR OF SPALLING BRIDGE DECKS**

Kliethermes, JC, Federal Highway Administration

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 83-92, 5 Fig, 6 Ref

Sponsored by Committee on Structures Maintenance.

Moisture, humidity, concrete cover, and age coupled with the increasing rate of chloride applications are causing embedded reinforcement steel to corrode and result in an alarming amount of bridge deck spalling. The spalling reduces the riding quality of the bridge and may have an effect on the structural integrity of the structure. The annual national cost associated with the repair is estimated to be approximately \$40 million per year. The spalling problem is dealt with throughout the country by using various patching techniques. The permanency, i.e., time to replacement, of these patches has become critical especially in high traffic volume areas. Many patches are failing after relatively short service periods and cause numerous traffic interference problems. This paper discusses several patching techniques that will increase service life. The California Division of Highways through a highway planning and research project developed a nondestructive instrument that will detect corrosion in reinforced concrete structures. This paper also describes how this instrument may be put into operational use. Based on a bridge inventory using this equipment, a deck classification system is proposed that defines the type and extent of repairs that can be made. The classification also permits an administrative evaluation for maintenance and reconstruction scheduling.

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**043908**  
**CONCRETE OVERLAYS FOR BRIDGE DECK REPAIR**

Furr, H, Texas Transportation Institute  
Ingram, L, Texas Transportation Institute

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 400, ISBN 0-309-02072-7, 1972, pp 93-104, 4 Fig, 6 Tab, 12 Ref

Sponsored by Committee on Structures Maintenance.

Tests were made on portland cement and resinous concrete overlays to determine their suitability as overlays for deteriorated concrete bridge decks. Direct shear strengths of overlays bonded with epoxy, portland cement grout, and latex-modified cement grout were compared with those applied with no bonding agent. Freeze-thaw tests were made to determine durability of bonding agents and of overlay concretes. Load tests were made on 8-ft. span beams to determine the stiffening effect of overlays and the effect of repeated loadings on overlaid beams. Durability was studied further by gradually lowering laboratory temperature to 20 F during periods of repeated load applications. Low frequency and low amplitude vibrations were maintained on one beam by cyclic loading during placement and cure of a 1-1/2-in. overlay to simulate vibration due to traffic on a lane adjacent to the one being overlaid. Shear bond strengths ranged from 214 to 668 psi. Epoxy and portland cement grout bonding agents withstood the ASTM C 290 test without failure. Two of three overlays of latex-modified cement concrete came unbonded during the ASTM C 290 test. Latex-modified cement concrete overlay provided better freeze-thaw scale resistance than did other materials. No overlay failed in any way, except for tension cracks, in 2 million cycles of load.

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#### 043909

##### SOIL-STRUCTURE INTERACTION: A SYMPOSIUM

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 413, ISBN 0-309-02085-9, 1972, 105 pp

Library of Congress Catalog Card No. 72-9785. Nine Reports prepared for the 51st Annual Meeting.

Since the introduction of corrugated metal pipe in the late 1890s, there has been a continuing interest in proper pipe usage for maintenance purposes. Early methods of design were truly "rule of thumb" and were developed through "failure criteria." Refinements of these methods resulted in a set of systems that were very effective in dealing with pipe problems. However, the building of the Institute Highway System brought with it a need to develop new approaches that would incorporate the latest soil-structure interaction theories and be applicable to the larger structures, higher embankments, and new materials. Better inspection and construction control are considered requisite to the utilization of more refined theories. Practice in the design and construction of culverts continues to improve, but, because many organizations have not been able to keep up with or apply the latest theories, the Highway Research Board Committee on Subsurface Soil-Structure Interaction organized a symposium to assess the state of the art and to delineate problems needing further attention.

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#### 043913

##### ANALYSIS AND DESIGN OF CABLE STRUCTURES

Birnstiel, C

Computers and Structures (Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 2, No. 5,6, Dec. 1972, pp 817-831

Cable structures are classified, and examples of some types are illustrated together with a discussion of their advantages and disadvantages. The problem of establishing the initial shape of the structure is discussed. Some techniques for computing the displacements of suspension structures resulting from changes in static loading, considering the geometrical nonlinearity, are described. A procedure for determining the displacements of stiffened and unstiffened cable three-dimensional structures is outlined that is suitable for computer solution. Results of numerical studies made utilizing this technique are presented.

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#### 043914

##### THEORY OF CRACKING IN CONCRETE MEMBERS

Edwards, AD Picarde, A

ASCE Journal of the Structural Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. ST12, Proc Paper 9428, Dec. 1972, 114 pp

A theory is presented that predicts the crack width and crack spacing in the constant moment region of a reinforced or prestressed beam. The theory is based on the same assumptions as the classical theory of cracking for reinforced concrete. Instead, however, of assuming a bond stress distribution, the bond slip characteristic of the steel is used, and this results in the bond distribution continually changing as the steel stress increases. It is shown that, for a given steel stress at cracks, the crack width depends mainly on the maximum bond strength of the reinforcement and the crack spacing depends mainly on the tensile strength of the concrete and the maximum bond strength of the reinforcement.

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#### 043915

##### INELASTIC BEHAVIOUR OF CONTINUOUS COMPOSITE BEAMS OF STEEL AND CONCRETE

Yam, LCP Chapman, JC

Institution of Civil Engineers, Proceedings (Institution of Civil Engineers, Great George Street, London SW1P 3AA, England)

Vol. 53, Pt2, 7551, Dec. 1972, pp 487-501

The elasto-plastic behavior of two-span composite beams is studied numerically and with reference to experimental results. It is concluded that for equal spans loaded symmetrically the second hinge will form before the first deteriorates and that the simple method of plastic design can therefore be used. When one span only is loaded, reduction in ultimate load is noted due to crushing at mid-span. If the shear connectors are spaced uniformly between points of maximum and minimum moment, failure of the connectors does not occur. The results will assist the formulation of design rules for continuous composite beams.

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#### 043916

##### HIGH STRENGTH BOLTED GALVANIZED JOINTS

Kennedy, DJL

ASCE Journal of the Structural Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York,

10017)

Vol. 98, No. ST12, Proc Paper 9410, Dec. 1972, pp 2722-38

Tests on steel plates without overt stress concentrations show that hot-dip galvanizing reduces the fatigue strength by only about 4 percent when cycled from zero to tension. Galvanizing in the presence of a notch reduces fatigue strengths by up to 28 percent at some stress levels when cycled from zero to tension. An analysis of the results indicates that this reduction is due to the loss of ductility of the galvanized steel plate as compared to the as-rolled (black) Plate. Initial coefficients of friction for galvanized plates in these tests (0.12) were about half of the value for plates with mill scale (0.21). In tests on high-strength bolted joints, under reversed loading, galvanized joints locked up after a few cycles of load, and cyclic slip ceased. Because of the action and the fact that fatigue failures of the connections occurred in front of the net section, the fatigue strength of galvanized friction type connections was comparable to that of identical black connections when cycled from zero to tension and from one-half compression to tension.

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043921

**LIME-FLYASH STABILIZATION OF SOIL:  
DEVELOPMENT OF THE TECHNOLOGY PARTS 1 AND 2**

Dyer, MR O'Flaherty, CA

Highways Design and Construction (IPC Building and Contract Journals Limited, 32 Southwark Bridge Road, London SE1, England)

Vol. 40, No. 1754, Oct. 1972

pp 10-14

This paper reviews the current state of knowledge concerning the utilization of fly ash in combination with lime as a soil-stabilizing agent. Difficulties arising from the complexity of the soil and ash components and from the potential multiplicity of reaction products are discussed. There is a gradual trend away from purely empirical studies toward a more fundamental research approach.

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043993

**INSTRUMENTATION APPLIED TO SLOPE STABILITY PROBLEMS**

Wilson, SD Hilt, DE

ASCE Journal of Transportation Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. TE3, Proc Paper 9109, Aug. 1972, pp 563-576

Unfavorable geologic conditions along proposed transportation routes often cannot be avoided by simple changes in grades and alignments. When such situations occur or when conditions cannot be defined with precision, it becomes necessary to supplement engineering judgment with field observations during and following construction. The collection of field data through fixed instrumentation is an effective means of evaluating embankment performance in areas where stability is questionable or where the effects of construction on adjacent lands must be determined. Inclined meters, which measure subsurface displacements, and piezometers, which record fluid pressures within the foundation soils, are commonly employed in conjunction with field evaluation. These and several other methods often used to monitor field performance are described. Three case histories are presented in which fixed instrumentation was used to control

construction scheduling of an embankment over soft ground and to determine the effects on adjacent ground.

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043994

**FRACTURE MECHANICS IN BRIDGE DESIGN**

Rolfe, ST

Civil Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 42, No. 8, Aug. 1972, pp 37-41

Brittle fracture of steel bridges is becoming more common as designs become more complex; as high-strength thick-welded steels displace thin, riveted plates; as engineers choose fabrication and construction practices mainly to minimize costs; and as safety factors decrease with computer design. There are three basic methods to control fracture: use of low design stresses, use of tough steels, and inspection to be sure no large flaws are present. There is a growing feeling among bridge engineers that fracture toughness criteria should be specified for bridge steels. To minimize brittle fracture, the designer must eliminate geometric discontinuities that act as notches. Indeterminate structures are usually more resistant to complete failure than are determinate structures, e.g., the Kings Bridge failure in Melbourne, Australia, as opposed to the failure of a primary member in the Silver Bridge at Pt. Pleasant, West Virginia.

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043996

**VEHICULAR TRAFFIC IN ROCK: DIRECTION FOR DEVELOPMENT**

Robbins, RJ

ASCE Journal of the Construction Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. C02, Proc Paper 9204, Sept. 1972, pp 235-250

Difficulties in tunneling are contributed by the large size required for vehicular tunnels, the inflexibility of design location, and necessity of handling whatever conditions are encountered in alignment, whether they be solid rock, fault zones, or a mixed face of rock and soil below the water table. Contractors around the world have been turning to mechanized systems of excavation utilizing tunnel boring machines, shield systems, precast concrete segments, or other lining systems offering maximum flexibility for adapting to varying ground conditions. Contrary to a commonly held belief, the primary development frontier is not how to cut hard rock cheaper and faster but how to develop a mechanized system that will reliably advance a tunnel heading in the widely varying conditions often encountered. Several case studies illustrate new approaches taken by progressive contractors in vehicular tunnels around the world.

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044000

**PROTECTION OF TRANSPORTATION FACILITIES AGAINST EARTHQUAKES**

National Transportation Safety Board, Department of Transportation, Washington, D.C., 20590

NTSB-ST-72-1, Feb. 1972, 41 pp

This study is an examination of federal involvement in the earthquake field, specifically in the transportation field. The report discusses the need for reexamination of the criteria used in the design of transportation structures, stepped-up earthquake-related programs, and better coordination between federal agencies. It also discusses earthquake history in the United States, existing standards for earthquake-resistant design and construction of transportation systems, and possible modifications to existing transportation structures.

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**044002**  
**NEW APPROACH TO THE DYNAMIC BREAKAGE OF ROCKS**

Kennedy, PA

Tunnels and Tunneling (Lomax Erskine and Company, Limited, 8 Buckingham Street, London WC2N 6DA, England)

Vol. 4, No. 5, Sept. 1972, pp 427-428

A new method of dynamic breakage of rock has been developed that uses the secondary breakage effect from an electrical pulse passed through electrodes into rock specimens. Breakage was achieved for the three rock types tested: triassic sandstone, oolitic limestone, and olivine basalt. The amount of breakage was analyzed in terms of increased surface area using a computerized statistical method. From experimental results and a review of available literature, it seems that this method of dynamic breakage is at least as efficient as conventional chemical blasting.

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**044008**  
**PLANNED VEGETATION CONTROL**

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 2, Mar. 1973, pp 53-54, 3 Phot

The results it has obtained over the past years have shown the Kansas City Southern the value of careful and practical programming of vegetation control. Kansas City Southern's approach involves a combination of measures. Growing conditions throughout the railroad are extensively inspected, even to the point of cataloging growing conditions milepost-by-milepost. Vegetation control chemicals are applied within the limits of a fixed budget. Advantage is taken of a "one-pass" technique, even though varying rates of chemicals are applied to suit the different application and drift control needs.

**ACKNOWLEDGEMENT**  
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**044011**  
**ENGINEERING THE HAMBURG CITY LINE**

Bock, H

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 4, Apr. 1972, pp 136-140

Constructed partly under water through a dense urban area, the 6-km S-bahn tunnel between Altona and the Hauptbahnhof has involved the use of a wide range of engineering techniques including

pioneer work on jacking precast tunnel sections and pipe shields.

**ACKNOWLEDGEMENT**

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**044024**  
**SOLID TRACKBED EXPERIENCE ON A CONCRETE ARCH UNDERBRIDGE**

Angeleri, G

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 129, No. 1, Jan. 1973, p 19, 1 Fig, 1 Phot

Underbridges, which already have structural support in the form of concrete or steel beams, are a natural choice for solid trackbed construction. Italian State Railways has been experimenting with such a trackbed in which the rail clips are fixed to blocks grouted directly into holes in the bridge deck.

**ACKNOWLEDGEMENT**

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**044066**  
**SOILS AND BASES: CHARACTERISTICS, CLASSIFICATION, AND PLANNING**

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 405, 1972, 156 pp

This publication consists of 16 related reports.

The multiplicity of problems faced by the soils engineer in a transportation-oriented department is illustrated in this RECORD, which includes papers on topics that are as widely separated as the effect of negative skin friction on piles and the capability of an unsurfaced roadway. This RECORD also includes papers of interest to the bridge engineer. Those papers deal with influence values for vertical stress distribution beneath uniformly loaded circles, uncertainty of settlement analysis, vertical sand drains, and dragdown due to negative skin friction. The planner and those responsible for route location will be interested in the applications of air-photo interpretation to the definition of soils problems and of the generalized regional concept to highway soils considerations. Transportation departments, increasingly involved in the design of roads in wilderness areas, will find the road capability study report helpful. The more sophisticated material characteristics, methods of arriving at trade-offs through values of relative strength, and improved soil bituminous mix design are discussed in several papers that will benefit the materials engineer and the structural pavement designer. Safety and convenience are improved with improved methods of in situ strength evaluation.

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**044317**  
**IMPROVING THE SEISMIC SAFETY OF PRESTRESSED CONCRETE BRIDGES**

Leonhardt, F

Prestressed Concrete Institute, Journal of (Prestressed Concrete

Institute, 205 West Wacker Drive, Chicago, Illinois, 60606)  
Vol. 17, No. 6, Nov. 1972, pp 37-44

Massive bridges should be designed to reduce the seismic forces on supporting structures. This can be done principally by allowing a limited movement between the bridge deck and the substructure. Additionally, some structural details need to be improved. This paper suggests some possible design solutions to improve the seismic safety of prestressed concrete bridges.

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**044318**  
**RECTANGULAR PRESTRESSED BEAMS IN TORSION AND BENDING**

GangaRao, HV      Zia, P

ASCE Journal of the Structural Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 99, No. ST1, Paper 9501, Proceeding, Jan. 1973, pp 183-198

An interaction criterion for prestressed concrete beams under torsion and bending is presented. Test results for 42 rectangular specimens included properties of beams, their ultimate strengths, crack patterns, and torque-twist and bending-deflection curves. Substantial reduction in torsional stiffness due to torsional cracks was observed; however, the effect on bending stiffness is relatively small. Beams with stirrups and longitudinal steel have ample rotation capacity at failure. Having established three modes of failure by experimental observations for varying bending to torque ratios, a generalized skew bending theory is developed to evaluate cracking and ultimate torques.

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**044320**  
**PRESTRESS LOSSES DUE TO THE EFFECT OF SHRINKAGE AND CREEP ON NONTENSIONED STEEL**

Abeles, PW      Kung, R

American Concrete Institute, Journal of (American Concrete Institute, Box 4754, Redford Station, Detroit, Michigan, 48219)

Vol. 70, No. 1, Proceeding, Jan. 1973, pp 19-27

Comparative tests on four types of beams all having the same initial prestressing force were carried out by the authors at Southampton in 1970-71. All four types were of about the same ultimate resistance, but they had different amounts of nontensioned steel in the ratios 1:2.68:4.0:5.22. The effective prestress with maximum amount of nontensioned steel was only 60 percent of that with minimum amount of nontensioned steel. Based on the good agreement between measurements and CEBFIP formulas, the losses were evaluated for humidities between 50 and 100 percent for the four types of beams of different percentages of nontensioned steel; this indicates that the prestressing losses at infinity increase substantially with reduced humidity and enlarged percentage of nontensioned reinforcement.

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**044322**  
**SOIL RESISTANCE PREDICTIONS FROM PILE DYNAMICS**

Rausche, F      Moses, F      Goble, GG

ASCE Journal of Soil Mechanics & Foundations Div (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. SM9, Paper 9220, Proceeding, Sept. 1972, pp 917-937

An automated prediction scheme is presented that uses both force and acceleration records measured at the pile top during driving to compute the soil resistance forces acting along the pile. The distribution of these forces is determined, and the dynamic and static resistance forces are distinguished such that a prediction of a theoretical static load versus penetration curve is possible. As a theoretical basis, stress wave theory is used, derived from the general solution of the linear one-dimensional wave equation. As a means of calculating the dynamic pile response, a lumped mass pile model is devised and solved by the Newmark beta method. Wave theory is also employed to develop a simple method for computing static bearing capacity from acceleration and force measurements. Twenty-four pile tests are reported, 14 of them with special instrumentation, i.e., strain gauges along the pile below grade. The piles tested were of 12-in. (30-cm) diameter steel pipe with lengths ranging from 33 to 83 feet (10 to 25 mm).

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York, New York, 10017, Repr PC: Price

**044323**  
**PERFORMANCE OF THE FOUNDATION UNDER A HIGH EMBANKMENT**

Lambe, TW

Boston Society of Civil Engineers, Journal of (Boston Society of Civil Engineers, 230 Boyston Street, Boston, Massachusetts, 02116)

Vol. 59, No. 2, Apr. 1972, pp 71-94

This paper presents the measured performance of an embankment constructed on a deep deposit of soft clay (Boston blue clay). The most important aspect of this measured performance is the large differences in settlement among three closely spaced settlement platforms. Possible reasons for this difference are discussed. Predicted embankment performance is compared to the measured performance. This test embankment (northeast test embankment), constructed along the proposed route of a connector to I-95, is close to an instrumented field test section (M.I.T. test section) constructed on the actual highway embankment.

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Boston Society of Civil Engineers, 230 Boyston Street, Boston,  
Massachusetts, 02116, Repr PC: R Price

**044325**  
**INVESTIGATION OF CHEMICAL PRESERVATIVES AND NATURALLY RESISTANT WOODS FOR LONG-TERM BORER PROTECTION**

Southwell, CR      Bultman, JD

Naval Engineers Journal (American Society of Naval Engineers, 1012 14th Street, NW, Washington, D.C., 20005)

Vol. 85, No. 5, Oct. 1972, pp 49-60

Six chemical wood preservatives were selected for evaluation over long periods of exposure in extremely borer-active marine environments in the Panama Canal Zone. Southern yellow pine and

Douglas fir were full-cell pressure-treated with these chemicals and exposed in tropical seas and tropical brackish water for periods up to 90 months. One hundred and thirteen untreated tropical wood species were concurrently exposed in these same waters. The long-term results show that heavy treatments of whole creosote and chromated copper arsenate (CCA, type A) are very effective preservatives for southern pine exposed in seawater and that the CCA was the singularly most effective treatment against the brackish-water Psiloteredo.

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American Society of Naval Engineers, 1012 14th Street, NW,  
Washington, D.C., 20005, Repr PC: Re Price

044433

**CONTINUOUS WEEKEND SHIFTS ON THIS BRIDGE PROJECT**

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 1, Jan. 1973, pp 24-25, 3 Phot

The modernization of New Jersey Route 24 from a two-lane highway into a multiple lane road in each direction required the replacement of a single span, double track bridge by the Eric Lackawanna with two 80-foot through-girder spans with ballasted deck for each track. To continue normal commuter operations, the contractor limited his work to weekends and the railroad scheduled buses to move commuters around the construction site during these periods. The overhead catenary wire was moved to one side and the track was removed from over the areas to be excavated. The men worked 12-hour shifts. After 6 a.m. Sunday, construction operations were suspended and the railroad crews moved in to change the site into a commuter railroad again. Before the first commuter train, a test train was run over the tracks to ensure safety. The two 80-ft. through-girder spans were constructed on temporary bents driven on each side. When completed, the railroad embankment between the two abutments was excavated sufficiently to permit rolling the spans in place and the tracks were returned to service.

**ACKNOWLEDGEMENT**

Railway Track and Structures

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

044491

**PRESSURIZED-SLURRY SHIELDS BORE SUBMARINE TUNNELS**

Ohira, T, Japan Railway Construction Corporation  
Shiraishi, S

Civil Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 42, No. 5, May 1972, pp 55-57

To construct two 865 m submarine railroad tunnels under Tokyo Bay, the Nishimatsu Construction Company used shields filled in the front cutter chambers with pressurized slurry. In operation, all pumps are synchronized for constant slurry pressure 284 psi slurry containing soil is pumped through exhaust pipe to treatment centers. Then treated slurry is pumped back into cutting chamber.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000210

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044492

**VEHICULAR TUNNELS IN ROCK-DIRECTION FOR DEVELOPMENT**

Robbins, RJ, Robbins Company

ASCE Journal of the Construction Division (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. CO2, Paper 9173, Sept. 1972, pp 235-250

Difficulties in tunneling are contributed by the large size required for vehicular tunnels, the inflexibility of design location, and necessity to handle whatever conditions are encountered in alignment, whether they be solid rock fault zones, or a mixed face of rock and soil below the watertable. Several case studies illustrate new approaches taken by progressive contractors in vehicular tunnels.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 002054

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044496

**SHEAR STRENGTH OF UNTREATED ROAD BASE AGGREGATES MEASURED BY VARIABLE LATERAL PRESSURE TRIAXIAL CELL**

Dunn, CS, Birmingham University

Journal of Materials (American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania, 19103)

Vol. 7, No. 2, June 1972, pp 131-142, 23 Ref

The angle of shearing resistance increases significantly as the size of the largest particle (maximum in Fuller graded aggregate mixes) is increased. The presence of flaky particles in a Fuller graded mix is not detrimental to its shear strength and may marginally increase it. Material having the highest angle of shearing resistance, suffered the least deformation while material with the lowest angle of shearing resistance, produced the greatest deformation after trafficking for 5 years.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000997

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044497

**STABILITY PROPERTIES OF UNCURED LIME-TREATED FINE-GRAINED SOILS**

Neubauer, CH, Jr, Air Force Weapons Laboratory  
Thompson, MR

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 381, 1972, pp 20-26, 7 Ref

The early strength and deformation properties of uncured lime-soil mixtures and untreated soils were investigated. Linear regression equations were developed relating cone penetrometer test results to shear strength, California Bearing Ratio, and modulus of deformation. The significance of the study findings is examined relative to problems such as expediting construction, increasing in situ subgrade support, and constructing temporary roads.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 022048

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044498

**COMPARISON OF THE RESULTS OF IN SITU AND LABORATORY TESTS ON COHESIVE SOILS 212 ESSAIS EN PLACE ET EN LABORATOIRE SUR SOLS COHERENTS COMPARAISON DES RESULTATS**

Amar, S, Department de Mecanique des Sols, France

Bull. de Liaison des Lab. des Ponts et Chaussées (Laboratoire Central des Ponts et Chaussées, 58 Boulevard Lefebvre, 75732 Paris, France)

Vol. 58, Apr. 1972, pp 97-108, 35 Ref

An attempt is made to seek the relations existing between the point resistance determined by a static penetrometer, the limiting pressure obtained by a standard pressiometer, and the cohesion of fine soils determined in the laboratory. The authors indicate that there is no one to one relation between the cohesion determined in the laboratory on the one hand, and the limiting pressure and the point resistance on the other hand.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 016458

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044499

**LIME STABILIZATION OF ORGANIC SOILS**Arman, A, Louisiana State University  
Munfakh, GA

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 381, 1972, pp 37-45, 20 Ref

The potentials of improving the engineering characteristics of organic soils found in Louisiana were studied. Laboratory studies of approximately 1,100 samples of inorganic and organic soils showed that plasticity and strength are improved by the addition of lime. Changes in pH of soil-lime mixtures showed that increased levels of lime treatment were able to neutralize the acidity of organic matter in the soil and initiate the soil-lime reaction.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 022050

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044500

**SUBGRADE MOISTURE UNDER OKLAHOMA HIGHWAYS**Haliburton, TA, Oklahoma State University  
Snethen, DR  
Shaw, LK  
Marks, BD, III

ASCE Journal of Transportation Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. TE2, Paper 8870, May 1972, pp 325-339, 25 Ref

Data and conclusions from a 6 yr field study of subgrade moisture under highways are presented to show the effects of soil, climate, and highway design on moisture. Effects of subgrade moisture conditions on expansive subgrade volume change and overall highway performance are described. Moisture contents were found to increase, over a 2 yr interval, from original conditions to an equilibrium value of 1.1 times to 1.3 times the subgrade plastic limit.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000013

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044501

**LONG-SPAN BRIDGE: UTILITY, GRACE AT LOW COST**Troxell, RD, Kaiser Engineers  
Montgomery, HM

Civil Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 42, No. 5, May 1972, pp 73-76

The Hegenberger expressway overhead in Oakland, California constructed of post-tensioned concrete, is described. The span features the use of precast-concrete pans for the deck and Y-shaped piers for support. The pans create a "waffle" appearance on its underside. The gentle inclination of the "Y" arms add architectural interest. The cost compares favorably with bridges of lesser spans.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000212

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044505

**USE OF AN IMPACT ROLLER IN COMPACTING A COLLAPSING SAND SUBGRADE FOR A FREEWAY**Williams, AAB, National Building Research Institute, South Africa  
Marais, GP

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 374, 1971, pp 21-28, 11 Ref

In comparative field trials of possible solutions to the problems of differential settlement on roads in southern Africa a flat-sided impact roller was found to cause consolidation to greater depth than vibrating or pneumatic rollers. Deep profiles were studied under the freeway where the impact roller has been used, under an old existing asphalt road, and the undisturbed natural condition. The variations with depth of density, moisture content, and penetration resistance were determined.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 016897

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044506

**INFLUENCE OF SESQUIOXIDES ON LATERITIC SOIL PROPERTIES**Townsend, FC, Waterways Experiment Station  
Manke, PG  
Parcher, JV

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 374, 1971, pp 80-92, 25 Ref

The laboratory study was an investigation of some mineralogical, chemical, physical, and engineering properties of a lateritic soil to evaluate the basic reasons for the effects of remolding. Results of X-ray diffraction and scanning electron microscopy studies showed that the hydrated iron and aluminum oxides coat the clayey constituents of the soil and bind them into coarser microaggregations. Analyses of grain size indicated that the remolding phenomenon disaggregates the micro-aggregations into finer clayey clusters.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 016901

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**044507**  
**MAXIMUM DENSITY OF SAND BY REPEATED STRAINING IN SIMPLE SHEAR**

Youd, TL, United States Geological Survey  
Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)  
No. 374, 1971, pp 1-6, 9 Ref

A new method is described for determining the maximum densities of granular soils in the laboratory. The method consists of applying many repeated cycles of shear strain (40 to 60 cycles/min) to samples mounted in a simple shear apparatus. Maximum densities produced by this method exceeded maximum densities reported in the literature or obtained from standard ASTM vibratory procedure by 2 to 6 pcf for several clean sands of varying gradation.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 016895

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**044508**  
**ROUGHNESS ELEMENTS AS ENERGY DISSIPATORS OF FREE-SURFACE FLOW IN CIRCULAR PIPES**

Wiggert, JM, Virginia Polytechnic Institute  
Erfle, PD  
Morris, HM

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)  
No. 373, 1971, pp 64-73

The report describes experiments on peripheral rings used in smooth, circular pipes, as roughness elements to reduce the velocity of flow. The studies pertain only to culverts flowing under inlet control on steep slopes, that is, pipes functioning as open channels with supercritical flow. Model tests were made to investigate the feasibility of roughness elements as energy dissipators to reduce the kinetic energy of high-velocity, free-surface flows in pipes.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 016393

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**044509**  
**DYNAMIC PROPERTIES OF CEMENT-TREATED SOILS**

Chiang, YC, New Jersey State University, New Brunswick  
Chae, YS

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)  
No. 379, 1972, pp 39-51, 20 Ref

The dynamic shear modulus and damping characteristics of 2 soils, a uniform sand and a silty clay, treated with Type 1 portland cement are determined by the resonant column technique. Test variables studied are cement content, confining pressure, shear-strain

amplitude, and moisture content. The dynamic shear modulus and damping of both uniform sand and silty clay can be greatly increased by adding a small amount of cement.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 022044

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**044514**  
**PAVEMENT EVALUATION USING ROAD METERS**

Highway Research Board, 2101 Constitution Avenue, NW,  
Washington, D.C., 20418  
133, Special Rp, 1973, 128 pp

This report consists of the proceedings of a workshop held April 18-20, 1972 at Purdue University.

Many instruments are available for measuring pavement roughness. Some of these instruments are costly and obtain very detailed data. Most require that pavement condition be measured at low speeds, thus demanding that production rates be quite low. For many years, engineers have been searching for a device that gives the required information but is inexpensive to produce and operate. The road meter, first developed by Max P. Brokaw, is a simple device that essentially measures the relative movement of the rear axle of a passenger car with respect to the frame of the car. This device permits obtaining a large amount of data and can in fact be operated by 1 person in a passenger car, although generally, 2 individuals are required. Because the instrument is new, a need has existed to bring together engineers and researchers who are using the device to discuss the experience of various agencies in obtaining pavement condition data by this technique.

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Highway Research Board, 2101 Constitution Avenue, NW,  
Washington, D.C., 20418, Repr PC: \$4.00

**044522**  
**SURVEY OF CURVED GIRDER BRIDGES**

Civil Engineering (American Society of Civil Engineers, 345 East  
47th Street, New York, New York, 10017)  
Vol. 43, Feb. 1973, pp 54-56

This report was prepared by the Subcommittee on Curved Girders.

Survey of Curved Girder Bridges by Subcommittee on Curved Girders. The results of a questionnaire survey are reported which shows the types of curved girder bridges constructed during the past decade. Information on design and fabrication methods, and on many constructional details is included. The survey shows that the typical bridge carried 3 lanes on a 5-degree curve, had two 4-girder spans of 125 ft each with diaphragms spaced at 18 ft, was of composite plate girder construction in A36 steel, and was fabricated by cutting to the desired curvature.

**ACKNOWLEDGEMENT**  
Civil Engineering

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037199

**EFFECTIVENESS OF ALLOYING RAIL STEEL WITH CHROMIUM**

Kazarhovskii, DS    Shnaperman, LY    Kravtsova,  
IP    Ravitskaya, TM    Pavlenko, YP    Skvortsov, OS  
Shvarts, YF

Steels in the USSR (Iron and Steel Institute, 39 Victoria Street, London SW1, England)

No. 9, Sept. 1969, pp823-5

Original text published in "Stal" n9, September 1969, pp828-30, published by Mezhdunarodnaya Kniga, Moscow G-200, USSR.

Service tests have proved that type R-50 railway rails made of steel containing 0.63 to 0.75% C and 0.7 to 1.0% Mn and alloyed with chromium (0.5 to 1.0%) have an increased (by a mean 25%) resistance to contact-fatigue defects, less wear per 100 million gross tons of freight, and less rippling of the surface after use than carbon steel rails of standard composition. These advantages are obtained if the total C + 1/4 Mn content of the steel is not lower than 0.88%.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 34498

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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, 94607

Final Rpt, Dec. 1966, 219 pp

Contract C-352-66

See also PB-179 220.

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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-179466

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NTIS, Repr, PC: \$6.00, Microfiche: \$0.95  
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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-179401

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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, 94607

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.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-179220

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PB-179220

039120

**RAILROAD RESEARCH FIELD TESTING PROGRAM**

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

Melpar, Incorporated, Falls Church, Virginia

Progress Rpt No. 1, Dec. 1968, 215 pp

Contract C-111-66

The primary purpose of this project is to assist in defining the operational characteristics and constraints of conventional rail systems at speeds of the order of 150 miles per hour. Four electric, multiple-unit commuter-type cars, modified to facilitate instrumentation and to achieve full-power balancing speed in excess of 150 miles per hour, were built and heavily instrumented. High-speed tests are being conducted on an improved 21 mile section of the Penn-Central Railroad between Trenton and New Brunswick, New Jersey, and track geometry measurements reflecting track conditions are being made between Washington, D. C., and Boston. Of particular interest are the evaluation of ride quality, truck and suspension performance and vibration, track geometry measurements, pantograph performance, catenary profile and dynamic response, track-roadbed characteristics, and interaction between trains. An initial part of the original contract was the formulation of a general purpose mathematical model of car motion suitable for evaluating the performance of new or proposed vehicles or vehicle components in response to rail excitation at high speeds. The parameters and characteristics of the research cars and statistics of track geometry are being used to validate the mathematical model with actual measurements. This dynamic railcar simulation program will be the subject of a separate comprehensive report. The

purpose of this report is to present in summary form the progress achieved thus far on this program.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-182470

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PB-182470

039204

#### STABILIZED BALLAST INVESTIGATION

Magee, GM

Association of American Railroads, Research Center, Chicago, Illinois

Final Rpt, Aug. 1969, 89 pp

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)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-192720

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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, 208 pp

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 road-bed, 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)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-194139

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PB-194139

039242

#### TEST CAR PROGRAM

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

Melpar, Incorporated, Falls Church, Virginia

No. 2, Prog Rpt, Sept. 1970, 179p

Contract C-111-66

See also Progress rept. no. 1, PB-182 470.

During the period covered by the report, much of the developmental effort was devoted to improving and refining the existing systems. Developments such as a new signal conditioner for the gage 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 resulted 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 hostile 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. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-195400

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-195400

039253

#### AUTOMATED TRACK INSPECTION INFORMATION AND ITS USE

Woll, TP

Federal Railroad Administration, Washington, D.C.

FRA-RT-72-02, Sept. 1970, 39 pp

Presented at the Roadmasters and Maintenance of Way Convention, Chicago, Illinois. 29 September 1970.

The paper describes the type of track inspection information provided by the Department of Transportation test cars (railroad) and the way it is to be used. The D.O.T. track inspection car program and a computer program from which gage data is produced are discussed. The basic principle discussed apply to all track parameters. The concepts for data processing described and the resulting preferred formats for the presentation of track geometry data resulted from discussions with knowledgeable people within the railroad industry. In particular track maintenance personnel were consulted regarding their preferred form for data presentation from the viewpoint of track maintenance. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-201621

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**039255**

**STUDY OF NEW TRACK STRUCTURE DESIGN. PHASE I**

Meacham, HC Voorhees, JE Eggert, JG

Battelle Memorial Institute, Columbus, Ohio

Prelim Rpt, Sept. 1966, 146 pp

See also report on Phase 2, PB-202 273 and Final rept., PB-194 139.

Conventional (tie-type) and non-conventional rail vehicle track structures were studied with the constraint that standard gauge and rail head contour not be varied from current practices. Computer programs were developed and used to analyze track response to both static and dynamic vehicle loading. A major philosophy in the development of improved track structures was to reduce the magnitude and number of pressure cycles transmitted to the foundation by passing rail vehicles. The report contains detailed discussion of material summarized in: 'Studies For Rail Vehicle Track Structures,' PB-194 139, and is a reference source cited in that document. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202272

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**039256**

**A STUDY OF NEW TRACK STRUCTURE DESIGN. PHASE II**

Meacham, HC Voorhees, JE Eggert, JG Enright, JJ

Battelle Memorial Institute, 505 King Avenue, Columbus, Ohio, 43201

Summ Rpt, Aug. 1968, 64 pp

See also report on Phase I, PB-202272 and Final rept., PB-194139.

Phase I 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 I program, a number of track structures and fasteners were devised which met the specified requirements. Following the conclusion of the Phase I 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 cited in that document.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202273

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PB-202273

**039265**

**SYSTEM INSTRUMENTATION MANUAL. DOT TEST TRAIN PROGRAM**

Gerhardt, CL May, JT

ENSCO, Incorporated, Springfield, Virginia

Annual Rpt, 7006-7012, Jan. 1971, 176 pp

The report describes current instrumentation installed aboard the Department of Transportation Test Train. The instrumentation is designed to gather research data on various rail research projects. The major discussion in this report covers the Track Geometry System aboard the test train, and the operation and calibration of this system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-203110

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PB-203110

**039266**

**COMPACTION OF THE CRIB AND SHOULDER AREAS OF THE BALLAST SECTION SUPPORTING THE LINEAR INDUCTION MOTOR RESEARCH VEHICLE TEST TRACT IN PUEBLO, COLORADO**

Genton, DL

Ecole Polytechnique Federale de Lausanne, Institut de Technique des Transports, Lausanne, Switzerland

IT-712, Final Rpt, Aug. 1971, 38 pp

Contract DOT-PR-10191

Observations concerning the problem of modifying a specifically identified unit of railroad ballast compacting equipment to achieve optimal working efficiency in one location are presented. The theories associated with the in-track compaction of railroad ballast are discussed and certain performance tests described. A comprehensive list of references is contained as an appendix. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-203184

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PB-203184

**039279**

**DOT TEST TRAIN PROGRAM SYSTEM INSTRUMENTATION MANUAL**

Gerhardt, CL May, JT

ENSCO, Incorporated, Springfield, Virginia

DOT-FR-72-1, Annual Rpt, 7106-7112, Jan. 1972, 167 pp

Contract DOT-FR-00015

See also PB-203 110.

The report describes current instrumentation installed aboard the Department of Transportation Test Train. The instrumentation is designed to gather research data on various rail research projects. The major discussion in this report covers the Track Geometry System aboard the test train, and the operation and calibration of this system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209709

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PB-209709

**039294**  
**DOT TEST TRAIN PROGRAM**

Demuth, H Gerhardt, C May, J Trzaskoma, W  
ENSCO, Incorporated, Springfield, Virginia  
No. 3, DOT-FR-71-2, Prog Rpt, 7007-7106, June 1971, 119 pp  
Contract DOT-FR-00015

See also report dated Jan 71, PB-203 110.

The progress report covers a 12-month activity period covering engineering and data management in conjunction with operation of rail research test cars, and discusses research and analysis work in fields associated with rail research. Developments include an operational prototype track geometry measurement system, various track measurement techniques and formalization of operating procedures. Existing data processing routines were improved and new ones were developed. Demonstration of and routine testing with the track geometry system was performed for a number of different organizations. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209762

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PB-209762

**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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206622

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**039794**  
**BOGIE-MOUNTED UNIVERSAL TAMPING MACHINE**

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

Vol. 127, No. 6, June 1971, p 236

Principal machine in the new Plasser and Theurer's 07 series is the Mainliner Duomatic 07 to 32, combining leveling, tamping, lining and consolidating functions in one unit. Machine is specially designed for moving quickly between work sites, having a heavy truck-mounted chassis and normal drawgear. Two adjacent ties can be tamped at once. Full automation can be achieved by the addition of a

cybernetic control system consisting of an electronic counter, an angle pace-setter and a rail fastening pulsator for determining tie spacing.  
**ACKNOWLEDGEMENT**  
Engineering Index, EI 72 49872

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**039796**  
**NEW ASPECTS OF CONCRETE-TIE TRACK**

Way, GH, Jr

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 67, No. 12, Dec. 1971, pp 22-5

The article covers a discussion of the proposed American Railway Engineering Assoc concrete-tie specifications, a report on two investigations sponsored by the Federal Railroad Administration, and an account of experience with concrete-tie usage in England.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 48564

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**039800**  
**ULTRASONIC TESTS ON RAILS IN SITU WITH ELECTRO-MAGNETIC AND ACOUSTIC TRANSDUCERS**

Vlassov, VV Lonchak, VA Glukhov, NA Invanov, LV Runov, NN

Russian Ultrasonics (Multi-Science Publishing Company, 33 South Drive, Brentwood, England)

Vol. 1, No. 3, July 1971, pp 178-84, 4 Ref

Article describes an ultrasonic contactless testing equipment used for detecting defects in rails. System uses ultrasonic oscillations produced by electromagnetic-acoustic transducer. Mechanical details of the assembly are described, as well as block diagram of electric circuitry.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 52091

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**039825**  
**TRACKWORK STUDY. VOLUME II. RECOMMENDED TRACKWORK STANDARDS**

Dunn, RH

Washington Metropolitan Area Transit Authority, Washington, D.C. WMATA-NTA-66-1

Vol. 2, WMATA-DCCO-TWS-2, Final Rpt, July 1969, 331p

See also Volume 1, PB-204212.

The study provided the Washington Metropolitan Area Transit Authority with recommendations for trackwork design standards and criteria for use as a basis for the final design of trackwork for the entire METRO rail rapid transit system. The recommendations were based on analytical studies and the experiences reported by operating properties. Trackwork components were analyzed considering different combinations of components and varying physical parameters such as size, spacing, and estimated life of elements of the track structure. The report includes recommendations on rail weight, rail type, rail welding, fastener types and spacing, cross tie types and

spacing, roadbed and ballast section, special trackwork, track appurtenances, track gauge and in-service test installations. (Author)  
**ACKNOWLEDGEMENT**  
 National Technical Information Service, PB-204213

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 PB-204213

**039826**  
**TRACKWORK STUDY. VOLUME I. TRACKWORK PRACTICES OF NORTH AMERICAN RAPID TRANSIT SYSTEMS**

Dunn, RH

Washington Metropolitan Area Transit Authority, Washington, D.C. WMTA-NTA-66-1

Vol. 1, WMATA-DCCO-TWS-1, Final Rpt, Nov. 1967, 149p

See also Volume 2, PB-204213.

The report is a summary of the trackwork practices of seven North American rail transit properties: Boston, Chicago, Cleveland, New York, Philadelphia, San Francisco and Toronto. Responses to questionnaires sent to the properties covered construction standards for rail, rail welds, track gauge, rail fastenings, support spacing, rail anchorage, ties, roadbed and ballast sections, special trackwork and track appurtenances. The properties also reported their track maintenance criteria for rail wear, tie life, and ballast cleaning as well as test installations and recommendations for improving trackwork. The report contains a bibliography of over 100 publications on trackwork design, construction and maintenance. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204212

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 PB-204212

**039827**  
**QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT**

National Research Council of Canada, Division of Mechanical Engineering, Ottawa, Ontario, Canada

DME/NAE-1971(3), 7007-7109, Sept. 1971, 90p

See also report dated 30 Jun 71, AD-730 379.

Contents: Note on a Model Study to reduce local pollution levels in swimming areas; Development of a valveless pulse jet powered railway track switch heater; Lubrication under cold weather conditions, and Current projects of the Division of Mechanical Engineering and the national aeronautical establishment.

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-732926

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**039872**  
**TEST TRAIN PROGRAM. SYSTEM INSTRUMENTATION MANUAL**

Gerhardt, CL May, JT

ENSCO, Incorporated, Springfield, Virginia

Ann Rpt, 7106-7112, Jan. 1972, 168p

Contract DOT-FR-00015

The report describes current instrumentation installed aboard the Department of Transportation Test Train. The instrumentation is designed to gather research data on various rail research projects. The major discussion in this report covers the Track Geometry System aboard the test train, and the operation and calibration of this system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-748286

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 AD-748286

**040622**  
**THE KANSAS TEST TRACK. NON-CONVENTIONAL TRACK STRUCTURES. DESIGN REPORT**

McLean, FG Williams, RD Turnbell, RC

Westenhoff and Novick, Incorporated, Chicago, Illinois

Sept. 1972, 214p

The report discusses the design of three non-conventional railroad track support structures. These non-conventional structures, which include a continuously reinforced concrete slab, twin cast-in-place concrete beams and twin precast concrete beams, are part of a research program to develop practical, low maintenance, high quality track structures for conventional and advanced rail vehicles. Included in this report are discussions of basic structural concepts, design methods and models, and recommended construction, inspection and maintenance techniques. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212358

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 PB-212358

**041097**  
**ON THE PERFORMANCE OF THE RAIL FASTENING DEVICE FOR THE SHARP-CURVED, STEEP-GRADED TRACK**

Umeda, S Aihara, K Kumazaki, H

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

Vol. 13, No. 1, Mar. 1972, pp 8-10, 5 Fig

In order to examine the performance of rail fastening device Type 6 designed for PC sleepers used in the sharp-curved, steep-graded section where a severe load condition is assumed, and to make clear the distribution of train load on sharp curve, the lateral wheel force and wheel load, stress of spring clip and rail inclination angle were measured in the field test. These measured results were used for the examination of the fatigue limit of spring clip, the relationship between the lateral wheel force and stress of string clip and the distribution of lateral wheel force.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041105  
DEVELOPMENT OF THE PORTABLE TYPE WOODEN TIE  
RENEWAL MACHINE**

Ikegami, S Kasui, H

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

Vol. 13, No. 1, Mar. 1972

The report describes a new wooden tie renewal machine comprising two toggle joints which are assembled to form a rhombic link, one end of which is equipped with knife edges for tie clamping and the other end is reciprocally connected to a hydraulic double action ram which produces repetitive movements like a looper by the aid of reciprocating motion of a piston for the tie renewal operation. The machine was completed for actual service in September 1970. Both the field station test at Hino and the service test carried out in Kodama Way and Maintenance Sub-section of Hachiko line revealed that it required only about 6 minutes per tie renewal operation and the design goals were met. Therefore, the generalization of machines of this type in the maintenance work promises a considerable labor saving.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041107  
NUMERICAL CALCULATION AND APPROXIMATE  
FORMULA OF BUCKLING STRENGTH OF TRACK**

Sato, Y Kobayashi, S

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

Vol. 13, No. 1, Mar. 1972, pp 35-39, 4 Fig, 1 Tab

In 1967, the adoption of 60 kg rail in the track of the Sanyo Shin Kansen was determined. For this determination, it was considered that the temperature difference corresponding to the buckling strength of the track with this rail would not be different so far from that of the track with 50 T rail. To confirm this, the authors made the calculation program of the buckling strength of track and computed this for every rail in Japan including the new 60 kg rail. Through the investigation of calculated results, it was found that there would be simple approximate formula to calculate the buckling strength of track. This paper contains the calculating method of the buckling strength, calculated results, the composition of the approximate formula and its application.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041116  
RESILIENT RAIL**

Satoh, Y Umekubo, S Hirata, G Arai, M Chino,  
T Tsukamoto, K Sawada, T

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

Vol. 13, No. 2, June 1972, pp 76-84, 7 Fig, 6 Tab

Design and experimental results of a Resilient Rail developed for the mitigation of vibration and noise under train operation are summarized. The paper is divided into three parts, Part I treating the design, performance, durability test and field test of the Resilient Rail

on revenue lines; Part 2 the noise-abating effect of this rail; and Part 3 the qualitative examination of anti-vibration rubber employed in 9 revenue line test. It is concluded that the Resilient Rail has been adequately designed; the metallic parts and anti-vibration rubber possess ample strength; the Resilient Rail can reduce the noise by about 4 phons (A) on elevated tracks or bridges; and also a vibration-abating effect can be counted on.

**ACKNOWLEDGEMENT**

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**041321  
RETAINING GAUGE ON CURVES: THE L&N APPROACH**

Dove, RE

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 1, Jan. 1973, pp 28-30, 1 Fig, 4 Phot

A similar article on the L&N approach to curve problems  
appeared in Railway Track and Structures, V69, N1, January  
1973.

Louisville and Nashville has found that powerful diesel units with three axle trucks cause problems with holding gauge on curves. L&N launched three point plan: a laboratory study, use of gauge-measuring devices, and new standards for tie-plate sizes and spiking patterns for curves. Use of a common tie-plate for 100 lb and 132 lb rail meant that the 132 lb rail base covered one of the spike holes on the gauge side. To help prevent rail overturning under those conditions, a compression clip anchor was used in place of the spike on curves. L&N has adopted a new 18 inch tie-plate for problem curves. Diesel locomotive truck side thrust was suspected as a source of wide gauge on curves, so a gauge sensing device was mounted on a locomotive truck. Tests confirmed the rail moved outward under dynamic loading. Measuring devices attached to the rails also confirmed movement. A pickup truck equipped for rail/highway operation was also equipped with gauge recording instruments. On heavy-tonnage routes, curves of 5 degrees or more or troublesome curves get the new 18 inch tie-plate. Three line spikes are now used on the outer rail of the curve, with one screw spike in the hold down holes on either side of the rail. Still another technique being tried is the use of washer head screw spikes which are driven as line spikes.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: \$0.6

**041636  
CONTINUOUSLY SUPPORTED RAIL SUBJECTED TO AN  
AXIAL FORCE AND A MOVING LOAD**

Kerr, AD, New York University, New York

International Journal of Mechanical Sciences (Pergamon Press,  
Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 14, No. 1, Jan. 1972, pp 71-78, 8 Ref

The recent practice of welding railroad rails to each other suggests that considerable axial compression forces may be induced in the rails because of a rise in temperature. This in turn may reduce the critical velocity for the track to the range of operational velocities of modern high-speed trains. The purpose of the paper is to demonstrate that this is indeed a possibility.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 072042

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**041997**

**NEW TIE INSERTER DEMONSTRATED ON THE ROCK ISLAND**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 172, No. 9, May 1972, pp 37-38

Design features and operation of the Fairmont W119-A tie inserter unit that is designed to pick up ties from the track shoulder and insert them in the final position in the track without the need for any manual help other than that of the operator. With the tie in position to be inserted, the boom is automatically leveled in relation to the track. Simultaneously, a hydraulic actuator on the outer boom end causes an upward force to be exerted on the tie end entering the tie chute.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 064348

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**043234**

**EMBANKMENT SUPPORT FOR A RAILROAD TEST TRACK CONSTRUCTION REPORT**

Shannon and Wilson, Seattle, Washington

Final Rpt, Aug. 1972, 221 pp

The report discusses the construction of three non-conventional railroad track support structures. These structures are part of a program to develop practical, low maintenance, high quality track structures for conventional and advanced rail vehicles. The design of these test structures is discussed in a separate report, 'The Kansas Test Track, Non-Conventional Track Structures—Design Report'. The report documents the construction phase of the Kansas Test Track. It includes drawings, field test data on the embankment and details of instrumentation. The information provided on instrumentation outlines the system configuration, components, shop drawings, installation details and calibration data. The field data obtained on the embankment during construction are summarized and interpreted. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212783

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**043240**

**METROLINER RIDE DATA COLLECTION SYSTEM**

May, JT

ENSCO, Incorporated, Springfield, Virginia

Tech Rpt, July 1972, 62 pp

Contract DOT-FR-00015

The report describes the engineering effort associated with collection of Metroliner dynamic vehicle performance data. A Metroliner car was instrumented with transducers and a digital recording system. Dynamic tests were performed and the resulting data was recorded. The entire data measuring system and collection process are described in detail in the report.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212704

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PB-212704

**043520**

**AUTOMATIC SUBMERGED-SLAG WELDING OF RAIL**

Oishibashi, H Hakamata, S Ohara, M Oi,  
I Muramoto, T

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

Vol. 13, No. 4, Dec. 1972, pp 235-240, 9 Fig, 5 Tab, 4 Phot

The procedure of submerged-slag welding—a new automatic fusion welding of rails in the field—is described in this paper. The optimum wire compositions and welding conditions are determined in relation to micro hot cracking in HAZ, and the mechanical properties of welded rails are examined. Finally, the results of investigations of rails welded by a trial "welding car" are discussed. Based on the favourable results obtained of using this welding machine, it is expected to realize the full automatic welding of rails in the field in the near future.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Repr PC: Req Price

**043614**

**A RAIL REVIEWAL PROBLEM**

Bardwell, RO, Regency Income, Incorporated

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp 55-61, 4 Tab, 1 App

Two alternative solutions are proposed for an unexpected rail trouble: laying a new track or reducing speed and intensifying inspection over the present one. The problem must be solved quickly because of material and service ordering. Cash inflows and outflows are analyzed and compared; and the figures favor a new rail. Next, a negotiating process takes place between financing people and engineering and operating people. The new rail is agreed upon and the decision is executed immediately.

**ACKNOWLEDGEMENT**

Railway Systems and Management Association

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611, R PC: \$5.00

**044005**

**MAINTENANCE OF WAY AND THE INFORMATION EXPLOSION**

Cary, AM, Southern Railway

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 2, Mar. 1973, pp 31-36, 2 Fig, 3 Phot

Maintenance of way activities have traditionally been subjected to budget restrictions, in part because it has been difficult to document and quantify the real cost of deferred track maintenance. Southern is using the computer to produce studies and reports on maintenance of way programs. The key elements are a group of data bases or master files containing essential information. Probably the



most important is the Track Characteristic Master. Southern's Research C r R-1 provides key information on track conditions. A second file contains all pertinent details on derailments. Correlation of the derailment file with the track characteristic master produced a sensitivity index of defect types as a predictor of derailments. Southern is completing a System-wide anchor and double spiking program with standards based on traffic density, degree of curvature, and grade. The best way to determine when rail should be relaid and when track should be retied and surfaced is by measuring rail and track condition. R-1 car findings cause adjustment in maintenance schedules. Southern is pursuing an equally aggressive role with respect to rail defects and rail failures. The most recent addition to the data bases is the bridge file. Track programs have been correlated for efficiency.

#### ACKNOWLEDGEMENT

Progressive Railroading

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Chicago, Illinois, 60606, Repr PC: \$

#### 044010

#### CN SEEKS MORE STABLE TRACK

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 2, Mar. 1973, pp 62-66, 1 Fig, 7 Phot

With the increase in traffic and the advent of six-axle diesel locomotives and 100-ton cars, CN has been experiencing some difficulty with conventional track...in maintaining line and gage, in accelerated rail wear, and in corrugation. The new 'track structure test' encompasses the overall function of the structure rather than specific components. It involves continuous welded RE high silicon rail, fastened accurately to prestressed monolithic concrete ties that are restrained by well tamped and drained crushed rock ballast. The test site was selected to include heavy trains, six-axle locomotives, and downgrades and sharp curvature. The results are intended to provide guidance in writing an improved track specification. Total tonnage moved in 1971 amounted to 31 million gross tons. The ties were made in England. The fastening used is the Pandrol 601 A clip. Details of the installation process under traffic are given. Three different tie spacings were used.

#### ACKNOWLEDGEMENT

Progressive Railroading

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#### 044023

#### BLANKETING A FRENCH HIGH-SPEED LINE

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 129, No. 2, Feb. 1973, 2 pp, 1 Fig, 5 Phot

Experience over four years with blanketing based on p.v.c-coated nylon cloth has given French National Railways confidence in this method which allows mechanised track maintenance without damage to the waterproof layer.

#### ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

#### 044028

#### INDIA PAVES THE WAY FOR HIGHER SPEEDS

Srinivasan, M

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 2, Feb. 1972, pp 57-61

When the general belief that speeds above 100 km/h would be unsafe was subjected to detailed investigation, it was found that speeds of 120 km/h—and more recently 130 km/h—were quite acceptable on existing track so long as maintenance standards and methods were improved. This in turn leads to reduced track stresses, off-setting the increased dynamic forces at higher speeds, and India now looks forward to 160 km/h trains.

#### ACKNOWLEDGEMENT

British Railways Board

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#### 044029

#### TRACKS TO CARRY THE BIG MINERAL HAULS

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 2, Feb. 1972, pp 49-53

All over the world special-purpose railways are being planned and built to connect mines with ports, steelworks or power stations. They are mostly single track, and carry a one-way flow of minerals in wagons with high axleloads. A unique survey made by Railway Gazette among the operators of such lines reveals wide variations in standards and costs, but it also provides a common data base from which interesting conclusions may be drawn.

#### ACKNOWLEDGEMENT

British Railways Board

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#### 044030

#### MATCHING THE TRACK TO THE LOAD

Paterson, A

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 2, Feb. 1972, pp 53-56

Inevitably, freight trains are going to get heavier and passenger trains faster as the commercial goals of increased payload and higher speed are pursued. In specifying track standards, the engineer must steer a delicate middle course between pessimism that impedes progress and optimism which later rebounds in the form of excessive maintenance costs.

#### ACKNOWLEDGEMENT

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#### 044046

#### GERMANS GAIN A BETTER UNDERSTANDING OF TRACK STRUCTURE

Eisenmann, J

Railway Gazette International (IPC Transport Press Limited,

Dorset House, Stamford Street, London SE1 9LU, England)  
Vol. 128, No. 8, Aug. 1972; pp 305-308.

Experience in the late 1960s with speeds of up to 200 km/h led to an urgent reappraisal of the structural behaviour of track components under the very large stresses imposed. Prof. Dr.-ing. J. Eisenmann of Munich Technical University examines the merits of various improvements now under investigation by the DB, which includes rubber and plastic pads between rail and sleeper, the HM fastening, and longer sleepers at 60 rather than 65 cm centres.

**ACKNOWLEDGEMENT**  
British Railways Board

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**044054**  
**RAIL STEELS: STRONGER, HARDER OR TOUGHER?**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)  
Vol. 128, No. 12, Dec. 1972, PP 471-472

A conflict emerged at an Iron and Steel Institute Conference, held in London recently, between the commercial demand for steels that resist wear and the requirements to reduce the number of brittle fractures likely to occur which might lead to derailment.

**ACKNOWLEDGEMENT**  
British Railways Board.

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**044061**  
**BR DEVELOPS LAYING-IN A CONTINUOUSLY  
REINFORCED CONCRETE PERMANENT WAY BASE  
UNDER SERVICE CONDITIONS ON HIGH-SPEED  
RUNNING LINES**

Rail Engineering International (Shaw Publishing Company  
Limited, Broadwall House, Broadwell, London SE1, England)  
Vol. 2, No. 8, Oct. 1972, pp 385-388

Experience with a number of concrete track sections constructed three years ago on a secondary line has enabled BR to go ahead with laying a 1.8 km section under full service conditions suitable for Inter-City expresses and heavy freight services using a purpose-built slip-paver manufactured and operated by Robert McGregor, civil engineering contractors.

**ACKNOWLEDGEMENT**  
British Railways Board

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London SE1, England, Repr PC: Req Price

**044062**  
**SOME CONSIDERATIONS CONCERNING PERMANENT  
WAY FOR HIGH SPEEDS**

Diaz Del Rio Y Juodenes, M

Rail Engineering International (Shaw Publishing Company  
Limited, Broadwall House, Broadwell, London SE1, England)  
Vol. 2, No. 8, Oct. 1972; 7 pp

Speeds above 220 km/h call for new design of track maintenance machines and assessment of available rail fastenings whilst improved stability and track geometry realise a long lasting infrastructure which is furthered by non-destructive testing and rail grinding of rails. Relative train speeds evaluation on pre-set parameters in relation to cant can regularise an approach to riding and track forces.

**ACKNOWLEDGEMENT**  
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**044308**  
**AUTOMATED GAGE INSPECTION**

Kaufman, WM, ENSCO, Incorporated  
Borntraeger, JE, Louisville and Nashville Railroad

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017

Paper C73-921-4-IA, Jan. 1973, 6 pp, 5 Fig

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

The L&N Railroad has been inspecting track gage using a "high railer" outfitted with a mechanical feeler system. The high railer was able to inspect the track at moderate speeds and it carried a paint spray system to identify with colored stripes those portions of track that required maintenance attention. Because of the possible dynamic gage widening that could occur under a locomotive during certain train handling operations, the L&N Railroad suspected that the unloaded measurement provided by the high railer might not be indicative of the true dynamic gage. Therefore, the L&N undertook to outfit a locomotive with a measuring system which could measure gage in the vicinity of the wheels most likely to encounter dynamic gage widening. A non-contact gage measuring system was installed on an L&N locomotive by ENSCO, Inc. This system was very similar to the gage measuring system in use aboard the DOT test cars. The system employs capacitive proximity sensors. By mounting the sensors in the shadows of the wheel flanges, the sensors are well protected from damage and are in a location close to the very point of interest where dynamic widening is anticipated.

**ACKNOWLEDGEMENT**  
Institute of Electrical and Electronics Engineers

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Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017 Repr PC: \$1.80

**044310**  
**DATA ACQUISITION FOR AUTOMATED TRACK  
INSPECTION**

Sullivan, JH, Southern Railway

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017

Paper C73922-2-IA, Jan. 1973, 8 pp, 10 Fig

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

The purpose of this paper is to describe the use of a mini-computer in an integrated track inspection program. The basic elements of such a program include the measuring vehicle, data reduction

process, and presentation of data to the various management levels. The paper describes such a system which has been in use on the Southern Railway over five years, and points out desirable changes, problems and economics.

#### ACKNOWLEDGEMENT

Institute of Electrical and Electronics Engineers

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#### 044311

#### ANALYSIS OF THE RECONSTRUCTION OF RAIL GEOMETRY FROM CURVATURE DATA

Iverson, WC, Kaman Sciences Corporation

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

Paper C73923-0-IA, Jan. 1973, 13 pp, 10 Fig, 1 Tab, 3 Ref

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

A detailed analysis is presented of the reconstruction of rail shape from measured curvature data. The framework for numerically integrating these data is built around the fundamental concept of curvature and its use in the differential equations of the rail path. The basic curvature data are assumed to be obtained by means of measurements at discrete points along the rail. Formulas are derived specifically for the chord-displacement method and its response function; however, the general theory developed applies to other measurement techniques, such as the use of accelerometers. The reconstruction of rail shapes is demonstrated by results of a computer program to simulate the processes of measuring curvature by the chord-displacement method and numerically integrating the data. The effects of measurement system response are observed, and then the important problem of measurement error is mathematically analyzed. Formulas are developed for the effects of both random and bias errors. For a typical chord-displacement device (script  $l = 10$  feet), the distances from chord to rail must be measured with accuracies less than 0.001 inch if lateral deviations of the reconstructed rail at the end of one mile are to be held to 1 inch. Corresponding accuracies for accelerometer devices traveling at 60 mph are less than 0.001 g. If the locations of the beginning and end points of the rail are known, then a correction term can be added to each curvature measurement to improve the reconstructed rail shape. These factors are considered with regard to the practical determination of track parameters.

#### ACKNOWLEDGEMENT

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#### 044314

#### AUTOMATIC RAILROAD TRACK INSPECTION

Hayre, HS, Houston University

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

Paper C73924-8-IA, Jan. 1973, 7 pp, 4 Fig

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

A technical survey of the automated stationary and mobile track test train systems to date is presented. The use and availability of sensors is also reviewed. A method of in-situ excitation in conjunction with a radio interrogation coupled to existing railway communication system is discussed. The automatic inspection system proposed here is limited to the track bed and the rails. The rails are tested for any fissures and flaws and not for the cross-over error and misalignment although these are invariably also caused by the settling of the track bed. The major features of this system are the real-time segment interrogation system and track sensors. The problem of selective random-spacing deployment to cover maximum optimum segment is also discussed. The need for the railroad industry to expand their efforts in the area of development of automatic track and track bed inspection is shown to be highly desirable as well as economical from an operational stand point.

#### ACKNOWLEDGEMENT

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#### 044431

#### FRA GEARING UP TO ENFORCE TRACK SAFETY STANDARDS

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 1, Jan. 1973, pp 19-21, 1 Fig

The Federal Railroad Administration's Bureau of Railroad Safety has been enlarged and reorganized under the name of Office of Safety. The result of the reorganization which became effective November 13, 1972, was to establish the activities of the Office of Safety under two groupings, one called the Compliance Division and the other the Standard and Procedures Division. Activities of the Compliance Division will include the training of personnel involved in administration of safety programs, the monitoring of programs in states that have been certified to participate in administration of the Safety Act, the evaluation of field performance, the development of guidelines for field programs, and the coordination of field safety activities. Under the Standards and Procedures Division will come such activities as the development of rules and standards, the provision of technical advice and counsel to the headquarters and field forces, the analysis of reports and data and the development of enforcement procedures and policies. Inspection and surveillance activities of the Office of Safety will be handled through the same regional setup as prevailed under the Bureau of Railroad Safety. Personnel are being recruited and trained, regulations are being prepared for the certification of states, and a track manual of uniform practices is being readied.

#### ACKNOWLEDGEMENT

Railway Track and Structures

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#### 044432

#### MAJOR M/W ACTIVITIES TO STAY AT HIGH LEVEL IN 1973

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 1, Jan. 1973; pp 22-23, 2 Fig

The Class 1 railroads laid 685,000 tons of new rail in renewal in 1972, which is 6.5% higher than the 643,321 tons laid in 1971. Although renewal of ties represented a decline of 4.8% compared to 1971, tie renewal for 1972 exceeded 20 million for only the second time in 15 years. Looking ahead to the next 12 months, it is estimated that the Class 1 railroads will install 730,000 short tons of new

rails in existing track in 1973, which will be an increase of 45,000 tons, or 6.6% compared to 1972. The estimate of tie renewal in the Class 1 railroads is that 19,500,000 new cross-ties will be installed in existing tracks in 1973, which is a reduction of 900,000 ties, or 4.4% compared with 1972. The question of whether, and to what extent, M/W activities are being influenced today by the FRA Track Safety Standards, is answered by "not much". The fact is that railroad management has become convinced of the need to spend more on the tracks and structures.

#### ACKNOWLEDGEMENT

Railway Track and Structures

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#### 044434

### THE FRA TEST CARS—WHAT ARE THEY DESIGNED TO DO, HOW THEY ARE BEING USED, NEW CAPABILITIES IN THE OFFING

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 1, Jan. 1973, pp 26-28, 2 Fig, 3 Phot

This article was prepared exclusively for Railway Track and Structures by the Public Affairs Department of the Federal Railroad Administration.

The Department of Transportation's Federal Railroad Administration is using automated Rail Research Track and Vehicle Response Measuring Cars for rapid and thorough track inspection and vehicle behavior evaluation. The DOT Track Geometry Measuring System on board the DOT Test Cars is one of the many innovations in progress or in the planning stage at FRA. Equipped with computers and electronic measuring devices, the test cars offer opportunity for on-site analysis of track conditions. At the request of the managements of several railroads scattered throughout the country, the cars have already been used extensively in a variety of track geometry and vehicle performance tests. The measuring system of car T2 is described along with a demonstration of a long-range program with the Bessemer and Lake Erie and Denver & Rio Grande Western and tests at the DOT High Speed Ground Test Center in Pueblo, Colorado.

#### ACKNOWLEDGEMENT

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#### 044435

### RESEARCH: THE ANSWER TO TRACK PROBLEMS

Brown, RM, American Railway Engineering Association

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 3, Mar. 1973, p 19, 1 Phot

The FRA Track Safety Standards have now been established and the railroads must bring all their tracks into compliance and continue to maintain them to these standards, or reduce operating speeds to the lower track classification levels. The Research and Test Department of the AAR, under Dr. Bill Harris' administration and in cooperation with member railroads, the RPI, individual manufacturers and other agencies, has many major research projects under way, studying the adequacy of design and material specifications for tank cars, equipment components, as well as a special committee assigned to study rail specifications and chemistry. The most promising of these projects, from a track standpoint, however, is the track-train

dynamic study. The results to be derived from these research programs will not only make it possible for the railroads to meet the transportation demands of the future, but will make it possible for them to do so at a lower cost, not the least of it is the cost of maintaining the track and roadbed.

#### ACKNOWLEDGEMENT

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#### 044436

### MANUFACTURERS HAVE THEIR SAY ON GETTING THE MOST OUT OF M/W MACHINES

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 3, Mar. 1973, pp 20-25, 5 Fig, 2 Phot

When manufacturers of M/W equipment get together to talk about how to get the most out of their machines, the conversation keeps coming back to the role of the machine operator. Apparently he presents the biggest obstacle to the efficient use of their equipment. Other aspects of the subject are also discussed in this article, such as the need for supervisors to exercise a more positive role in training and supervising operators and in familiarizing themselves with the capabilities of the machines, the problem of safety and of getting more on-track time.

#### ACKNOWLEDGEMENT

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#### 044437

### HOW I'D MECHANIZE A 5000-MILE RAILROAD—FROM SCRATCH

Smith, FH, American Railway Engineering Association

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 3, Mar. 1973, 4 pp, 3 Tab, 1 Phot

The assignment is to come up with a blueprint for mechanizing the maintenance-of-way operations of a 5,000-mile railroad, the hypothetical Ft. Knox & Denver Mint R.R. Three assumptions are made: the railroad runs through a thousand miles of changing climate and terrain with 3,000 mile of light-traffic branch lines and 2,000 miles of medium to heavy mainlines, all in good condition, and there are three major yards and many lesser ones—the railroad has money—and, fantastically enough, it has no maintenance machinery. There are at least two ways to attempt a national solution of the problem: one is to find one or more railways with similar conditions and use their machine fleets as models, the other is to develop a fleet consist by independent means. This is the method selected by the author. Details are given of the equipment fleet he would assemble, including three tables: (1) Rail gang equipment; (2) Tie gang equipment, and (3) Equipment for bridge gangs, switch gangs and special purposes.

#### ACKNOWLEDGEMENT

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044439

**MECHANIZED TRACK INSPECTION: WHERE IT IS TODAY, WHERE IS IT HEADING?**

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 3, Mar. 1973, 4 pp, 8 Phot

Technology is available for mechanizing track inspection, but traditional methods are waging a stubborn battle against the new techniques which have been accepted in varying degrees on some roads but rejected on others. However, a significant point is the fact that no railroad after having acquired a track recorder, ever abandoned the idea later. The C&O/B&O, the Southern, the Canadian National, the Chicago and North Western, the Louisville and Nashville have track inspection cars which are described in this article. At least two track-measuring cars of European origin are now commercially available, the Matisa (Tamper) Trackfax car and the latest, the Plasser EM-50 Track Recording Car which has been in operation on the Union Pacific. The technology of track-measurement and data processing has been brought to a high level of sophistication in the track-recording cars developed for the Department of Transportation. Known as "Rail Research Track and Vehicle Response Measuring Cars", these are self-propelled cars designed for operation in electrified territory, but operated also on portions of a number of roads and in more or less regular use for track-measurement in the Northeast Corridor.

**ACKNOWLEDGEMENT**

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044490

**MODERN PERMANENT WAY**

Srinivasan, M, Indian Railway Service of Engineers

Somaiya Publications PVT Limited, Bombay-14, India  
1969, 555 pp, 275 Fig

Heavier loads, higher speeds, and a greater concern for safety are creating a greater emphasis on railroad track structure. Yet the number of current books on railroad track is indeed small. This book is an attempt to present a modern treatment of track and its components in the English language. Although the author is associated with the Indian Railways, the book is pertinent to American practice, and contains many references to specific American practices. The book covers rails, ties, fasteners, ballast, soils, track assembly, track maintenance and track modernization. It also covers concrete ties, welded rail, and high speed track.

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044561

**FOR M/W, A BIGGER SHARE OF THE DOLLAR**

Dick, MH

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, 3 pp, 2 Fig, 2 Phot

For more than ten years both rail and tie renewals have traced a generally upward curve and for the next twelve months the rail-renewal curve is expected to continue upward. Tie renewals are projected to decline slightly but tie insertions in 1973 will be at a higher level than in 1972. In spite of the increases of recent years, tie renewals are running short of actual needs and insertion of new rails are running far below requirements. Apparently the FRA Track Safety Standards have had little effect so far on M/W programs. There seems to be a trend towards performing more spot work on track as opposed to out-of-face work and towards the use of insulated rail joints and new and improved M/W machines; and an effort is being made to determine the cause of cracks in concrete ties shortly after they are inserted.

**ACKNOWLEDGEMENT**

Railway Age

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037169

**COMPUTER STUDY OF DYNAMIC LOADS CAUSED BY VEHICLE-TRACK INTERACTION**

Meacham, HC, Battelle Memorial Institute  
Ahlbeck, DR

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

Paper 69-RR-1, 12pp, 11 Ref

ASME Meeting, April 15-16, 1969.

Computer analyses of vehicle and track described produce results regarding actual dynamic loads and manner in which various parameters of vehicle and track structure affect these loads; it is possible to decide how to alleviate high wheel-rail stresses caused by modern 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 track structure.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 18066

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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)

**ACKNOWLEDGEMENT**

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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)

**ACKNOWLEDGEMENT**

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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)

**ACKNOWLEDGEMENT**

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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)

#### ACKNOWLEDGEMENT

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#### 039121

#### FEASIBILITY STUDY FOR A WHEEL-RAIL DYNAMICS RESEARCH FACILITY

Milenkovic, V Poczatek, JJ

General American Transportation Corporation, General American Research Division, Niles, Illinois

Dec. 1968, 180 pp

Contract DT-7-35363

The principal objective of the program is to determine the most suitable form of laboratory apparatus required to significantly advance the current knowledge of wheel-rail dynamics, and to establish the safe upper-limit speed for those wheel-rail combinations which hold promise of achieving speeds up to 300 mph. What is sought here is a versatile piece of equipment or equipments capable of accommodating as many of the rail vehicles, suspension systems, mating tracks and/or models or components thereof, as might reasonably be of interest, and being able to evaluate their merits or deficiencies either in component fashion, in scale-model fashion, or in full-scale systems fashion. Such equipment must be both technically feasible and practical, and economically justifiable. (Author)

#### ACKNOWLEDGEMENT

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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)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183846

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#### 039167

#### SUPPLEMENTARY REPORT TO FEASIBILITY STUDY FOR A WHEEL-RAIL DYNAMICS RESEARCH FACILITY

General American Transportation Corporation, General American Research Division, Niles, Illinois

Oct. 1969, 146 pp

Contract DT-7-35363

Supplement to report dated Dec 68, PB-182 472.

This supplement to PB 182 472 deals with: (1) the trade-off considerations in extending the simulation capability of the wheel-on-roller design to lower speeds and sharper curves, and to more precise simulation of general system behavior; (2) the methods of implementation of the various simulation schemes and/or the method of compensation and constraint in lieu of such simulation; (3) the relative merit of electromechanical drive versus hydraulic drive systems, and some considerations in tractive and braking performance associated with the electromechanical drive-system selected; and (4) stress and deflection considerations of the diaphragm-coupler and the roller systems, their compliances, and how they relate to total system compliance and system performance.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-189096

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#### 039207

#### DYNAMIC RAILCAR SIMULATION PROGRAM

Melpar, Incorporated, Falls Church, Virginia

293 p, p, 293p\*

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)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-192886

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PB-192886



**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, 273 pp

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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-196707

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PB-196707

**039239**  
**DYNAMIC ANALYSIS OF MULTIPLE CAR VEHICLES**  
**USING COMPONENT MODES. VOLUME II. PARAMETRIC**  
**STUDY**

Hasselmann, TK Kaplan, A

TRW Systems Group, Redondo Beach, California

Vol. 2, 06818-6049-RO-00, Final Rpt, July 1970, 37 pp

Contract DOT-C-353-66

Report on High Speed Ground Transportation Systems  
Engineering Study. See also Volume 1, PB-193 545.

The report documents the results of a parametric study made to assess the effects of inter-car coupling on the dynamic characteristics of high speed trains. In addition to shedding light on potential problems which may arise from the dynamic coupling of vehicle modes, the report includes a summary of the experience gained in application of the computer program developed for this purpose.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-194375

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PB-194375

**039251**  
**OPTIMIZATION OF A SIMPLE DYNAMIC MODEL OF A**  
**RAILROAD CAR UNDER RANDOM AND SINUSOIDAL**  
**INPUTS**

Mixson, JS Steiner, R

National Aeronautics and Space Administration, Langley  
Research Center, Langley Station, Virginia, 22065

Nov. 1969, 40 pp

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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201620

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PB-201620

**039252**  
**A TECHNIQUE FOR EVALUATING TRACK CONDITION**  
**USING RAILCAR VIBRATIONS**

Clevenson, SA Ullman, KB

National Aeronautics and Space Administration, Langley  
Research Center, Langley Station, Virginia, 22065

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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201623

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PB-201623

**039277**  
**SUMMARY OF METROLINER TEST RESULTS**

Herring, JMJ Strong, PM

Budd Company, Technical Center, Fort Washington, Pennsylvania

Feb. 1972, 272 pp

Contract DOT-FR-1-0035

Laboratory dynamic test results are presented for Metroliner railroad car. Power spectra of road test also included. Track geometry power spectra of roadbed input are also documented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208284

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PB-208284

**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 post-buckling 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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209614

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**039854**

**DYNAMIC RESPONSES OF RAILROAD CAR MODELS TO VERTICAL AND LATERAL RAIL INPUTS**

Sewall, JL Parrish, RV Durling, BJ

National Aeronautics and Space Administration, Langley Research Center, Langley Station, Virginia

NASA-TN-D-6375, Nov. 1971

97 pp

Simplified dynamic models were applied in a study of vibration in a high-speed railroad car. The mathematical models used were a four-degree-of-freedom model for vertical responses to vertical rail inputs and a ten-degree-of-freedom model for lateral response to lateral or rolling (cross-level) inputs from the rails. Elastic properties of the passenger car body were represented by bending and torsion of a uniform beam. Rail-to-car (truck) suspensions were modeled as spring-mass-dashpot oscillators. Lateral spring nonlinearities approximating certain complicated truck mechanisms were introduced. The models were excited by displacement and, in some cases, velocity inputs from the rails by both deterministic (including sinusoidal) and random input functions. Results were obtained both in the frequency and time domains. Solutions in the time domain for the lateral model were obtained for a wide variety of transient and random inputs generated on-line by an analog computer. Variations in one of the damping properties of the lateral car suspension gave large fluctuations in response over a range of car speeds for a given input. This damping coefficient was significant in reducing lateral car responses that were higher for nonlinear springs for three different inputs. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, N72-10962

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N72-10962

**040979**

**TRACK-TRAIN DYNAMICS BIBLIOGRAPHY**

Lind, EF

Association of American Railroads, 3140 South Federal Street, Chicago, Illinois, 60616

This comprehensive bibliography of subjects in the area of track-train dynamics, which has been in preparation since November 1971, includes approximately 600 publication abstracts and an extensive thesaurus and key work index. The published bibliography consists of three volumes, each with a three-hole, looseleaf format to facilitate the later additions of more reference material, which will be issued as annual supplements.

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**041108**

**THEORETICAL ANALYSIS OF VARIATION OF WHEEL LOAD**

Hirano, M

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

Vol. 13, No. 1, Mar. 1972, pp 42-44, 4 Fig

A three mass model was developed for theoretical analysis of the variation of the wheel load for a high speed railway like the Shin Kansen. The calculation of the frequency response function and transient response are demonstrated, with particular emphasis on passage through very small low spots of track.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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**041111**

**RUNNING PERFORMANCE TESTS ON THE CAR BODY VIBRATIONS OF THE 591-PROTOTYPE ELECTRIC CARS**

Koyanagi, S Uetake, Y

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

Vol. 13, No. 1, Mar. 1972, pp 50-51, 2 Fig

For the purpose of raising running speeds on curves, the 591 prototype electric cars were produced, and various tests were performed on Tohoku line in April 1970. As for riding comfort, it was confirmed that the allowable maximum speeds on curves are determined not by stationary lateral accelerations but by shock vibrations at the entrances of curves.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
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**041672**  
**MEASUREMENT AND ANALYSIS OF WHEEL-RAIL FORCES**

Peterson, LA, Bessemer and Lake Erie Railroad  
 Freeman, WH, Quebec Cartier Mining Company Railroad  
 Wandrisco, JM, United States Steel Corporation

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

71-WA/RT-4, 1971

This paper was presented at the ASME Winter Annual Meeting,  
 November 28-December 2, 1971. The notification of this paper  
 appeared in Mechanical Engineering.

Described is a method used to continuously measure, record, and  
 analyze the lateral and vertical forces between wheels and rails of  
 several types of railroad freight cars under a variety of car and track  
 conditions. The method, using analog-to-digital conversion and  
 computerized data handling, has produced results relating to a mul-  
 titude of car and track behavior subject areas. Especially important is  
 the definition, development, and verification of performance "signa-  
 tures" which are generated in a unique and characteristic manner by  
 each car in negotiating a given curve. The finding of such "signa-  
 tures" to be completely reproducible and yet sensitive enough to  
 change with relatively minor track or car component variations, i.e.,  
 modifications, supports the belief that these techniques can be applied  
 beyond pure experimental scopes into routine (a) trackside inspection  
 of cars in passing trains; (b) mechanized track inspection; and (c)  
 truck design evaluation.

ACKNOWLEDGEMENT  
 Mechanical Engineering

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**043365**  
**STUDY OF ACTIVE VIBRATION ISOLATION SYSTEMS FOR SEVERE GROUND TRANSPORTATION ENVIRONMENTS**

Calcaterra, PC Cavanaugh, RD Schubert, DW

Wright (Barry) Corporation, Watertown, Massachusetts

NASA CR-1454, Contr Rpt, 155 pp, 20 Tab, 11 Ref, 2 App

Prepared for National Aeronautics and Space Administration.

An investigation is conducted to evaluate the application of ac-  
 tive mechanisms for the protection of equipment and/or personnel  
 from the severe dynamic inputs characteristic of ground transporta-  
 tion vehicles. For the purposes of the study, dynamic loads and iso-  
 lation system performance are defined in terms of the maximum ex-  
 pected vertical excitations associated with the suspension system of  
 high speed ground transportation vehicles, and conservative levels of  
 allowable passenger acceleration. Selected configurations employ  
 available hardware, and consist of a static load support fluidic spring  
 in parallel with a 0.2 Hz resonant frequency electrohydraulic isolator,  
 which: a) provides the desired degree of isolation from both discrete  
 frequency and broad-band vibration excitations; and b) limits the  
 payload deflections to within plus or minus 6 inches under conditions  
 of combined vibratory and transient dynamic loads. Rigid and flex-  
 ible payloads of 1,000 3,000 and 10,000 pounds per isolator are con-  
 sidered. The response of the selected isolation systems is presented in  
 terms of absolute and relative transmissibility; payload acceleration;  
 and relative displacement between the payload and the source of ex-  
 citation for the vibratory, transient, and combined excitations. In all  
 cases the effect of increasing the payload weight by twenty percent is  
 shown. The results indicate that the selected active isolation systems  
 are capable of protecting a range of payloads from severe vibratory  
 and transient dynamic loads. Systems stability, estimates of flow and  
 power requirements, system weight, reliability, and failsafe criteria

considerations are shown. Recommendations are made regarding ex-  
 tension of the techniques to provide isolation in the combined vertical  
 and lateral directions. (Author)

ACKNOWLEDGEMENT  
 National Aeronautics and Space Administration

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**043511**  
**EXPERIMENTAL RESULTS ON RELATIONS BETWEEN TRACK IRREGULARITIES AND RUNNING SAFETY OF TWO-AXLE WAGONS**

Ikemori, M

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

Vol. 13, No. 4, Dec. 1972, pp 194-197, 6 Fig

In order to make clear mechanism of derailment and effects of  
 relating factors and to decide the way of raising running safety of  
 wagons, experiments have been made in KARIKACHI experimental  
 track since 1967. This paper states, based on a result of analysis of  
 the experimental values on relation between track irregularities, run-  
 ning safety related with frequency response characteristic of two-axle  
 wagon, and others.

ACKNOWLEDGEMENT  
 Railway Technical Research Institute

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 Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan

**044189**  
**DYNAMICS OF A MODEL VEHICLE RUNNING ON AN IMPERFECT ELASTIC TRACK**

Developmental Sciences, Incorporated, Aerospace Technology  
 Division, City of Industry, California De-mtd-7

Interm Rpt, Feb. 1971

Theoretical analyses of both longitudinal and lateral dynamics of  
 a scaled model subway vehicle were performed to identify design  
 parameters and the relationships among different system components  
 and conditions. The longitudinal analyses assumed both rigid and  
 elastic trackage to estimate critical speeds. Effects such as the eccen-  
 tricity of the wheel, track imperfections, curvature in the track plane,  
 and the coupling between rotary and translation vibration due to as-  
 ymmetry of the center of gravity were considered in the analysis. La-  
 teral dynamics were also investigated, with particular attention fo-  
 cused upon both wheel shimmy, which involved solid and viscous  
 friction, and the stability of the "snake" type motion of the vehicle  
 on a rigid imperfect track. All critical speeds in the dynamic analysis  
 exceeded the maximum required normal operations of subway vehi-  
 cles (65 + miles per hour).

ACKNOWLEDGEMENT  
 Urban Mass Transportation Administration

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 PB-201882

**044281**  
**TECHNICAL STUDIES TO EVALUATE THE INFLUENCE OF OPERATIONAL FACTORS ON TRACK LOADING**

Scott, JF, Canadian National Railways  
 Belevins, WG, Canadian National Railways  
 Wilson, JT, Canadian National Railways

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

Paper 72-WA/RT-11, Nov. 1972, 11 pp, 14 Ref

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

This paper describes briefly theoretical and physical investigations which have recently been performed by Canadian National Railways. The objective of investigations has been to establish means of reducing the probability of train derailment. While the scope of the derailment study is indicated, two efforts have been singled out for more detailed description. The first effort was directed to determine through computer simulation and analysis programs the lateral loading on curved track which can result from longitudinal train action forces. The second effort to be reviewed was directed to determine, through field measurement, actual lateral tieplate loads on curved track imposed by various vehicle types.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044284

#### COMPUTER PREDICTIONS OF FREIGHT TRAIN SHOCK ACTIONS

Roggeveen, RC

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

Paper 72-WA/RT-9, Nov. 1972, 32 pp, 32 Fig, 6 Ref

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

Results obtained from a digital computer simulation of longitudinal train action are presented. The effects of running friction, draft gear springback, train position and train speed on a run-out shock are shown. Various modifications in the characteristics of friction draft gears are studied. The impact characteristics of hydraulic end-of-car cushioners are studied. Simulations study the effects of such hydraulic cushioners on train action. Some underlying mathematical considerations and the general characteristics of the computer simulation are given.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044285

#### THE INFLUENCE OF WHEEL-RAIL CONTACT FORCES ON THE FORMATION OF RAIL SHELLS

Martin, GC, Association of American Railroads  
Hay, WW, Illinois University, Urbana

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

Paper 72-WA/RT-8, Nov. 1972, 13 pp, 1 Tab, 19 Ref

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

This paper describes an analytical and experimental investigation of the problem of rail shelling; in particular the influence of the stresses resulting from wheel-rail contact forces is studied. These contact forces are due to the weight of the car, and the tracking of the wheel on the rail. An analytical analysis includes the yielding of the rail material, the subsequent development of residual stresses, and

plastic flow due to a moving load. Explanations are given for the mechanics of shelling and other associated behavior that is found in rail.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044288

#### DYNAMIC ANALYSIS OF TRAIN DERAILMENTS

Yang, TH, Pullman-Standard  
Manos, WP, Pullman-Standard  
Johnston, B, Pullman-Standard

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

Paper 72-WA/RT-6, Nov. 1972, 8 pp, 9 Fig, 2 Tab, 6 Ref

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

In actual train derailments little is known except the end result. An analytical simulation has been developed to determine the influence of various parameters on derailment severity. In this theoretical analysis the equations of motion for each derailed car are derived in general in the horizontal plane. These are then coupled with a system of constraint equations and the equations of motion for the nonderailed cars. The equations are then solved numerically (by digital computer) in their non-linear forms with the first car derailed as the sole initially assumed condition; and with the ground friction, mating coupler moment and brake retarding force in action accordingly. This work was sponsored by the RPI/AAR Tank Car Safety Research and Test Project Committee and represents one phase of the overall RPI/AAR study of means to improve tank car safety in accidents.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044344

#### FRICTIONAL AND VIBRATORY BEHAVIOR OF ROLLING AND SLIDING CONTACTS

Nayak, PR Tanner, RB

Bolt, Beranek and Newman, Incorporated, 50 Moulton Street, Cambridge, Massachusetts, 02138

BBN-2402, July 1972, 194 pp

Contract DOT-FR-10031

Experimental investigations of the influence of rolling velocity, normal load and high-frequency normal vibrations on the traction/slip characteristics of rolling discs are described. Major findings are: measured creep coefficients are systematically lower by a factor of two to three than theoretically predicted ones, given this discrepancy (which remains unexplained), the creep coefficients are insensitive to rolling velocity or normal vibrations, the rolling friction coefficient ('adhesion') is insensitive to normal vibrations and rolling velocity, for reasonably clean surfaces, (however, high rolling velocities tend to centrifuge contaminants onto the rolling surfaces from the sides of the discs), and traction does not decrease with increasing slip in the region of large slip, for reasonably clean surfaces. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-214939/1

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**044524**  
**EFFECT OF FLAT WHEELS ON TRACK AND EQUIPMENT**

Association of American Railroads Research Center, 314 South Federal Street, Chicago, Illinois, 60616

MR-113, May 1951

This report was prepared by the Joint Committee on Relation Between Track and Equipment.

Under present AAR rules governing removal of flat wheels, flat spots are limited to 2-1/2 in. length for one slid flat and 2 in. each for adjoining spots on freight car wheels and 1 in. on passenger car wheels. These limitations have been established from the experience

and judgment of those concerned with the operation and maintenance of equipment and track. To date mathematical solutions to evaluate the impact effects from flat spots have not been adequate. Until recent years, instruments of sufficiently high frequency response to accurately measure the rapid stress changes have not been available. Tests made on the New York, New Haven, and Hartford RR. in 1942 established the characteristics required for reliable instrumentation. Suitable stress measuring instruments were obtained and a comprehensive test program to determine the effects of flat spots on both the track and equipment was conducted on the Chicago & North Western Railway during the summer of 1947. A special test train was used consisting of a locomotive, a passenger car carrying the measuring and recording instruments for the measurements on the test car, and a flat test car having a flat wheel and loaded with rails.

**ACKNOWLEDGEMENT**  
 Association of Americans Railroads

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028742

**DEVELOPMENT OF STUDIES ON NOISE AND VIBRATIONS IN RAILROAD TRANSPORTATION AND THEIR RESULTS**

Volkov, AM

Wright-Patterson Air Force Base, Foreign Technology Division,  
Dayton, Ohio

FTD-MT-24-358-68, Nov. 1968, 13 pp

Edited machine translation of Gigiena Truda i Professionalnye  
Zabolevaniya (USSR), VII, N11, pp 58-60, 1967.

The report is a survey of studies on the adverse effect of noise and vibration in railroad cars. Further studies started in 1948, used EEG and EKG to determine the function of analyzers, thresholds of acoustic sensitivity and vestibular chronaxy and effects on the cardiovascular system; model vibratory platform was constructed. Characteristics of noise and vibration were divided into 3 groups according to noise and 2 according to vibratory parameters; these were determined for the various types of passenger coaches. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-685497

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037165

**DEVELOPMENT OF NEW DESIGN FOR RAILROAD FLATCAR TO CARRY CARGO CONTAINERS AND HIGHWAY TRAILERS INTERCHANGEABLY**

Brodeur, RH, Trailer Train Company

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

Paper 69-WA/RR-1, 10pp

ASME Meeting, November 16-20, 1969.

Review of approach taken to evolve new design by initial writing of set of general specifications, purchase from each of four car builders of prototype, laboratory testing and period of service testing for each prototype, writing of final specifications for production car, and final performance testing of production model; data on end wall force measurements on containers, longitudinal restraint force, and trailer kingpin forces at various speeds of coupling impacts are presented for final production design.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 14891

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037168

**THREE DIMENSIONAL FINITE DIFFERENCE SOLUTION FOR THERMAL STRESSES IN RAILCAR WHEELS**Novak, GE, Materials Research Laboratory, Incorporated  
Eck, BJAmerican Society of Mechanical Engineers, 345 East 47th Street,  
New York, New York, 10017

Paper 69-RR-4, 8pp, 12 Ref

ASME Meeting, April 15-16, 1969.

Numerical solution is presented for both transient temperature and three-dimensional stress distribution in railcar wheel resulting from simulated emergency brake application; computer program was

written for generating thermoelastic solutions and results include effect of shear stresses caused by axial-radial temperature gradients and high degree of boundary irregularity associated with this type of problem; program has been validated by computing thermoelastic solutions for thin disks and long cylinders, computed values being in good agreement with closed form solutions.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 15900

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037178

**SWITCHING AND CONTROL OF MULTIPLE UNIT TRAIN, MODEL 420, OF THE WEST GERMAN 212 SCHALTUNG UND STEUERUNG DES TRIEBZUGES BAUREIHE 420 DER DEUTSCHEN BUNDESBahn**

Voss, U

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse  
145, Munich 80, West Germany)

Vol. 40, No. 11, Nov. 1969

pp 255-7

The operation of the control circuits incorporating thyristors is described. Topics considered include the installation of the high-power equipment, braking, efficiency, and circuit protection.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20558

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037179

**NEW MULTIPLE-UNIT TRAINS OF THE WEST GERMAN FEDERAL RAILROAD SYSTEM FOR CROWDED LOCALITIES 212 NEUE TRIEBZUEGE DER DEUTSCHEN BUNDESBahn FUER 'BALLUNGSRAEUME**

Rappenglueck, W

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse  
145, Munich 80, West Germany)

Vol. 40, No. 11, Nov. 1969, pp244-54

The development of trains for Munich rapid transit system to be widely used for 1972 Olympic Games is reported. The construction, the braking and control system, and choice of driving equipment are discussed.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20557

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037180

**DESIGN AND INTERIOR EQUIPMENT OF CAR OF URBAN RAPID TRANSIT SYSTEM IN MUNICH, WEST GERMANY 212 FORMGEBUNG UND INNENAUSSTATTUNG DES MUENCHNER S-BAHN-WAGENS**

Schuh, E

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse  
145, Munich 80, West Germany)

Vol. 40, No. 12, Dec. 1969, pp271-4

Constructional details are presented. It is shown how the comfort of passengers was emphasized when planning the interior layout.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20556

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**037181**

**INSTALLATION OF THE ELECTRIC EQUIPMENT OF THE MULTI-UNIT TRAIN MODEL 420, WITH SPECIAL ATTENTION PAID TO THE TRANSFORMER AND THE AUXILIARY INVENTOR INSTALLATION 212 EINBAU DER ELEKTRISCHEN AUSRUESTUNG BEIM TRIEBZUG 420 UNTER BESUNDERER BERUECKSICHTIGUNG VON TRANSFORMATOR UND HILFSUMRICHTERANGLAGE**

Winden, R

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse 145, Munich 80, West Germany)

Vol. 40, No. 12, Dec. 1969, pp280-7

The operation of the electric equipment aboard the train for the Munich rapid transit system is described.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20562

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**037182**

**ILLUMINATION EQUIPMENT OF THE ELECTRIC MULTI-UNIT TRAIN 420 212 DIE LICHTTECHNISCHE AUSSTATTUNG DES ELEKTRISCHEN TRIEBZUGES 420**

Pfannkuch, H

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse 145, Munich 80, West Germany)

Vol. 40, No. 12, Dec. 1969, pp265-9

The development of specific illumination facilities for the model 420 train of the West German Federal Railroad system is reported. This equipment differs considerably from conventional illumination and was designed to meet the physiological needs of passengers having to travel underground for long periods.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20561

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**037183**

**AIR SUSPENDED PIVOT MOUNTING OF MULTI-UNIT TRAIN, MODEL 420, OF THE WEST GERMAN FEDERAL RAILROAD SYSTEM 212 LUFTGEFEDERTE DREHGESTELLE DES TRIEBZUGES BAUREIHE 420**

Kayslering, U

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse 145, Munich 80, West Germany)

Vol. 40, No. 11, Nov. 1969, pp263-9

The development of a system for a train consisting of three units using components that can be interchanged on all six mountings is described.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20560

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**037184**

**DESIGN AND CONSTRUCTION OF THE CAR BODY OF THE MULTI-UNIT TRAIN, MODE 420, OF THE WEST GERMAN FEDERAL RAILROAD SYSTEM 212 KONSTRUKTION UND BAU DER WAGENKAESTEN DES TRIEBZUGES BAUREIHE 420**

Tribukait, K

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse 145, Munich 80, West Germany)

Vol. 40, No. 11, Nov. 1969, pp258-62

Studies carried out on models are reported. Steps taken to insure uniform train construction are discussed, along with the installation of the electric equipment.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20559

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**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.

**ACKNOWLEDGEMENT**

Battelle Memorial Institute, BCL-522

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**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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173649

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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 transfer 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.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173648

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**039035**

**BUFFETING TESTS ON THE HUDSON TUBE**

Chilton, EG

Stanford Research Institute, Menlo Park, California SRI-  
PHU-5391

Final Rpt, June 1965, 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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-168647

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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.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173513

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**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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176137

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PB-176137

**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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176044

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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 pp

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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-180198

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PB-180198

**039094****DYNAMIC SIMULATION OF AUTO AND PASSENGER RAIL TRANSPORTS**

Robinson, RR

IIT Research Institute, Chicago, Illinois     IITRI-M6167

Final Rpt, 6609-6703, Jan. 1968, 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 bumpers, 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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-180132

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PB-180132

**039198****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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183845

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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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-185008

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039228

**INVESTIGATIONS OF BOXCAR VIBRATIONS**

Luebke, RW

Chesapeake and Ohio Railway, Terminal Tower, P.O. Box 6419, Cleveland, Ohio, 44101  
Baltimore 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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-195341

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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)

**ACKNOWLEDGEMENT**

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039270

**FLAW DETECTION IN MODEL RAILWAY WHEELS**

Bray, DE Finch, RD

Houston University, Department of Mechanical Engineering, Houston, Texas

Final Rpt, Feb. 1971, 234 pp

The purpose of the report is to present the results of a theoretical and experimental study of acoustic pulses propagating within a model railway wheel. The ultimate goal is the development of a method, using either ultrasound or audible sound, for detecting flaws in wheels that are moving. Ultrasonic pulses have been produced on the tread of each model wheel and an experimental investigation has been made of the propagation in the plate and on the tread surface. Echos from artificial plate flaws are identified, and, using pulse-echo and attenuation techniques, thermal flaws on the tread have been located. Records of pulse arrivals are made by photographing the oscilloscope trace with a Polaroid camera. The behavior of these pulses is shown to be in accordance with the predicted propagation of Lamb waves in the plate region of the wheel, Morse waves in the rim and surface waves on the curved tread surface. Artificial plate flaws have also been detected by differences in the spectrum of audio sound radiated into the air by a wheel excited with a random noise input. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-199956

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039804

**TEST OF TURBO-ELECTRIC RAIL CAR. A SUMMARY REPORT ON PART TWO OF THE MASS TRANSPORTATION DEMONSTRATION GRANT PROJECT— LONG ISLAND RAIL ROAD, OCTOBER 1968— JUNE 1971**

Tri-State Regional Planning Commission, New York, New York INT-MTD-12

Final Rpt, 6810-7106, Dec. 1971, 15p

Contract DOT-H-717

See also reported dated March 1971, PB-201909.

Under this project, a dual-mode, gas-turbine, electric rail car was tested in an attempt to evaluate its potential for high-speed commuter rail service. The car was designed to operate on electrified and non-electrified track. The project had two phases: Testing of a turbomechanical drive, and direct electrical drive. The test car was the one used previously in Part One of this test program to demonstrate the use of turbomechanical drive. For Part Two, summarized in this report, the test car was modified to provide an electric traction system in place of direct turbine power, to allow the use of diesel fuel for powering the turbines, and to demonstrate a 'chopper' type of voltage control for the traction motors. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208231

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PB-208231

040609

**SUMMARY OF METROLINER TEST RESULTS**

Herring, JMJ Strong, PM

Budd Company, Technical Center, Fort Washington, Pennsylvania

Feb. 1972, 272p

Contract DOT-FR-1-0035

Laboratory dynamic test results are presented for Metroliner railroad car. Power spectra of road test also included. Track geometry power spectra of roadbed input are also documented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208284

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040615

**FIRE PROTECTION OF RAILROAD TANK CARS CARRYING HAZARDOUS MATERIALS—ANALYTICAL CALCULATIONS AND LABORATORY SCREENING OF THERMAL INSULATION CANDIDATES**

Levine, D Dancer, DM

Naval Ordnance Laboratory, White Oak, Maryland NOL-541/FRA-X01

NOLTR-72-142, July 1972, 59 pp

In recent years there have been a number of incidents in which railroad tank cars carrying liquefied petroleum gas (LPG) have been engulfed in fires. The LPG cars have ruptured from the fires, causing extensive property damage and loss of life. This report describes a laboratory screening program to select two thermal insulation candidates for use in future fire tests of fifth-scale and full scale LPG tank cars. Also included are analytical calculations to predict pressures and

liquid levels in LPG tank cars being heated by fires. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-747974

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041096

**SEVERAL PROBLEMS ABOUT ROLLING STOCK WHICH CAN RUN ON CURVES AT HIGH SPEED**

Kunieda, M

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

Vol. 13, No. 1, Mar. 1972, pp 1-7, 8 Fig

It is well known that in order to reduce the end to end travel time of passenger train the speed-up on curves is most effective. The running safety criteria and the allowable limits for the riding comfort on curves are explained at first. Then the factors hampering the speed-up which are revealed by the test are described. Several considerations about the countermeasures are also dealt with.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
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041123

**EFFECT OF NON-LINEAR CHARACTERISTIC ON HUNTING OF CAR—EFFECT OF SIDE PLAY BETWEEN AXLE AND BEARING METAL**

Yokose, K

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

Vol. 13, No. 2, June 1972, pp 107-111, 4 Fig

The equation of motion for a two-axle car was introduced when there was side play between the axle and the bearing metal, and an observation on the value of side play was made. Non-linearity of the elasticity and the side play was treated by the describing function method, linearizing of the equation of motion, and then the characteristic equation of the two-axle car was derived and the sinusoidal hunting velocity was calculated. A one-fifth sized model of a two-axle car was used in order to verify the theoretical treatment of hunting of a two-axle car experimentally. The experimental results and the theoretical calculation coincided closely and qualitatively and moreover when the damping of the supporting device for the car body was selected properly, the above results also coincided quantitatively. It was proved that the side play not only prevented the body hunting effectively but also lessened the side thrust experimentally.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan, Repr PC: Req Price

041151

**LUBRICATION, PROHIBITED EQUIPMENT STANDARDS ARE PROPOSED BY FRA**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 11, Dec. 1972, 3 pp

The Federal Railroad Administration has created two additional proposals for the Freight Equipment Safety Standards. Phase II and Phase III, covering Lubrication of Journal Bearings and Prohibited Equipment respectively, have been issued. The FRA has set Jan. 15, 1973 as the date for submitting comments on the new proposals. The general prohibitions on average cars and those with Duryea underframes would outlaw components that include K-type air brakes, tubular axles, cartridge journal bearings, certain specific types of roller bearings, all cast-iron wheels and certain cast steel types, four types of jokers and many specific types of side-frame and bolster castings. The lubrication standards would include stenciling, plain bearing boxes, roller bearings and restenciling.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041153**

**'SCALING UP' FREIGHT CARS HAS ALSO INTENSIFIED PROBLEMS**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 11, Dec. 1972, 3 pp, 2 Phot

Premature wear and outright failures in the center plates and bolsters are plaguing a large number of freight cars. This lack of component reliability and inadequate ride quality is causing railroads to reevaluate the relationship between the cost of the technological advance and the revenue producing benefits. It is recommended that railroads and car builders should make it their responsibility to move beyond the immediate problems with a more complete systems approach to the vehicles they are producing.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041154**

**WHEEL AND AXLE MANUAL**

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

10 Edition, Oct. 1972

Notice of this manual was given in Volume 146, No. 11 of "Railway Locomotives and Cars", dated December 1972.

This new publication, effective Oct. 1, 1972, contains all the rule and paragraph changes which have been approved by the AAR committees responsible for wheels, axles, bearings and lubrication of freight cars since publication of the Ninth Edition in 1968. It is valuable, not only in shops, but also on repair tracks and in yards where work is performed by railroads and by private car owners.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

AAR, Repr PC: \$2.00

**041156**

**1972 SPECIFICATIONS FOR TANK CARS**

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

Notice of this publication was given in Volume 146, No. 11 of "Railway Locomotives and Cars", dated December 1972.

Numerous additions and revisions keeping this publication current with AAR and DOT requirements has necessitated a complete reprinting. There are revisions in safety relief flow rating requirements and approvals, a new list of certified facilities for tank fabrication and repair, an index of special commodity requirements, and a new section giving tank car definitions. Many of the appendixes have been completely rewritten.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

AAR, Repr PC: \$8.00

**041157**

**FRA MAKES ITS PROPOSALS FOR FREIGHT EQUIPMENT INSPECTION STANDARDS**

Ingram, JW, Federal Railroad Administration

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 9, Oct. 1972, 6 pp, 8 Fig, 3 Phot, 1 App

The Federal Railroad Administration proposes to provide minimum federal safety standards for railroad freight cars under the Federal Railroad Safety Act of 1970 by a new Part 215. The proposed standards are divided into several subparts covering wheels, axles journal bearings, other truck components, couplers and draft systems. In addition there is a subpart which prescribes inspection requirements and an appendix dealing with object detection gauges.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041297**

**CUSHION UNDERFRAME DEVICES**

Railway Educational Bureau, 1809 Capitol Avenue, Omaha, Nebraska, 68102

160 pp

This manual was prepared by the Railway Educational Bureau and announced in Railway Locomotives and Cars, V146, N8, September 1972.

This pocket-size manual is intended to serve as a means of familiarizing its readers with six of the end-of-car and sliding-sill type hydraulic cushioning units. For each such device there is nomenclature, functioning and maintenance recommendations. In the 160 pages are many drawings and illustrations which serve to explain the accompanying text.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Railway Educational Bureau, 1809 Capitol Avenue, Omaha, Nebraska, 68102, Repr PC: Req Price

**041310**

**STUDY TO REDUCE HAZARDS OF TANK CAR TRANSPORTATION**

Bullerdiek, WA Vassallo, FA Adams, DE Matheis, CW

National Technical Information Service, 5285 Port Royal Road,

Springfield, Virginia, 22151

172 pp

This report was announced in *Railway Locomotives and Cars*, V145, N9, September 1971.

This 172-page report of a four-month study undertaken for the Federal Railroad Administration by Cornell Aeronautical Laboratory defines the rate of generation of vapors of hazardous materials in tank cars and then attempts to develop the performance of safety devices which might prevent catastrophic explosions. It was found that safety devices should function to release liquids, as well as vapors, from upset tank cars. Staged safety relief devices were recommended with a secondary arrangement to dump ladings when primary devices were no longer adequate.

#### ACKNOWLEDGEMENT

*Railway Locomotives and Cars*

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00

041316

#### NOW YOU WILL BE WASHING ACI LABELS

*Railway Locomotives and Cars* (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 7, July 1972, pp 30-31

The AAR Mechanical Division has approved for letter ballot the requirement to wash ACI labels. Car labels are to be inspected and washed each time a car is placed at a maintenance facility. Locomotive labels are to be cleaned in conjunction with quarterly inspections. Piggyback flat cars are also to have their labels cleaned twice yearly, in April and in October. The General Committee noted that methods for improving journal performance are showing results expected in improved miles per hotbox setoff. A survey indicated that of approximately 2 million freight cars, 730,751 are equipped with roller bearings. Inadequate center plate lubricants result in galling and abnormal wear. The Coupler and Draft Gear Committee is revising Specification 921 involving special cushioning devices. It was proposed that the AAR Research Undertake an evaluation of the various disposable air filter media.

#### ACKNOWLEDGEMENT

*Railway Locomotives and Cars*

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041318

#### STATE OF THE ART CAR: READY FOR REVENUE TESTING

Houser, FN

*Railway Age* (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 1, Jan. 1973, pp 17-19, 1 Fig, 1 Tab, 4 Phot

Two State of the Art transit cars are now undergoing testing at the UMTA test facility at Pueblo. Next month the cars will be moved to begin a series of revenue service tests. These cars represent the first phase of a three year program. Phase two will attempt to produce a better transit car, constrained only by 600 volt DC power, standard track gauge, and the clearance envelope of five transit systems. Systems manager Boeing-Vertol has five tasks: observe the prototype car program of BART, manage production of the state of the art cars, manage design competition leading to Advanced Concept Train ACT-1 cars, manage the ACT-2 component development program to move from first generation ACT-2 cars to second generation ACT-3

cars, and plan for ACT-3 revenue demonstration. There are two versions of the state of the art car, a 64 seat version and a 72 seat version. The car bodies are stainless steel. The lightweight trucks use air bellows and eliminate metal to metal contact from the car body to the rail. In tests, the interior noise level at 40 mph was 63 db. Each truck is fitted with a pair of 175 hp DC traction motors. Solid state chopper propulsion is used. The car builder, St. Louis Car, and the truck supplier, GSI Castings Division, are both being liquidated. The cars are air conditioned.

#### ACKNOWLEDGEMENT

*Railway Age*

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.6

041616

#### A REVIEW OF THERMAL DAMAGE IN RAILROAD WHEELS

Berg, NA Kucera, WJ

Griffin Wheel Company, 445 North Sacramento Boulevard, Chicago, Illinois, 60612

Sept. 1970, 18 pp, 16 Fig, 9 Ref

This report was presented at the Air Brake Association Annual Meeting, Chicago, Illinois, September 15, 1970.

The purpose of this paper is to provide a common starting point for further discussions on the subject of thermal damage in railroad wheels. The intent is to construct a simple explanation of a complex subject. Wheel design would be fairly straightforward if the wheel functioned only as a load bearing member, or only as an outlet for heat from braking. Because it serves both purposes, design problems compound. Balanced braking among all cars in the train is critical. A locomotive dynamic brake offers a huge outlet for braking heat. The paper discusses the contributions of better wheels, properly aligned brake rigging, and better brake shoes.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Griffin Wheel Company, 445 North Sacramento Boulevard, Chicago, Illinois, 60612, Repr PC: Req P

041618

#### TREAD BRAKING VERSUS THE WHEEL

Berg, NA Alber, RH

Griffin Wheel Company, 445 North Sacramento Boulevard, Chicago, Illinois, 60612

1972, 20 pp, 11 Fig, 3 Tab, 8 Ref

This report was presented at the Air Brake Association Annual Meeting, Chicago, Illinois, September 18, 1972.

Many railroads, when initiating 100-ton car unit train operation, have experienced wheel problems. The bulk of these problems have centered around the tread of the wheel, and have taken the form of what has been described over the years as 'shelling'. The purpose of this paper is to determine if there are any links between 'shelling' and tread braking. While it has been shown that the detrimental effect can be catastrophic, the converse has also been shown that identical cars operate with no problems. The report makes several recommendations, including: (1) Through strong operating rules, use of locomotive dynamic brakes should be required to control or decrease the speed of the train. (2) Empty-load brake equipment should be used on the cars.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Griffin Wheel Company, 445 North Sacramento Boulevard, Chicago, Illinois, 60612, Repr PC: Req P

041632

**DESIGN PRINCIPLES FOR CONSTRUCTION OF HIGH-SPEED MOTOR TRAIN UNITS AND EXPERIENCES WITH MAINTENANCE**

Sato, T Kubo, S Ogura, Y

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse 145, Munich 80, West Germany)

Vol. 43, No. 5, May 1972, pp 116-118

Based on the test results of 1962 obtained with six prototype coaches for the New Tokaido Line (NTL), in Japan, a design for a standard motor coach was started and further improved in 1964 after the opening of the NTL for the purpose of reducing maintenance cost and improving the operational efficiency. Two permanently coupled motor coaches with all axles driven constitute a single unit from the viewpoint of operating and electrical function; the electrical equipment is arranged so that an equal weight distribution is achieved as far as possible. For traction motors undulating current motors are in use with amplitude control and silicon rectifier bridges. The extremely low rate of disturbances of motor coaches in operation is the result of a mature and tested design and particularly of the maintenance system of the NTL; since 1967 only 0.03 train delays (more than 10 minutes late) per one million traction km were registered.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 068331

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

041633

**GM/RAILROAD GOAL: SAFE, FAST TRANSPORT FOR NEW AUTOS**

Bartley, RD

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 172, No. 12, June 1972, 4 pp

The concept of Stac-Pak described is part of an experimental program and features four containers riding aboard a flat car, each one carrying full-size automobiles stacked three high.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 072057

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

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041638

**INCREASING THE LOAD-CARRYING CAPACITY OF PLAIN BEARINGS**

Al'shits, IYa

Russian Engineering Journal (Engineering Research Association, Melton Mowbray, Leicestershire, England)

Vol. 51, No. 6, Jan. 1971, pp 17-19

The possibility is considered of increasing the load-carrying capacity of plain bearings by deformation under working load. Bending of the bearing liner, resulting from a carefully designed undercutting between the load-carrying surface of the housing and the outer surface of the liner, can increase the extent of the load-bearing oil-film of plain bearings with a large relative clearance to values that correspond to plain bearings with small relative clearance.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 066441

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

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041639

**SUMITOMO FREIGHT CAR TRUCKS AND MANUFACTURING EQUIPMENT**

Hori, K Harada, A Yoshi, S Miyamoto, H

Sumitomo Search (Sumitomo Electric Industries Limited, Osaka, Japan)

No. 7, May 1972, pp 58-77

Paper reports on Sumitomo freight car trucks and mentions the outline of their features, components, inspections and manufacturing equipment.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 066680

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

041642

**BEHAVIOUR OF BOGGIES ON CURVES**

Scales, BT

Railway Engineering Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1, England)

Vol. 1, No. 4, July 1972, pp 19-24

Research study was conducted to reduce derailments and excessive rail wear on curves. The research work described was concerned with the conventional three piece freight car truck, which consists of a pair of side frames and a bolster and side frames. The results can be applied equally well to the primary suspension truck, where the frame is in one piece and H-shaped, with suspension by springs between the frame and the bearings on the ends of the axles. The advantages of a radial truck are given and a prototype truck is described.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 066675

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041669

**HYDRAULIC DRAFT GEAR FOR LOCOMOTIVES**

Hawthorne, VT, Keystone Railway Equipment Company

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

71-WA/RT-1, 1971

This paper was presented at the ASME Winter Annual Meeting, November 28-December 2, 1971. The notification of this paper appeared in Mechanical Engineering.

During the past two decades the weight of road locomotives has more than doubled, but the draft gears have not advanced at the same rate. The author, in order to offer improved impact cushioning characteristics, proposes a hydraulic draft gear and gives a mathematical model to illustrate the improved cushioning behavior. A system of valves provides train handling characteristics. An alignment coupler and plunger arrangement provide lateral force reduction during locomotive braking.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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**041674**  
**TRUCK BOLSTER DYNAMIC LOADING MEASURED**  
**UNDER HARMONIC ROLL CONDITIONS**

Monselle, D, Association of American Railroads

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

71-WA/RT-6, 1971

This paper was presented at the ASME Winter Annual Meeting,  
 November 28-December 2, 1971. The notification of this paper  
 appeared in Mechanical Engineering.

In service, two general types of fatigue loading conditions are imposed on railroad freight-car truck bolsters. Both types of loading involve a relative rolling or rocking motion between truck and car body bolsters but differ in amplitude and frequency of the motion. One condition, the lateral harmonic roll motion action possible with large and high center of gravity freight cars, is associated with low train operating speeds and operation on track of periodic low joint conditions. This paper illustrates the truck-bolster dynamic loadings measured under the extreme harmonic roll condition on a specially prepared test track and describes the methods of instrumentation developed to measure such loadings.

**ACKNOWLEDGEMENT**  
 Mechanical Engineering

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
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**041675**  
**PROGRESS IN RAILWAY MECHANICAL ENGINEERING:**  
**1970-1971 REPORT OF SURVEY COMMITTEE--CARS AND**  
**EQUIPMENT**

Manos, WP, Pullman-Standard  
 Marshall, MG, Pullman-Standard

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

71-WA/RT-7, 1971

This paper was presented at the ASME Winter Annual Meeting,  
 November 28-December 2, 1971. The notification of this paper  
 appeared in Mechanical Engineering.

This portion of the annual report by the ASME Survey Committee reviews the considerable emphasis, during the past year, on improving TOFC-COFC equipment. Vulnerability of cargo on the auto carrier has motivated many new ideas to provide needed protection. Improvements in trailer chassis and bodies make them better suited for TOFC usage. Versatile trailer chassis for use with removable containers have become available; also, many new uses (commodities) for containers and new container designs are coming to the forefront. Endeavors involving passenger cars and facilities, intercity passenger systems, and commuter-transit cars include the development of an ultra high speed passenger train, which is progressing with federal assistance although it probably will be several years before something faster and better is running than the old "Twilight Limited" between Detroit and Chicago. Suburban transit car systems are being built and put into service at a fairly fast rate, and therein lies America's greatest need in relieving the morning and evening traffic congestion at the inner-city focal point.

**ACKNOWLEDGEMENT**  
 Mechanical Engineering

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**041678**  
**VERT-A-PAC AUTO-CARRYING CAR**

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

71-WA/RT-7, 1971

This paper was presented at the ASME Winter Annual Meeting,  
 November 28-December 2, 1971. The notification of this paper  
 appeared in Mechanical Engineering.

A very exciting new type of freight car has entered the fleet of automobile-carrying cars. A giant-sized freight car called Vert-A-Pac stretches up 18 ft, 4 in. off the rail. A joint development of Southern Pacific and General Motors, the towering car is designed and equipped for hauling the tiny Vega 2300s, Chevrolet's entry in the new U.S. subcompact automobile field.

**ACKNOWLEDGEMENT**  
 Mechanical Engineering

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**041679**  
**ILLINOIS CENTRAL DOUBLE-DECK COMMUTER CAR**

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

71-WA/RT-7, 1971

This paper was presented at the ASME Winter Annual Meeting,  
 November 28-December 2, 1971. The notification of this paper  
 appeared in Mechanical Engineering.

The 85-ft cars are climate-controlled. Plastics, aluminum, and stainless steel are used extensively on the interiors not only for esthetic purposes, but also to hold maintenance costs in line. The cars have a seating capacity of 156.

**ACKNOWLEDGEMENT**  
 Mechanical Engineering

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**041770**  
**TRANSPORTATION OF LIQUEFIED NATURAL GAS BY**  
**RAIL AND BY HIGHWAY 212 TRANSPORT DE**  
**GAZ NATURAL LIQUEFIE PAR RAIL ET PAR ROUTE**

Stahl, G

Gaz D'Aujourd'hui (Industries du Gaz, 120 F. 62 rue de  
 Courcelles, Paris (8e), France)

Vol. 92, No. 9, Sept. 1968, pp 319-324

This article was also published by Erdoel-Erdgas- Zeitschrift,  
 V83, N12, pp 430-435 in Dec. 1967 issue.

The design and fabrication of two transport vehicles for liquefied natural gas is described. One is a railroad tank car and the other is a highway tractor-trailer. In addition to an introductory history and some administrative detail, the design limitations, safety regulations, material specifications, and similar design considerations are discussed. Both carriers utilize an inner tank of 5% nickel austenitic stainless steel which is designed for 95% liquid content and 5% ullage. The outer tank is common boiler plate. The annular space (220-250-mm thick) contains insulation, perlite for the trailer and hostafon for the railroad car. The inner tank is attached to the outer longitudinally by tension-compression tie-rods with ball-and-socket joints at both ends. It is supported transversely by a bottom rail and lateral elastic pads. This complex support system is designed to minimize thermal stresses in and loading thermal shock to the internal tank.

**ACKNOWLEDGEMENT**  
 Air Pollution Technical Information Center, 19887

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Industries du Gaz, 120 F. 62 rue de Courcelles, Paris (8e),  
France, Repr PC: Req Price

**041873**

**STANDARD LIGHT RAIL VEHICLE SPECIFICATION.  
CONTRACT SECTION**

Massachusetts Bay Transportation Authority, Boston,  
Massachusetts UMTA-MA-06-0015

Final Rpt, Oct. 1972, 86p

Prepared in cooperation with San Francisco Municipal Railway  
Improvement Corp., Calif. See also PB-212 688.

The specification describes a standard United States Light Rail Vehicle. Performance parameters and design characteristics contained in this specification were developed in cooperation with mass transit operators, consulting engineers, and the Urban Mass Transportation Administration. The overall specification is divided in two sections which detail contractual procedures and technical specifications for the manufacture of the light rail vehicle. The report, the contract section, contains information for bidders and other relevant documentation.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212687

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-212687

**041875**

**STANDARD LIGHT RAIL VEHICLE SPECIFICATION.  
TECHNICAL SECTION**

Massachusetts Bay Transportation Authority, Boston,  
Massachusetts UMTA-MA-06-0015

Final Rpt, Oct. 1972, 286p

Prepared in cooperation with San Francisco Municipal Railway  
Improvement Corp., Calif. See also PB-212 687.

The specification describes a standard United States Light Rail Vehicle. Performance parameters and design characteristics contained in this specification were developed in cooperation with mass transit operators, consulting engineers, and the Urban Mass Transportation Administration. The overall specification is divided in two sections which detail contractual procedures and technical specifications for the manufacture of the light rail vehicle. The report, the technical section, contains comprehensive design specifications for all vehicle components.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212688

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-212688

**041998**

**APT-E TAKES TO THE RAILS**

Wickens, AH

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 5, May 1972, pp 185-188

Features of the British Railways experimental Advanced Passenger Train that is reported to offer the prospect of 250 km/hr on existing tracks and possibly 400 km/hr on new lines, and greatly extending the range of conventional steel-rail track, by virtue of a suspension which combines a high critical speed and passage through curves without flange contact.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 064354

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

**043022**

**BR COMPLETES PROTOTYPE HIGH-DENSITY TRAIN**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 9, Sept. 1971, pp 353-356

After three years of development, the first train of high-density electric multiple-unit stock was allocated to the Southern Region for service trials on its complex 750 v dc inner-suburban network. The cars will eventually replace the 4-Sub units. Electric braking, sliding doors and types of trucks are features. Traction and braking forces are transmitted between truck and vehicle body, by a floating link system and king-pin, all flexible connections have bonded rubber bushes.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 28663

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

**043507**

**NEW CAR CUTS COSTS FOR SHIPPERS AND  
RAILROADS**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 172, N6, Mar. 1972, 2 pp, 2 Phot

The new freight car designed by C&O/B&O is designed to win more tinplate and aluminum sheet traffic. This traffic had been shifting to the highway mode because shippers felt that rail shipment involved too much damage and too high load preparation costs. The doors for the Canstock Car are considerably off center and provide a twelve and one half foot opening to facilitate loading. There are four heavy duty movable bulkheads. A translucent fibreglass roof panel permits light to enter the car, and a stripe painted down the center of the floor guides fork lift truck operators in loading the car. Side posts are used to vent the car to avoid moisture buildup. The 50 foot car is adequate for the high density metal coils and avoids the wasted length that would exist with a longer car.

**ACKNOWLEDGEMENT**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: \$0.6

**043517**

**EFFECT OF COUPLING DEVICES ON LATERAL  
VIBRATION OF 951**

Miyoshi, K

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

Vol. 13, No. 4, Dec. 1972, pp 222-225, 6 Fig.

The experiment investigation of the effect of coupling devices on the characteristics of lateral vibration of 951-type test electric car is described. The dominant component of lateral body vibration is forced body hunting with both modes of rolling and yawing with a wave length of 40-50m. The lateral relative motion around the position of action of coupling devices decreases markedly and the restricting force is preferably enlarged in the range of value tested. (Author)

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
Repr PC: Req Price

**043518****DESIGN OF WHEEL TREAD FOR TWO-AXLE RAILWAY VEHICLE**

Yokose, K

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

Vol. 13, No. 2, Dec. 1972, pp 262, 9 Fig, 1 Tab

In a railway vehicle having flexible supporting stiffness like a two-axle car with double link suspension, it is extremely important to prevent the body hunting occurred at a comparatively low running speed. As the results of fundamental research, a very effective method was developed for the prevention of body hunting, which method is to use an arcform wheel tread of worn profile and to give an adequate gravitational force between a wheel tread and a rail. By introducing the thought mentioned above, the N-shape tread for the wheel tread conformed the two-axle car having the double link suspension was exploited, the basis of its design was established, the theoretical analysis of hunting was carried out, and further the running test of actual cars was examined. The wheel having the N-shape tread, which is the result of this research, is utilized to all of the two-axle cars having double link suspension in the Japanese National Railways at present. (Author)

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
Repr PC: Req Price

**043523****PLEXIGLAS SAFETY STANDARDS**

Commercial Plastics and Supply Corporation, 630 Broadway,  
New York, New York, 10012

Booklet, 16 pp

The announcement of this publication appeared in Railway Locomotives and Cars, January 1973, Volume 147 Number 1.

Characteristics and properties of Plexiglas with recommendations for safety guards of all kinds as outlined by National Occupational Safety & Health Act are the subject of this 16-page booklet.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Commercial Plastics and Supply Corporation, 630 Broadway,  
New York, New York, 10012, Repr PC: N Charge

**043617****FIFTEEN-O-ONE TO SIXTEEN-THIRTY TECHNICAL AND MANAGERIAL LESSONS FROM ONE EXPERIENCE IN INTRODUCING NEW TECHNOLOGY TO IMPROVE URBAN MASS TRANSPORTATION**

Price, CR Scheele, DS

Social Engineering Technology, Los Angeles, California

Final Rpt, Nov. 1972, 127 pp

Acquiring 130 new, double-desk, self-propelled, electrically operated, numbered commuter cars, 1501 to 1630 is part of a five-year effort to improve service in the suburban lines in the South Chicago area operated by the Illinois Central Railroad. The introduction of the cars and other improvements represent one instance of attempts to upgrade service in an existing system. In the course of this effort, experience has been acquired that can be useful both to systems that are being altered, and to totally new systems yet to be designed and developed. The report deals with lessons learned and the insights or new ideas that emerged which may be useful for: (1) the further development of this particular system; (2) the conception, design, and development of similar systems elsewhere; (3) stimulation of designers and related systems; and (4) the practices of managers and planners responsible for improving urban mass transit services. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213448

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-213448

**043618****CONTRIBUTION TO JUDGING THE RIDING COMFORT OF RAILWAY WAGONS**

Sperling, E

Royal Aircraft Establishment, Farnborough, England

RAE-LIB-TRANS-1630, July 1972

14 pp

Translated into English from Glasers Ann. (West Berlin),  
October 1956, pages 314-317.

Increase in the riding comfort of passenger railway carriages, an improvement in air conditioning and illumination, and reduction in noise and vibration are discussed. Tests in railway car construction have two aims: (1) to determine riding comfort as observed by the passengers, and (2) to advise the constructors on improvements. The subjective estimation of riding noise and vibration is considered. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, N72-3265

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**043654****ELECTRONIC CRASH RECORDER. VOLUME I. DESIGN AND PRELIMINARY DEVELOPMENT**

Conlon, CMJ

Avco Systems Division, Wilmington, Massachusetts

Final Rpt, 7006-7202, Feb. 1972, 164 pp

Contract DOT-FH-11-7603

The requirements for a sensing and recording device for use in passenger vehicles are listed with a discussion of how the requirements are met with a prototype unit which was fabricated and assembled. A complete description of the electronic circuits for conditioning signals from remote transducers is included with a signal processing technique for recording data on a magnetic tape system. Laboratory tests on critical elements of the recording devices are discussed and the results of the tests are noted to show feasibility of the design. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213449

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**043677****CHILD RESTRAINT DEVELOPMENT**

Roberts, VL

Michigan University, Ann Arbor, Highway Safety Research Institute, Ann Arbor, Michigan

UM-HSRI-BI-72-1, Final Rpt, 7106-7208, Sept. 1972, 133 pp

Contract DOT-HS-031-1-180

The report documents the results of the development of child restraint systems. Two child seats were designed and constructed which gave superior impact protection over those which are available commercially. In addition to the development of the child seats, performance standards and a compliance test procedure for the evaluation of child seating systems were developed. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214046

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**044006****'MILLION MILE' FREIGHT CAR SUSPENSION SYSTEM**

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 2, Mar. 1973, 2 pp, 1 Fig, 3 Phot

A freight car suspension system has been introduced by American Steel Foundries. The T-11 system is designed expressly for 100-ton capacity freight cars. It combines an advanced snubbing system to absorb and dissipate energy and a design change such that longer travel load-carrying coil springs can be used. The system is warranted for a million miles or 10 years of life. The T-11 system also includes the Simplex side bearing which uses controlled friction to reduce rock and roll motion at critical speeds and to control the high speed swiveling of the truck. Recent tests indicate that the T-11 reduced the damaging effects of lateral shock to an unloaded freight car by as much as 75 percent at speeds above 50 mph. It also reduces the damaging effects of vertical shock inside of a loaded car by as much as 60 percent. Comparisons are to a conventional truck. Better riding qualities should result in longer life for truck components. The life expectancy is rated at 2.65 times that of a conventional truck.

**ACKNOWLEDGEMENT**

Progressive Railroading

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
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**044009****TANK CAR SAFETY PROJECT...MILEPOST IN RAILROAD RESEARCH**

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 2, Mar. 1973, pp 57-58, 4 Phot

The tank car is a special type of freight car and has a unique character of its own. This unique character relates to what happens when a tank car is damaged or derailed and releases its lading. Much has been learned about tank cars as a result of the Tank Car Safety Research and Test Project. Four results have been achieved: (1) a better understanding of tank car performance, of how to improve tank car safety, (2) a better understanding of the design character of certain components of any freight car that can reduce the severity of damage when a wreck or derailment occurs, (3) various forces in the railroad industry joined ranks and proved that they could get far more done by working in unison than separately, and (4) there is an emerging methodology of railroad research that has been applied more extensively and more intensively to the tank car project than any other heretofore. Significant is the conclusion that "while head punctures can be reduced significantly by a head shield, the E top and bottom shelf coupler is not only more effective, but is significantly more cost-effective." To evaluate the shelf coupler in normal service, 200 car sets are currently being installed by railroads and tank car companies.

**ACKNOWLEDGEMENT**

Progressive Railroading

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**044032****NEXT GENERATION OF BR COACHES EMERGES**

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 4, Apr. 1972, pp 145-149

Soon to appear in the prototype High-Speed Diesel Train, the 200 km/h Mk III standard carriage represents a new starting point for the development of all types of locomotive-hauled passenger stock.

**ACKNOWLEDGEMENT**

British Railways Board

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London SE1 9LU, England, Repr PC: R Price

**044044****CARS FOR LIGHT RAPID TRANSIT**

Yearsley, I

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 10, Oct. 1972, pp 385-387, 5 Phot

Recognising the value of light rapid transit where traffic flows do not demand full-scale metro construction, transport authorities in different parts of the world are planning to order tramcars. Such is the quality of the forty-year old American PCC design that it still forms the basis of cars being built today in several countries, but the author points out that it now has a powerful competitor in the standardised German articulated tramcar.

**ACKNOWLEDGEMENT**

British Railways Board

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**044049**

**SBB TESTS PROTOTYPE TILTING COACHES**

Lock, H

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 11, Nov. 1972, pp 431-433

Four prototypes of Swiss Federal Railways' Series III coaches have been delivered and are now undergoing tests. With body-tilting and air-conditioning, they are designed to meet growing competition from other modes by giving greater comfort at higher speeds over existing lines.

**ACKNOWLEDGEMENT**

British Railways Board

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London SE1 9LU, England, Repr PC: R Price

**044059**

**RAILWAY WHEELSETS FACING HIGHER SPEEDS AND INCREASED LOADINGS**

Rail Engineering International (Shaw Publishing Company Limited, Broadwall House, Broadwell, London SE1, England)

Vol. 2, No. 8, Oct. 1972, pp 360-368

Some 20 papers presented in Paris, July 4 to 7, at the Fourth International Wheelset Congress, by authors from railways and industry located in seven countries including USA and the Far East, consider the wheelset under high-speed operating conditions. Solid-rolled and tyred wheels are evaluated in relation to performance, chemical composition and safety, taking into account economic and production considerations under the overall chairmanship of Monsieur Hutter, SNCF.

**ACKNOWLEDGEMENT**

British Railways Board

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**044067**

**COUPLER IS SUBJECT OF TWO SAFETY PROJECTS**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 147, No. 2, Feb. 1973, pp 18-19, 1 Phot

The freight car coupler's sphere of operation is one of almost constant violence. Couplers must take the brunt of crushing forces. But when something goes wrong, the strong coupler can damage other components. A key safety recommendation is that car couplers should be modified to prevent uncouplings in derailments. Both the Type F coupler, with a top shelf, and the Type E coupler, with top and bottom shelves, have the ability to reduce the probability of vertical separation. For better than two years, the Type F coupler has been required on new tank cars. It is felt the Type E coupler would not only do a better job of preventing punctures of tank cars, but would be more cost effective. Service testing of 200 car sets of the Type E coupler is now in progress. Plans call for an instrumented boxcar to be operated over 25,000 miles by more than eight railroads to produce a fair sampling of the railroad environment.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

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**044194**

**PROPOSED METHOD FOR AERODYNAMIC MATHEMATICAL ANALYSIS—INTERIM REPORT**

Parsons, Brinckerhoff, Quade and Douglas, Inc, 111 John Street,  
New York, New York, 10038 Dc-mtd-7

Oct. 1970

An empirical method is developed for evaluating air flow rates which result from piston action subway trains moving in a single-track tunnel. It is assumed that air behaves as a perfect gas and that air flow is one dimensional, isothermal, unsteady, viscous, and compressible. An initial step in the proposed method is to divide the subway system into a series of finite segments; these include eleven sections of single-track subway running through a tunnel between two subsurface stations. Application of the principle of conservation of mechanical energy to these finite segments results in a set of simultaneous, non-linear, ordinary differential equations which reflect the interdependence of pressure, density, and velocity. The method uses a six step interactive process: (1) assume initial density distribution; (2) solve simultaneous equations for velocity distribution; (3) calculate pressure distribution; (4) compute density distribution; (5) compare computed and original density distribution; (6) if the densities do not match within specified tolerances, reiterate using the computed density distribution. All relevant data and equations are contained and a numerical example assuming incompressible flow is appended.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044265**

**PROGRESS ON THE RAILS**

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

Vol. 95, No. 4, Apr. 1973, pp 26-30

This article is based on the 1971-1972 report of the Survey Committee of the ASME Rail Transportation Division.

Each year ASME's Rail Transportation Division puts together a report on the state of the art of railway engineering in countries all over the world. The art appears to be moving toward speed, style, and function. From the passenger train to the locomotive, speeds are projected beyond the level of 120 to 150 mph. As the saying goes, "speed is of the essence." As shown in this report, it was a banner year for passenger trains. Presented are excerpts from the two-part report.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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American Society of Mechanical Engineers, 345 East 47th Street,  
New York, New York, 10017, Repr Req Price

**044275**

**STANDARDIZED FORMAT FOR RAILROAD ENVIRONMENT WITH APPLICATION TO FATIGUE DESIGN AND TESTING**

Cook, RM, Association of American Railroads

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

Paper 73-RT-2, Apr. 1973, 8 pp

Contributed by the Rail Transportation Division of ASME for presentation at the IEEE-ASME Joint Railroad Conference, St. Louis, Mo., April 11-12, 1973.

This paper outlines a format for recording railroad environmental spectrum data that utilizes the standard arrangement of the modified Goodman diagram. In this form the environmental data is applicable to theoretical finite life fatigue design and to variable-cycle spectrum-type fatigue testing. Maximum loadings for operational guidance, equivalent static design analysis, lading damage studies, and proof testing are also accurately portrayed. The extensive environmental data requirements for modern design dictate the need for standardization of data format and content to provide compatibility of data from various sources and facilitate formation of the national data bank required by the railroad industry.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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**044276**

#### LIMITING PERFORMANCE OF SHOCK ABSORBERS IN FREIGHT CARS

Pilkey, W  
Wang, BP, Virginia University

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

Paper 73-RT-3, Jan. 1973, 4 pp, 5 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the IEEE-ASME Joint Railroad Conference, St. Louis, Mo., April 11-12, 1973.

The problem of determining the limiting performance of a freight car shock absorber (cushion) in protecting ladings under crash conditions is considered. This work differs from the usual approach in that rather than analyzing (optimizing) a specific absorber configuration, e.g., prescribed set of springs and dashpots, the absolute optimum absorber behavior is computed regardless of configuration. For the problem treated in detail here, performance is measured in terms of peak force transmitted to the lading for a specified bound on cushion travel distance. The limiting performance problem is formulated as a linear programming problem. Numerical examples are included.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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**044280**

#### THE EFFECT OF WHEEL DIAMETER ON TREAD TEMPERATURE IN GRADE OPERATION

Cabble, GM, Westinghouse Air Brake Company

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

Paper 72-WA/RT-10, Nov. 1972, 8 pp, 14 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

It has long been thought that as wheel diameters decreased, tread temperatures increased during similar grade braking conditions. The author gives data to prove this is true and to show how much. Curves are also presented to allow prediction of temperatures for

wheel sizes not tested.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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**044282**

#### ASYMMETRICAL WHEEL STRESSES CAUSED BY SIMULATED THERMAL AND MECHANICAL SERVICE LOADS

Novak, GE, Del Engineering, Incorporated  
Eck, BJ, Griffin Wheel Company

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

Paper 72-WA/RT-13, Nov. 1972, 13 pp, 16 Fig, 6 Ref

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

The computer simulation of a 36-in. railcar wheel under an actual drag braking service condition is described. Temperatures and associated stresses generated under these conditions are presented for a worn wheel profile with rim dimensions approaching those designated as the minimum acceptable for interchange service in the United States. An analytical method was used to develop the solution for the stress fields in a wheel under asymmetrical lateral rail loads and brake shoe contact forces. The octahedral shear stress concept was employed as the mechanism to locate the critical stress magnitudes throughout the wheel structure due to both thermal and mechanical loadings. The concept of captive plastic cycling or thermal ratcheting, coupled with mechanical fatigue, was introduced as a method of assessing the degree of cumulative damage that occurs in a wheel structure under simulated operating conditions.

#### ACKNOWLEDGEMENT

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**044283**

#### NEW FREIGHT CAR DOOR DESIGN

Ross, ID, Jr, Youngstown Steel Door Company

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

Paper 73-RT-5, Apr. 1973, 8 pp, 11 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the IEEE-ASME Joint Railroad Conference, St. Louis, Mo., April 11-12, 1973.

Freight car doors have been of two different types, namely sliding or corrugated doors and plug doors. The sliding or corrugated door is characterized by its longitudinal movement along a car side to register with a door opening. The plug type door, in addition to movement parallel to a railroad car side, also moves laterally into a door opening. A new car door design is now available that has characteristics of both cars. The front or leading edge of the door "slides" into the door opening while the rear or trailing edge moves laterally into the opening.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044286

**NEW ELECTRIC MULTIPLE UNIT RAILWAY CARS FOR NEW HAVEN WEST COMMUTER SERVICE**

Klauder, LT, Klauder (Louis T) and Associates

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

Paper 72-WA/RT-7, Nov. 1972, 8 pp, 1 Fig, 1 Tab

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

This paper gives a description of the technical details of the 144 electric multiple-unit cars being built by the General Electric Company for the Metropolitan Transportation Authority of New York and the Connecticut Department of Transportation for use by Penn Central in the New Haven West End Commuter service.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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044289

**EXTRA HEAVY-DUTY WHEEL LOAD TESTS ON ALL-STEEL NAILABLE FREIGHT CAR FLOORING**Lautensleger, RW, Amco Steel Corporation  
Larsen, GD, Southern Railway

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

Paper 72-WA/RT-3, Nov. 1972, 12 pp, 13 Fig, 2 Tab, 12 Ref

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

Demand for heavier freight car payloads has created a need for extra heavy-duty service cars with a 70,000-lb lift truck axle load floor capacity. Lack of design criteria for this load capacity and for the dynamic effect of rolling wheel loads in general prompted a static and dynamic test program on five all-steel flooring designs. Performance was generally adequate at a 50,000-lb axle load but inadequate at a 70,000-lb load. Rolling loads were significantly more punishing than static loads; as a result, a recommendation to include provisions for dynamic loading in floor design specifications is made. The shakedown concept is proposed as a basis for establishing a floor service criterion.

**ACKNOWLEDGEMENT**

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044291

**PROGRESS IN RAILWAY MECHANICAL ENGINEERING (1971-1972 REPORT OF SURVEY COMMITTEE) CARS AND EQUIPMENT**

Manos, WP, Pullman-Standard

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

Paper 72-WA/RT-12, Nov. 1972, 11 pp, 29 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

This report covers some of the major developments in freight, passenger, and transit equipment. The past year has seen considerable activity in personalized people movers as well as transit equipment. Most of these developments are the result of the Department of Transportation's funded programs reaching fruition. Advances in the freight equipment seemed to be directed toward the bulk commodities. As the demand for power continues to increase the need for larger and faster unloading cars to haul coal as well as other integral train cars were developed. Containerization of freight handling is continuing to gain momentum.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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044316

**METROLINER DYNAMIC BEHAVIOR INVESTIGATION**

May, JT, ENSCO, Incorporated

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

Paper C73928-9-IA, Feb. 1973, 6 pp, 8 Fig

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

The Metroliner Cars used in regular rail passenger service on the Northeast Corridor are the subject of a program sponsored by the Federal Railroad Administration, U.S. Department of Transportation, to improve the ride quality performance of the cars. The technique of mathematical modeling of the car was utilized in this program to predict and postulate methods of obtaining improved performance. The model was generated, verified, and then various parameters were altered to obtain optimum vehicle response. The altered parameters were then used to specify various car component modifications and to generate a specification for a completely new truck.

**ACKNOWLEDGEMENT**

Institute of Electrical and Electronics Engineers

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044525

**PULSE EXCITATION OF RAILWAY WHEELS**

Bray, DE

Houston University, Mechanical Engineering Department, Houston, Texas, 77004

M-2165, MA Thesis, Aug. 1969, 111 pp, 37 Ref

A review is given of current applications of acoustic principles to testing and performance evaluation of railroad equipment. Also, a brief review is given of previous knowledge of the propagation of dispersive pulses in wave-guides. Pulses of a single frequency are produced at a point on the outer circumferential surface of each test piece and are received at other points along its periphery. Records of pulse arrivals are made by photographing the oscilloscope trace with a Polaroid camera. Experimental results show that pulses originating from a small source on the rim of the model railway wheel propagate directly through the wheel and also through the interior and on the surface of the rim. The behavior of these pulses is shown to be in accordance with the predicted propagation of Lamb waves in the plate region of the wheel and the predicted propagation of Morse waves in the rim of the wheel.



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044526

**ULTRASONIC FLAW DETECTION IN MODEL RAILWAY  
WHEELS**

Bray, DE    Dalvi, NG    Finch, RD

Ultrasonics (IPC Science and Technology Press Limited, 32 High  
Street, Guildford, Surrey, England)

Vol. 11, No. 2, Mar. 1973, pp 1-7, 10 Fig, 1 Tab, 16 Ref

This paper describes feasibility studies for ultrasonic inspection of railroad wheel treads and plates. Ultrasonic techniques had an early application in the railroad industry for locating cracks in steam locomotive driving axles and crank pins. Wet and dry magnetic particle inspection is also widely used in the industry as is the liquid penetrant method. Acoustic techniques, however, appear to offer potentially greater convenience than these methods when it comes to wheel inspection.

**ACKNOWLEDGEMENT**  
Ultrasonics

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014609

**PREVENTION OF EXPLOSIONS IN DIESEL CRANKCASES  
212 PREDOTVRASHCHENIYE VZRYVOV V KARTERAKH  
DIZELEY**

Krylov, YI

Transport (Moscow,USSR)

Russian, 1968, 71pp

This book is intended to be used by a wide circle of diesel operators and diesel designers to aid them in decreasing accidents. The author analyzes several problems of explosions in diesel crankcases and how to prevent them. He states that explosions occur not only in diesel engines on ships, but in any type of diesel engine, and that they are a result of physicochemical processes. The explosion of oil vapor in diesel engine crankcases is one of the most complicated as well as one of the most neglected problems. Contents: 1. Causes and probability of explosions in diesel crankcases. 2. Requirement of company classification for engines designed with the objective of preventing explosions or decreasing their aftereffect. 3. Means of localizing or preventing explosions and an appraisal of their effectiveness.

**ACKNOWLEDGEMENT**

Joint Publications Research Service

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20540, Repr PC: Req. Price

024931

**THE SOUND ENVIRONMENT IN LOCOMOTIVE CABS**

Aurelius, JP

Systems Consultants, Incorporated, New York, New York

July 1971, 33pp

Measurements of the sound environment in locomotive cabs including audible warnings perceived by crew members are described. Data was collected during two different test runs under diverse conditions, one on the Long Island R.R. and the other on the St. Louis-San Francisco Railway. The crew's working environment was found to approach the exposure limits set in the Walsh-Healey Public Contract Service Act. Tape recordings from each run indicate the following elements as significant: engine noise, horn sounds and air brake application noise. Data indicate sound level readings taken under various operating conditions in the cab. The study does not include a definition of legal exposure from observed data. The study suggests that because measurements of noise level in a typical locomotive cab approach the limits allowed in the Walsh-Healey Act, a more detailed survey would be desirable to determine whether exposure do exceed legal limits, and if so under what conditions. Forms of frequency analysis used in the study are also explained. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202669

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034675

**STUDY OF GAS TURBINE ADVANCES AND POSSIBLE  
MARINE APPLICATIONS**

Brady, CO

Massachusetts Institute of Technology, Department of Ocean  
Engineering, Cambridge, Massachusetts, 02139

June 1971

The present status of marine gas turbine propulsion systems is reviewed with special emphasis on certain areas such as method of thrust reversal, environmental problems, fuel requirements and cost considerations. The future of marine gas turbine propulsion is considered by looking at the following: 1) Expected development of marine gas turbine engines. 2) Thrust reversal methods. 3) Suitability of gas turbine propulsion for different ship types. This is carried out by an extensive literature survey and personal interviews and/or correspondence with authorities in the gas turbine and marine engineering field. Among the conclusions reached concerning the future of marine gas turbine propulsion are the following: 1) Most non-nuclear warships built in the future are expected to be propelled entirely by aero-derivative gas turbines. 2) A significant increase in the use of gas turbines for merchant ship propulsion utilizing both aeroderivative simple cycle and heavy duty regenerative engines is expected. 3) Primary method of obtaining thrust reversal with gas turbine propulsion is expected to continue to be through use of controllable, reversible pitch propellers. CRP propellers up to 40 to 50,000 HP per shaft for destroyer type ships and to over 60,000 HP per shaft for larger vessels are expected to be available in the next few years. 4) Marine gas turbine propulsion plant thermal efficiencies are expected to reach approximately these levels in the next decade: Aero-derivative simple cycle gas turbine 38%; Heavy duty regenerative gas turbine 41%; Combined gas turbine and vapor engine 49%. Specific powers will also increase significantly.

**ACKNOWLEDGEMENT**

Massachusetts Institute of Technology

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Engineering, Cambridge, Massachusetts 02139, Repr PC: Req  
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034754

**OPERATIONAL EXPERIENCE WITH MEDIUM SPEED  
DIESEL ENGINES**

Short, KI, Cunard Limited

Institute of Marine Engineers-Transactions (Institute of Marine  
Engineers, Memorial Building, 76 Mark Lane, London EC3R  
7JN, England)

Vol. 84, No. 2, 1972, pp 37-50

The philosophy leading to the adoption of geared medium speed Diesel engines in a cargo liner and a products carrier is described and results obtained in service are presented and discussed against this background. The importance of considering a wide range of factors in addition to purely technical considerations in selecting and judging the performance of equipment is emphasized. Details of noise trail results, piston, piston ring and liner wear, usage rates of water cooled and rotocap exhaust valves are presented. Service experience with critical items of the installation including reduction gearbox and exhaust gas blowers is also included. Comments are made on the vitally important role of all ship's personnel in exploiting innovations.

**ACKNOWLEDGEMENT**

United States Merchant Marine Academy, N-414

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London EC3R 7JN, England, Repr Req Price

035058

**THE TREATMENT OF MARINE HEAVY FUELS FOR GAS  
TURBINE COMBUSTION**

Cullen, PJ

Urbas, TA, General Electric Company

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

Vol. 94, No. 7, 72-GT-97, July 1972

Price is \$1.00 for members

The resurgence of interest in the heavy duty gas turbine for marine use is due in a large part to its ability to burn residual and crude fuels. Generalities involving fuel treatment requirements have been bandied about for years and often the wrong information is used by unknowledgeable individuals when making quotations or bid evaluations. The purpose of this paper is to present firm information on the treatment of marine fuels for heavy duty gas turbines.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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American Society of Mechanical Engineers, 345 East 47th Street,  
New York, New York, 10017, Repr \$3.00

#### 035064

#### PISTONS FOR HIGH OUTPUT DIESEL ENGINES

Mahle, KG

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

Vol. 94, No. 7, 72-DGP-11, July 1972

Price is \$1.00 for members

Along with the increase in specific output of internal combustion engines the thermal and mechanical loadings on the pistons have grown continually. This paper deals with modern piston designs used on diesel engines for commercial vehicles, railway traction and marine propulsion. A survey on the comprehensive research and development work on pistons and explanations are given by means of practical examples how part of piston trials can be carried out in the laboratory.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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American Society of Mechanical Engineers, 345 East 47th Street,  
New York, New York, 10017, Repr \$3.00

#### 035065

#### DIESEL AND GAS ENGINE POWER COSTS AND TRENDS

Holmes, VH

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

Vol. 94, No. 7, 72-DGP-13, July 1972

Price is \$1.00 for members.

Under the sponsorship of both the Diesel and Gas Power Division of ASME and the Diesel Engine Manufacturers Association, the author has collected 1968, 1969 and 1970 data for the 1971 and 1972 Reports. The procedure of collecting and preparation of data for the report is explained. The reasons for the trends in power costs, downward in many instances, are enumerated with respect to load growth and progressive development of internal combustion engines.

#### ACKNOWLEDGEMENT

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New York, New York, 10017, Repr \$3.00

#### 035196

#### THE FATIGUE STRENGTH OF LARGE CAST STEEL CRANK THROWS FOR MARINE DIESEL ENGINES

Nishihara, M, Kobe Steel, Limited

Kono, M, Kobe Steel, Limited

Makioka, M, Kobe Steel, Limited

Selected Papers, J of Soc of Naval Arch of Japan (Society of Naval Architects of Japan, #35 Shiba-Kotohiracho, Minato-ku, Tokyo, Japan)

Vol. 6, 1970, pp 141-158

A study has been made of the influence of minor casting defects on the fatigue properties of cast steel throws for large crankshafts. The rotating-beam fatigue strength of unnotched and notched specimens of 60 to 100 mm diameter were investigated using a 5,500 kg.M rotary bending fatigue testing machine. The test specimens are cut out from the pin, in the direction parallel with the pin centreline, from two crank throws of more than 650 mm pin diameter. The cast steel crank throws are made from vacuum degassed steel and heat treated to the strength level of 50 kg/sq.mm by double normalizing and tempering. It was found that the rotary bending fatigue strength varied between plus and minus 16kg/sq.mm and plus and minus 13kg/sq.mm according to the number and distribution of pinholes, and shrinkage porosities on the surface of the machined test specimens. The former figure applies to a casting having defects less than 1 mm deep and less than 2 mm diameter, as revealed by the liquid penetration test, the latter figure applies to the largest defect, 3 mm deep, revealed by visual test. The corresponding figure for a sound casting was found to be plus and minus 17kg/sq.mm to plus and minus 18kg/sq.mm, using test specimens taken from keel blocks cast from the same melt and having surface defects of less than 1 mm, as indicated by the liquid penetration test. The foregoing figures have been used for comparison with those of estimated values of working stress in the fillet area of crank pin and web.

#### ACKNOWLEDGEMENT

Society of Naval Architects of Japan

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Society of Naval Architects of Japan, #35 Shiba-Kotohiracho,  
Minato-ku, Tokyo, Japan, Repr PC: Price

#### 035197

#### ON CRANKSHAFT FILLET STRESSES OF MARINE DIESEL ENGINES

Arai, J, Nippon Kaiji Kyokai

Selected Papers, J of Soc of Naval Arch of Japan (Society of Naval Architects of Japan, #35 Shiba-Kotohiracho, Minato-ku, Tokyo, Japan)

Vol. 6, 1970, pp 159-178

The author describes how the crankshaft fillet stresses are measured using FM radio link strain telemeter. The results of the measurements are summarized as follow; 1) When the additional stress by resonance is smaller, there is good agreement between the measured fillet stresses and calculated ones which are computed considering the resilience of main bearings. 2) The alternating bending stresses were found on fillet at the resonance of torsional vibration. 3) On large two stroke cycle engine crankshaft alternating bending stresses were found at the resonance of axial vibration. And the mode curve estimated from the measured stress differ from the one calculated theoretically. 4) Axial vibration damper is effective to reduce the bending stress induced by axial vibration, but ineffective by torsional vibration.

#### ACKNOWLEDGEMENT

Society of Naval Architects of Japan

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Minato-ku, Tokyo, Japan, Repr PC: Price

037162

**THYRISTOR (SCR) CHOPPER CONTROL SYSTEM FOR TRANSPORTATION EQUIPMENT**Zeccola, RA, General Electric Company  
Weiser, EF

IEEE Transactions on Industry &amp; Genrl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. IGA5, No. 4, Paper TP-12-IGA, July 1969, pp 470-5

Circuit design. Series field d-c traction motor control, providing smooth tractive effort control motoring and in dynamic braking of 500 to 1,000 hp (continuously rated) rapid transit car drives, especially in the Chicago Transit Authority System is described. The thyristors are switched by a feedback current control system utilizing a fixed-frequency variable pulse-width technique. Armature series reactors and line filter requirements are minimized by a multistage scheme. Both armature and field currents are modulated for full speed range control. Third rail system extreme voltage transients are accommodated by system features.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 51262

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037173

**THERMAL RELAY FOR OVERLOAD PROTECTION OF OVERHEAD LINES 212 THERMISCHES UEBERLASTSCHUTZRELAIS FUER FAHREITUNGEN**

Seiffert, K Scharf, T

Glaser's Annalen ZEV (Georg Siemens Verlagsbuchhandlung, Luetzowstrasse 6, 1 Berlin 30, West Germany)

Vol. 93, No. 8, Aug. 1969, pp255-9

Overhead line system of German Federal Railways and its thermal behavior are described. The operating principle of the thermal overload relay is outlined. A tripping signal is initiated when the contact wire has reached a certain final temperature. For this purpose, the ambient temperature is measured at the relay location and the temperature rise is simulated on the basis of the respective current loading.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 17532

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037176

**POWERED TIPPER WAGONS FOR IRON ORE TRAINS**

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

Vol. 125, No. 17, Sept. 1969, pp 654-8

Paper describes how by motoring the axles of two cars next to the locomotive, long 6% gradients can be tackled with heavy trains. The solution of problem in East Germany was found by constructing special cars with powered trucks similar to those on the locomotive, which in effect created a 12-axle power unit. This combination could also haul eight cars but in addition the two motored cars were also carrying ore so that the net train load was increased to 750 tons for no increase in gross train weight.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 17975

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037187

**GOVERNOR CONTROL SYSTEM FOR THE TURBO TRAIN**

Long, LO, Woodward Governor Company

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

ASME Paper 70-GT-117, 8 pp

ASME Meeting May 24-28, 1970.

The Turbo train is an exciting venture introduced recently to the rail industry. Due to its unique configuration and unprecedented features, its background is outlined to underscore highlights of this revolutionary innovation to transportation. This is helpful to appreciate why the electric governing control system was devised of this application and why the proportional actuator was chosen. Equal distribution of traction load among the multiturbines at both ends of the train is effected and the switching of the auxiliary electroc power unit at either end is facilitated. After the primary and secondary functions of the control system are outlined, the proportional actuator is then described and analyzed, followed by a detailed description and analysis of the electric governor control system.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 37590

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037202

**GAS TURBINE PROGRESS**

Sawyer, RT, Gas Turbine International

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

Feb. 1972, pp 26-30, 5 Fig, 1 Phot

After twenty years of experience, the definite trend is to use a modified aircraft gas turbine with mechanical drive for railroad power in order to get the desired light weight ratio and to get transmission cost to a minimum. Turbo-train developments in four foreign countries are reviewed, including Germany, which proposes the most powerful and fastest turbo-trains compared to any others. The U.S. and Canada are progressing satisfactorily.

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American Society of Mechanical Engineers, 345 East 47th Street,  
New York, New York, 10017, Repr Req Price

039225

**LIGHT-MODULATED ACCELEROMETER FOR PANTOGRAPH MEASUREMENTS**

Medeck, H Magnus, DE

General Applied Science Laboratories, Incorporated, Westbury, New York

GASL-TR-739, Final Rpt, 6908-7003, Mar. 1970

31 pp

Contract DOT-FR-9-00010

An instrument was developed to measure the accelerations of a pantograph shoe for power collection on railway vehicles. The basic problems of high operating voltages and severe electromagnetic interference are solved using optical methods. The intensity of a light source is modulated in proportion to the acceleration of the shoe. These signals are transmitted through fiber optics. The accelerometer was tested in field service on the DOT test cars. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-193452

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-193452

040616

**DIAGNOSIS OF MOTOR VEHICLE ENGINES USING SPECTRAL ANALYSIS OF SPENT OIL 212 DIAGNOSTIKA AVTOMOBILNYKH DVIOATELE I PRI POMOSCHE SPEKTRALNOGO ANALIZA OTRABOTAVSHEGO MASLA**

Boldin, AP

Army Foreign Science and Technology Center, Charlottesville, Virginia

FSTC-HT-23-899-72, July 1972, 12 pp

Trans. of mono. Nadezhnost i Diagnostika Agregatov i Sistem Avtomobilei (Reliability and Diagnosis of Motor Vehicle Units and Systems), Moscow, n.d. p95-107, by Albert L. Peabody.

The method of spectral analysis of a liquid sample of spent oil using a rotating disk electrode is tested as a means for practical diagnosis of motor vehicle engines. Preliminary results indicate stability of concentration of wear products in spent oil, regardless of the mileage of the vehicles. Hidden defects in engines can be discovered in a timely manner on the basis of sharp increases in the concentration of corresponding elements in spent oil. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, AD-747517

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
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040617

**FUEL CELLS AND PROSPECTS FOR THEIR USE IN RAILROAD TRANSPORTATION**

Anisimov, VM

Army Foreign Science and Technology Center, Charlottesville, Virginia FSTC-T7023012301

FSTC-HT-23-960-72, July 1972, 75 pp

Trans. of mono. Toplivnye Elementy i Perspektivy Primeneniya ikh na Zheleznodorozhnom Transporte, Moscow, 1971, by Marcelle R. Blau.

The principles of the direct conversion of chemical energy into electrical energy are examined. Different types of fuel cells are described and existing power plants and power plants with fuel cells are compared. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, AD-747512

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NTIS, Repr PC: \$5.75, Microfiche: \$0.95  
AD-747512

041122

**HOW TO PREDICT THE TOOTH ROOT STRESS OF A CROWNED GEAR**

Miyanishi, K

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

Vol. 13, No. 2, June 1972, pp 103-107, 8 Fig

Traction gears of railcars and locomotives are affected by alignment error between gear shafts, rigidity of gear case, etc. For this reason, such gears of JNR are relieved and/or crowned at the

tooth face in order to avoid a local high tooth bearing, which leads to a failure. The conventional calculation methods of the crowned gears are tedious and troublesome. A simple method is proposed which utilizes a table of figures, that is good for practical application.

## ACKNOWLEDGEMENT

Railway Technical Research Institute

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Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan, Repr PC: Req Price

041152

**ASSURING SUPPORT BEARINGS PERFORMANCE**

Hanson, MA, Magnus Metal Corporation

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 11, Dec. 1972, 3 pp, 7 Phot

In most cases of motor support bearing failure, the cause can be ascertained by careful inspection of the failed assemblies. An adequate analysis of the failures which do occur is the only effective tool in determining the action required to prevent additional failures. Some of the less obvious causes for bearing failure include electric arcing, gear case rubbing, misalignment, improper gear lubrication and excessive dirt. Wicks should be analyzed for rounded contact and inadequate oil feeding. Other problems include overfilling of gear cases, mounting gaskets, misalignment of boxes and rough thrust faces.

## ACKNOWLEDGEMENT

Railway Locomotives and Cars

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041159

**PROGRAMMER SIMPLIFIES TRANSITION**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 9, Oct. 1972, 4 pp, 2 Fig, 2 Phot

The Union Pacific decided that its voltage/current transition systems have been too unreliable and complex in the past. Therefore the Genisco transition programmer was developed as a module-type transition system. The programmer essentially consists of a solid state electronic unit that mounts in the locomotive's electrical cabinet and an axle-transducer assembly that is mounted on any one of the locomotive's axles. The actual wheel speed of the locomotive is converted to an electrical signal that is amplified and filtered for use in binary circuits. The programmer's binary counter produces a signal for each transition relay that is to be actuated according to speed a special fault detector constantly monitors the performance of the programmer as well as the locomotive. To determine which relays are activated personnel in the locomotive cab can consult indicator lights on the face of the electronic unit housing.

## ACKNOWLEDGEMENT

Railway Locomotives and Cars

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041300

**SOUTHERN PACIFIC MOTIVE POWER ANNUAL 1971**

Strapac, J

Chatam Publishing Company, 1012 Oak Grove Avenue, Burlingame, California, 94101

68 pp, 141 Phot

The announcement for this Annual appeared in Railway Locomotives and Cars, V146, N6, June 1972.

In addition to complete details of SP's current locomotive ownership, the Annual again contains a feature. This year there are 28 pages on General Electric internal-combustion motive power as it was used on the big Western road. SP acquired secondhand the very earliest of GE's gasoline-electric locomotives built in 1913. Since then, almost 300 other diesel-electric units have been acquired from that builder, including a substantial fleet of GE's low-horsepower switchers built in the 1940s and 1950s as well as most models of the U series introduced since 1962. The author observes that "the story of GE locomotives on SP isn't yet complete." Whether or not the proposed electrification finally reaches the hardware stage, there will be more GE units purchased since "it is difficult for even Espee to comparatively evaluate the products of the two domestic builders and determine who is selling the 'best' locomotives.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Chatham Publishing Company, 1012 Oak Grove Avenue,  
Burlingame, California, 94101, Repr PC: \$5.9

041301

#### THE MODERN LOCOMOTIVE HANDBOOK

Railway Fuel and Operating Officers Association, 10414 South Wood Street, Chicago, Illinois, 69643

40 Fig

This handbook was prepared by the Railway Fuel and Operating Officers Association and announced in Railway Locomotives and Cars, V146, N4, April 1972. For copies write care of L.H. Peters, secretary-treasurer.

This textbook-style manual supplements RF&OOA's question-and-answer manual on locomotive operation. There are six easy-to-follow sections in the new publication. The introduction describes how each builder classifies different model locomotives and the terms and devices used by the builders are compared. There is a glossary of terms used in the following sections. All contemporary road freight units produced since 1960 are covered. The first part of each builder's section presents general information (weight, horsepower and tractive effort) along with general arrangements. The second segment describes locomotive cab controls. Section 5 discusses brake equipment. Section 6 is the trouble-shooters guide covering basic malfunctions.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Railway Fuel and Operating Officers Association, 10414 South Wood Street, Chicago, Illinois, 60 Repr PC: \$4.00

041314

#### REBUILDING, NEW UNITS IN 1972 MILWAUKEE PROGRAM

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 7, July 1972, pp 13-16, 1 Tab, 8 Phot

In addition to purchasing 50 new units, the Milwaukee Road is rebuilding 18 units that are over 15 years old. The 1750 hp units are repowered to 2000 hp by the installation of a 645 engine. Improvements include lowering the height of the short end hood, new traction motors, rewiring of the control circuits, and other items.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041315

#### TWO CYCLE DIESEL—THAT IS EMD

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 7, July 1972, 6 pp, 1 Fig, 22 Phot

This article, which marks the 50th anniversary of Electro Motive, presents a technical history of the development of the Two Cycle Diesel Engine as it was developed for railroad service.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041317

#### MILW DELIVERS POWER FOR CANADA'S LRC

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 1, Jan. 1973, 9 pp, 1 Phot

MILW Industries has delivered a single low profile diesel electric locomotive for use with the prototype coach previously built for Canada's Light Rapid Comfortable passenger train project. The active suspension coach has a hydraulic banking system that tilts it as much as 10 degrees on curves. This powered banking is built into the coach trucks to permit speeds 40 percent higher than allowed for regular passenger trains. The LRC is designed to operate with a locomotive at each end. Existing technology is used to the limit. Centrifugal forces are nullified while curves are traversed in the 100 mph speed range. The locomotive have no active suspension, but the center of gravity is kept low by a depressed box underframe. A 12-cylinder model 251 diesel supplies 2900 horsepower. Three phase power supplies all train services. The traction alternator output is rectified for four conventional traction motors. Power for traction at 120 mph is calculated at 2000 horsepower for the five car train. With intercity speeds at an average of over 100 mph, the Montreal-Toronto market could have three and one half hour train schedules.

#### ACKNOWLEDGEMENT

Railway Age

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.6

041630

#### RAILROAD REVIVAL: ON THE RIGHT TRACK

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 9, No. 8, Aug. 1972, pp 63-66, 5 Ref

In keeping with previous Joint ASME/IEEE Railroad Conferences, the transnational character of the 1972 meeting in Jacksonville was retained with the presentation of papers by Candian, Swedish, German, French, and Japanese engineers, suppliers of traction equipment, and representatives of locomotive builders. The emphasis in this year's conference, in contrast with those of 1970 and 1971, was more on the nuts-and-bolts aspects of locomotive traction and system electrification. Thus there was a minimum of dwell time on automatic train operation (ATO) and the highly sophisticated computer-controlled systems presently in use on a number of overseas rail

lines. In fact, two of the conference's sessions were listed under the headings of "adhesion" and "electrification."

ACKNOWLEDGEMENT  
IEEE Spectrum

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Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10 Repr PC: Req Price

041637

**RADIATION CAPACITY OF DIESEL ENGINE COMBUSTION  
FLAME 212 DAS STRAHLUNGSVERMOEGEN DER  
DIESELMOTORISCHEN FLAMME**

Sitkei, G Ramanaiah, GV

Periodica Polytechnica, Mechanical Engineering (Technische  
Universitaet, Budapest, Hungary)

Vol. 16, No. 2, 1972, pp 111-122, 6 Ref

The radiation intensity of the combustion flame was measured in a one-cylinder test diesel engine provided with a quartz window by using an electronic radiation meter. It was found that the radiation constitutes a substantial share of the total heat transmitted to the cooling water. It was also found that the amount of flame radiation is a function of the crank angle and depends to a great extent on the excess air amount in the fuel mixture.

ACKNOWLEDGEMENT  
Engineering Index, EI 72 067864

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041646

**AUTOMATIC CONTROL OF MOTION AND BRAKING OF  
MOTOR VEHICLES AND AUTOMATION OF DRIVING  
PROCESSES IN RAILROADS 212 AUTOMATISCHE  
FAHR-UND BREMSSTEUERUNG DER TRIEBFAHRZEUGE  
UND AUTOMATISIERUNG VON BETRIEBSVORGAENGEN  
IN ZUEGEN**

Lehmann, S

Elektrische Bahnen (Verlag R. Oldenbourg, Kosenheimer Strasse  
145, Munich 80, West Germany)

Vol. 43, No. 2, Feb. 1972, pp 33-38

The functions of automatic control of motion and braking are discussed, such as selection of dominant control criteria, speed control as well as control of traction and of braking force.

ACKNOWLEDGEMENT  
Engineering Index, EI 73 017373

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041649

**THYRISTOR CONTROL OF MULTIPLE UNIT CAR  
EQUIPMENT BY ASEA**

Eriksson, LG, Allmanna Svenska Elektriska Aktiebolaget

IEEE Transactions on Industry & Genrl Applications (Institute of  
Electrical and Electronics Engineers, 345 East 47th Street, New  
York, New York, 10017)

Vol. 1A-8, No. 3, May 1972, pp 329-337

The Swedish State Railways has acquired 90 two-car units intended for the suburban services in Stockholm. The cars have thyristor control equipment and separately excited dc traction motors. The line voltage is 15 kV with 16 2/3 Hz. In this paper the electrical traction equipment of these suburban trains is described. The paper

also deals with the development of thyristor vehicles in Sweden in general, and with tests and experiences for regular service.

ACKNOWLEDGEMENT  
Engineering Index, EI 73 000095

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041650

**PROGRESS IN DESIGN AND OPERATION OF AC  
LOCOMOTIVES AND MULTIPLE-UNIT TRAINS**

Kibblewhite, GG, British Railways Board

Institution of Electrical Engineers, Proceedings (Institution of  
Electrical Engineers, Savoy Place, London WC2R OBL, England)

Vol. 119, No. 4, Apr. 1972, pp 425-430

The results of a further five years' operation of 50 Hz motive power on British Railways are reviewed. Individual classes of locomotive are considered, and details are given of the various items of equipment which have given trouble, and of the consequential modification required. Comparisons are made between the latest class in service and earlier classes. Preliminary details are given of the new class under construction for the extension to Glasgow, and reasons are given for not selecting thyristor control at the moment. The large fleet of multiple-unit trains is reviewed, and various defects and modifications noted.

ACKNOWLEDGEMENT  
Engineering Index, EI 73 015054

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041662

**PROPULSION MOTOR REQUIREMENTS FOR MASS  
TRANSPORTATION**

Priebe, EP, General Electric Company

IEEE Transactions on Industry & Genrl Applications (Institute of  
Electrical and Electronics Engineers, 345 East 47th Street, New  
York, New York, 10017)

Vol. IA-8, No. 3, May 1972, pp 310-315

Mass transportation is being recognized as a critical need in modern society. The application requirements of propulsion motors for rail passenger vehicles can be derived from elementary mechanics of motion. The implications in motor design are discussed in this paper.

ACKNOWLEDGEMENT  
Engineering Index, EI 73 000093

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041663

**ADVANTAGES OF THYRISTOR LOCOMOTIVES AND  
EXPERIENCE IN SWEDEN**

Nordin, TI, Allmanna Svenska Elektriska Aktiebolaget  
Arne Magnusson, LB

IEEE Transactions on Industry & Genrl Applications (Institute of  
Electrical and Electronics Engineers, 345 East 47th Street, New  
York, New York, 10017)

Vol. 1A-8, No. 3, May 1972, pp 316-328

This paper explains the choice of low-frequency ac for electric traction equipment in Sweden and then traces the development of the modern thyristor locomotive. Advantages of this design, and special



measures required to deal with reactive power and harmonic currents, are set forth, as are the operating experience and tests which have been conducted on this new type of locomotive.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 000094

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**041673**

**PROGRESS IN RAILWAY MECHANICAL ENGINEERING:  
1970-1971 REPORT OF SURVEY COMMITTEE-  
LOCOMOTIVES**

Baker, PH, General Electric Company  
Schulze, FW, General Electric Company

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

71-WA/RT-5, 1971

This paper was presented at the ASME Winter Annual Meeting,  
November 28-December 2, 1971. The notification of this paper  
appeared in Mechanical Engineering.

This year's survey reports on ten new locomotive designs but with no major departures from the design trends already established. Another investigation into propulsion with a-c traction motors has resulted in a prototype locomotive for testing in Germany, a joint development of Brown, Boveri and Henschel. The earlier study, with the British Railways locomotive "Hawk," was reviewed in the 1965 survey. The a-c/d-c/a-c transmission has solid-state components for rectifiers, inverters, and control to power three-phase squirrel cage motors. Variable frequency and voltage provide very good tractive characteristics. Benefits of weight and space savings are expected, as are maintenance advantages from elimination of brushes, slip rings, and commutators. The prototype locomotive is a C-C design with pivotless trucks and low level traction links. Also reviewed are continuing studies and tests, in several countries, for both air-suspension and magnetic support of vehicles. Propulsion by linear motor appears to be favored with choice between on-board power or third-rail collection still being decided. The Association of American Railroads annual report on the distribution of motive power on Class I U.S. railroads shows a total decrease of only 14 from 1970, compared to decreases between 100 and 300 per year for the several preceding years. The U.S. gas-turbine fleet has completely disappeared. Electrification is scheduled in Taiwan and Greece, construction is under way in South Korea and Turkey and extension continues to be supported in other European, Asian, and African countries. An 80-mile electric road is to be built in northern Arizona by the Black Mesa and Lake Powell Railroad. Elsewhere in the U.S. and in Canada, electrification of high density main lines continues under study.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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**041676**

**PHILOSOPHY OF LOCOMOTIVE DESIGN**

Dellacanonica, OG, Gibbs and Hill, Incorporated

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

71-WA/RT-8, 1971

This paper was presented at the ASME Winter Annual Meeting,  
November 28-December 2, 1971. The notification of this paper  
appeared in Mechanical Engineering.

In order to meet the needs of today's shippers, American railroads must substantially increase the overall speed of their freight trains. They must think in terms of time, rather than of tons. The much needed speed gains call for—among other measures—considerably higher ratios of locomotive power to train weight than those presently used. Achievement of the required powers, however, is believed to be beyond the capabilities of the diesel locomotive because the dimensions and axle-loads of American diesel locomotives have fully exhausted the possibilities afforded by the permissible envelope. The solution lies in electric traction by a-c locomotives patterned after the highly successful designs (capable of outstanding adhesion performances) developed in Europe through the past 20 years and, most particularly, after the latest achievements of thyristor-controlled locomotives with separately excited d-c traction motors.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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**041680**

**A DIESEL HYDRAULIC LOCOMOTIVE**

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

71-WA/RT-5, 1971

This paper was presented at the ASME Winter Annual Meeting,  
November 28-December 2, 1971. The notification of this paper  
appeared in Mechanical Engineering.

A diesel hydraulic locomotive of 1600 hp for heavy switching, built by MaK in Germany, weighs from 163,000 to 200,000 lb—depending on features—on four axles. It is powered by an eight-cylinder turbocharged 1000-rpm engine with air-to-air charge cooling. The Voith hydraulic transmission has two converters to provide reversing by filling and emptying one converter for each direction of travel.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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**041682**

**MLW WORTHINGTON'S 40,000-HP**

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

71-WA/RT-5, 1971

This paper was presented at the ASME Winter Annual Meeting,  
November 28-December 2, 1971. The notification of this paper  
appeared in Mechanical Engineering.

MLW Worthington's 40,000-hp fast freight locomotive. It is the highest-hp single-engine unit yet to appear in North America. A new feature is the clutch-driven air compressor behind the radiator-fan gear box.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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**041771**

**UPDATE PROPOSED FOR DIESEL FUEL  
SPECIFICATIONS**

SAE Journal of Automotive Engineering (Society of Automotive  
Engineers, 2 Pennsylvania Plaza, New York, New York, 10001)

Vol. 78, No. 11, Nov, 1970, pp 34-40

Modifications to diesel fuel specifications have been proposed to bring the properties of the fuel more in line with the needs of the trucking industry, the railroads, and the farm, tractor, and industrial machinery operators. The present diesel fuel specifications and the revised ones proposed by Gilbert K. Brower of International Harvester are presented tabularly. Gravity distribution characteristics are discussed, as well as the maximum cloud point or freezing point. It is also proposed that a 675 F maximum end point requirement be added to D 975 and the present 90% point maximum be reduced from 640 F to 625 F. The minimum cetane number should be raised to 45, while the copper strip corrosion test temperature should be 212 F, and a maximum carbon residue of 0.15% should be specified. Storage stability, thermal (high temperature) stability, and the low-temperature fluidity test are discussed. An analysis of fuel properties, using an up-to-date version of the fuel property map first described by H. Amberg, Chevron Research Company. This map shows how fuel properties are interrelated. An investigation of smoke suppressant additives shows that, although they reduce the level of smoke emitted, undesirable effects occur in some cases.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 24070

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10001, Repr PC: Req Price

041988

#### PROGRESS IN DESIGN AND OPERATION OF A.C. LOCOMOTIVES AND MULTIPLE-UNIT TRAINS

Kibblewhite, GG, British Railways Board

Institution of Electrical Engineers, Proceedings (Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, England)

Vol. 119, No. 4, Proceeding, Apr. 1972, pp 425-430

The results of a further five years' operation of 50 Hz motive power on British Railways are reviewed. Individual classes of locomotive are considered, and details are given of the various items of equipment which have given trouble, and of the consequential modifications required. Comparisons are made between the latest class in service and earlier classes. Preliminary details are given of the new class under construction for the extension to Glasgow, and reasons are given for not selecting thyristor control at the moment. The large fleet of multiple-unit trains is reviewed, and various defects and modifications noted.

#### ACKNOWLEDGEMENT

Engineering Index, EI 72 63025

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041994

#### CONTRIBUTIONS OF SOME CARBONYL, PHENOL, AND HYDROCARBON COMPONENTS TO DIESEL EXHAUST ODOR

Vogh, JW, Oklahoma University

Bureau of Mines-Report of Investigations (Bureau of Mines, College Park Research Center, College Park, Maryland, 20742)

RI 7632, 1972, 11 pp

The report covers initial findings in an experimental program to identify diesel exhaust odorants and determine their contributions to diesel odor. The approach was to isolate selected component groups from exhaust and to evaluate the contribution of each group to exhaust odor. The evaluated carbonyls, phenols, and hydrocarbons were found to account for about 20 pct of the total odor in exhaust from an indirect-injection engine during idle. For exhaust from the indirect-injection engine at no load, these compounds were found to have no significant levels of odor.

#### ACKNOWLEDGEMENT

Engineering Index, EI 72 061552

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041995

#### NITRIC OXIDE FORMATION AROUND DROPLETS BURNING AT ELEVATED PRESSURES

Altenkirch, RA, California University, Berkeley  
Shahed, SM  
Sawyer, RF

Combustion Science and Technology (Gordon and Breach Science Publishers, 12 Bloomsbury Way, London WC1, England)

Vol. 5, No. 4, June 1972, pp 147-154, 16 Ref

NO formation around single droplets may be an important phenomenon with respect to total NO formation in the diesel engine. A model is presented to predict the NO formed by a fuel droplet burning above the critical pressure of the fuel. The model is applied to the diesel engine in an attempt to predict measured exhaust gas NO concentrations. The results indicated individual droplet burning is important for low fuel/air ratios.

#### ACKNOWLEDGEMENT

Engineering Index, EI 72 061553

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043023

#### SEPARATELY EXCITED DC TRACTION MOTOR APPLIED TO DC AND SINGLE PHASE AC RAPID TRANSIT SYSTEMS AND ELECTRIFIED RAILROADS-1

Van Eck, RA, AiResearch Manufacturing Company

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. IGA7, No. 5, 7109-7110, pp 643-649, 14 Ref

The introduction of power thyristors and rectifiers in dc-dc chopper and ac-dc converter circuits allows the replacement of the traditional dc series motor by the separately excited dc motor. This paper considers the characteristics of separately excited dc motors operating from either a dc input with a dc chopper using dynamic braking, or from a single-phase ac input with an ac-dc converter using regenerative braking.

#### ACKNOWLEDGEMENT

Engineering Index, EI 72 25217

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043024

#### SEPARATELY EXCITED DC TRACTION MOTOR APPLIED TO DC AND SINGLE PHASE AC RAPID TRANSIT SYSTEMS AND ELECTRIFIED RAILROADS-2

Van Eck, RA, AiResearch Manufacturing Company

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. IGA7, No. 5, Applic, 7109-7110, pp 650-657, 11 Ref

The separately excited dc traction motor can be used for traction only because of the availability of large power thyristors. In this paper, the type of control circuit required in order to use the separately excited dc motor (dc-dc chopper or ac-dc converters) is investigated

depending on the power supply available (ac or dc).

ACKNOWLEDGEMENT  
Engineering Index, EI 72 24126

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**043025**  
**THYRISTOR VOLTAGE CONTROLS USED FOR METROLINER PROPULSION**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 145, No. 2, Feb. 1971, pp 24-7

The electric control and propulsion systems on Penn Central Metroliner trains are discussed. Systems can accelerate a train to 150 mph in about 3 min and automatically apply motoring or breaking force as needed to hold the selected speed. Power is taken from the 11,000 v a-c catenary by a pantograph and passed through the main transformer, which is rated at 1370 kva. Power for traction is varied by a-c line switches and an a-c thyristor switch. The motor for each axle is part of a Tracpak drive, which consists of a d-c motor and a gear assembly.

ACKNOWLEDGEMENT  
Engineering Index, EI 71 74468

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**043026**  
**PROPULSION CONTROL FOR PASSENGER TRAINS PROVIDES HIGH-SPEED SERVICE**

Moxie, JE Krings, BJ

Westinghouse Engineer (Westinghouse Electric Corporation, Westinghouse Building, Pittsburgh, Pennsylvania, 15222)

Vol. 30, No. 5, Sept. 1970, pp 143-149

The electric control and propulsion systems in the Penn Central railroad's new Metroliner trains running between New York City and Washington, D.C., are discussed. They are claimed to be major steps in railroad technology. They accelerate a train smoothly to 150 mph in about 3 min and automatically apply motoring or braking force as needed to hold the selected speed.

ACKNOWLEDGEMENT  
Engineering Index, EI 72 03589

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**043238**  
**U. S. TRANSPORTATION. SOME ENERGY AND ENVIRONMENTAL CONSIDERATIONS**

Fraize, WE

Mitre Corporation, 1820 Dolley Madison Boulevard, McLean, Virginia, 22101

MITRE-72-164, Sept. 1972, 50 pp

The role of transportation in air pollution and consumption of energy, especially petroleum, is reviewed, with emphasis on the U.S. situation. Both technological and control measures for each problem area are discussed. Technological measures focus on the automobile, high speed ground transportation modes, and non-petroleum fuels, while control measures, which encourage the use of the more efficient transportation modes, are seen to offer significant benefits. The near future is discussed with respect to the impact of the U.S. Amended Clean Air Act of 1970. Transportation evolution over the next few

decades is projected. (Author)

ACKNOWLEDGEMENT  
National Technical Information Service, PB-213034 /

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NTIS, Repr PC: \$3.75, Microfiche: \$0.95  
PB-213034 /

**043524**  
**LIQUID HYDROGEN AS A FUEL FOR THE FUTURE**

Jones, LW, Michigan University, Ann Arbor

Science (American Association for Advancement of Sciences, 1515 Massachusetts Avenue, NW, Washington, D.C., 20005)

Vol. 114, Oct. 1971, pp 367-370

Liquid hydrogen is discussed as a future replacement for hydrocarbon fuels in surface and air transportation, noting advantages in energy per unit weight and pollution-free combustion.

ACKNOWLEDGEMENT  
American Institute of Aeronautics and Astronautics, A71-44365

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A71-44365

**043613**  
**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 49-54, 1 Tab

The article presents a general discussion of the operating and financial elements to be considered in justifying locomotive replacement programs. The industrial revolution in motive power since the end of World War II has stimulated keen competition between locomotive builders. Requests for modifications on new locomotives have brought in new ideas that are being incorporated into future models. Technological improvements have been introduced in many areas such as: (1) handling and filtration of intake air, (2) pressurized engine compartments to exclude outside dirt, (3) improved water temperature control, (4) rack mounted air brake equipment for ease of maintenance, (5) improved wheel slip detection and correction systems, (6) more efficient radiator designs to provide a more even flow of cooling air at high speeds, (7) easier access to major components for maintenance, and (8) improved visibility with low front head and angled windows. Computer techniques are used to compute optimum locomotive performance conditions and to measure maximum return on capital employed.

ACKNOWLEDGEMENT  
Railway Systems and Management Association

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Railway Systems and Management Association, 163 East Lake Shore, Chicago, Illinois, 60611, Repr \$5.00

**043782**  
**DESIGN FEATURES OF AUXILIARY ELECTRICAL MACHINES FOR ROLLING STOCK**

Partington, W, GEC Traction Limited  
Clarke, GE

Institution of Electrical Engineers, Proceedings (Institution of Electrical Engineers, Savoy Place, London WC2R OBL, England)

Vol. 119, No. 6, June 1972

The paper is a review of some of the principal design and the insulation methods relating to rotation auxiliary electrical machines used on both electric locomotives and multiple-unit stock. Items considered are: supply-motor generators, Carnoconverters, excitermotor generators, and auxiliary motors. The trend towards alternators with rectifiers instead of d.c. generators is discussed, and the constructional details of modern alternators are given, together with reasons for their preference, particularly when fluorescent lighting is used. The effects of voltage surges and short circuits due to supply disturbances, and the values of starting resistances are considered.

ACKNOWLEDGEMENT  
Engineering Index, IE 73 021647

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**043917**  
**FUTURE ENERGY SOURCES FOR TRANSPORTATION**

Savery, CE

Traffic Quarterly (Eno Foundation for Transportation, Incorporated, Saugatuck, Connecticut, 06880)

Vol. 26, No. 4, Oct. 1972, pp 485-499

Three means of conserving transportation fuel sources are considered. They are a changed energy source mix achieved by substituting nuclear sources for those non-transportation sources presently served by oil and natural gas, new automobile technology resulting in improved fuel economy, and the substitution of new electric power transportation systems and vehicles for those currently fueled with fossil sources. The economic factors omitted from consideration in this paper will play an important role in determining which methods gain prominence.

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Eno Foundation for Transportation, Incorporated, Saugatuck, Connecticut, 06880, Repr PC: Req Pr

**044019**  
**GERMANS BUILD 2,500 HP PROTOTYPE DIESEL WITH THREE-PHASE MOTORS**

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 5, May 1971, 3 pp, 2 Fig, 1 Phot

Rheinstahl (Henschel) has teamed up with Brown Boveri to offer for export the world's first main-line diesel-electric with an ac/dc/ac solid-state transmission supplying brushless squirrel-cage motors.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

**044020**  
**SNCB ADOPTS THE SERIES CHOPPER**

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 5, May 1971, 3 pp, 2 Fig, 1 Phot

SNCB is now taking delivery of 12 railcars with chopper control which can run in multiple with the existing e.m.u. fleet.

ACKNOWLEDGEMENT  
British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

**044034**  
**COMING TO TERMS WITH THE DC CHOPPER**

Band, C

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 6, June 1972, pp 221-224

Controllable semiconductors have not penetrated the dc traction field as rapidly as expected, mainly due to higher first cost and possible interference with signalling, but those operators who have carried out pilot schemes have the advantage of hard facts on which to base decisions involving series production.

ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

**044036**  
**HELSINKI METRO TRIES OUT CHOPPER PROTOTYPE**

Mard, M

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 9, Sept. 1972, pp 349-351

A six-car prototype train with thyristor control is now undergoing tests on the first 3-km stretch of rapid transit line in the Finnish capital which is being used as a proving ground. Scheduled passenger services will commence in the mid-1970s.

ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

**044047**  
**THYRISTOR CONTROL OF HIGH-SPEED TRAINS**

Nordin, T

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 8, Aug. 1972, pp 289-293

Passenger service in the 200 to 300 km/h range demands high power transmission through lightly loaded axles to minimise track stresses. Maximum use of available adhesion can only be achieved through stepless variation of traction motor current by a control system that responds instantly to wheelspin, while the input from driver or a.t.o. system should be acceptable as a constant speed demand. Tore Nordin of ASEA, points out that present thyristor converters meet these exacting requirements.

ACKNOWLEDGEMENT

British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

044277

**AIR FILTRATION FOR MODERN LOCOMOTIVES**

Vest, GE, General Electric Company  
Schulze, FW, General Electric Company

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

Paper 73-RT-4, Apr. 1973, 8 pp, 12 Fig.

Contributed by the Rail Transportation Division of ASME for  
presentation at the IEEE-ASME Joint Railroad Conference, St.  
Louis, Mo., April 11-12, 1973.

In a program to improve the reliability and to reduce the  
maintenance of GE locomotives, a unique primary air cleaner and a  
new disposable paper air filter have been developed. Both of these  
have been applied to diesel-electric locomotives and have proven  
themselves in extensive road service: The most recent new application  
has been on the straight-electric locomotive for the Black Mesa and  
Lake Powell Railroad. The removal of dirt from air entering both  
engine and electrical equipment is an absolute necessity for the high  
performance equipment demanded by today's railroads. The system  
discussed here has met those needs with efficiency, reliability, and  
economy.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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044290

**PROGRESS IN RAILWAY MECHANICAL ENGINEERING:  
1971-1972 REPORT OF SURVEY COMMITTEE  
LOCOMOTIVES**

Baker, PH  
Schulze, FW, General Electric Company

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

Paper 72-WA/RT-2, Nov. 1972, 11 pp, 13 Fig, 26 Ref

Contributed by the Rail Transportation Division of ASME for  
presentation at the Winter Annual Meeting, New York, New  
York, November 26-30, 1972.

This paper is the report of ASME Survey Committee RR-5 for  
locomotive design and development in the period September 1, 1971  
to September 1, 1972. It discusses developments in high-speed pas-  
senger locomotives and train sets and provides data and pictures of  
new diesel-electric and electric locomotives introduced in North  
America and overseas countries.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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044315

**E60C ELECTRIC LOCOMOTIVES FOR THE BLACK MESA  
AND LAKE POWELL RAILROAD**

McSparran, LW, General Electric Company

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017

Paper C73925-5-IA, Jan. 1973, 6 pp, 10 Fig

This paper was recommended by the IEEE Land Transportation  
Committee of the IEEE Industry Applications Society for  
presentation at the 1973 Joint ASME/IEEE Railroad Conference,  
St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for  
members.

A new 50 kilovolt, 60 hertz electric locomotive has been de-  
signed to meet American railroad standards and requirements. This  
new locomotive has been designated the E60C with a nominal rating  
of 6000 equivalent diesel horsepower (4500 kW). Many of the de-  
sign features of the locomotive are described. In order to operate 125  
km (78 miles) from the substation provisions were made in the lo-  
comotive circuits for operations at line voltages as low as 50% of  
nominal.

**ACKNOWLEDGEMENT**

Institute of Electrical and Electronics Engineers.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10 Repr PC: \$1.80

044531

**WHAT YOU SHOULD KNOW ABOUT DIESEL DIETS**

Du Val, D

Trains (Kalmbach Publishing Company, 1027 North 7th Street,  
Milwaukee, Wisconsin, 53233)

May 1973, pp 36-40

This article covers the refining, cost, uses, and future supplies of  
diesel fuels. Basic concepts of hydrocarbon chemistry are introduced.  
Environmental protection is discussed briefly. Some figures are given  
on railroad consumption of diesel fuels.

**ACKNOWLEDGEMENT**

Trains

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Kalmbach Publishing Company, 1027 North 7th Street,  
Milwaukee, Wisconsin, 53233, Repr PC: Req P

044557

**FUEL SHORTAGE THREATENS TO SLOW RAILROADS**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, p 11

Railroads are close to the top in markets for the kind of fuel  
which is running short. In 1971, the industry brought 8.9% of all  
distillate fuel oil sold in the United States. In early 1973, while rail-  
roads—along with other distillate fuel-oil users—were suffering, a  
wide range of causes for the shortage was being cited: the energy  
crunch, a colder than average winter, increased demand for gasoline  
last year, environmental concerns, political and economic problems,  
switchover of electric utilities from coal to oil with resulting increased  
demand for oil, shortages of natural gas, wet weather. Opinions differ  
on overall approaches that might be taken, and no immediate help  
for the energy problem seems to be forthcoming.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

039203

**DEVELOPMENT OF NONFRICTION BRAKING SYSTEMS FOR HIGH SPEED TRAINS**

Cassidy, RJ Pleuthner, RL Schenkel, FK

Cornell Aeronautical Laboratory, Vehicle Research Department, Buffalo, New York

CAL-YM-2811-K-3, Final Rpt, 6905-7004, Apr. 1970, 204 pp

Contract DOT-FR-9-0040

Performance potential and approximate cost estimate for three nonfriction braking systems are obtained. The systems are: the air retarder, the hydraulic retarder, and aerodynamic braking. It is shown that the air retarder and the hydraulic retarder have potential to develop full braking deceleration in a speed range from 250 MPH to 25 MPH. Because of its advantage over the hydraulic retarder in system weight, simplicity and cost, it is recommended that development of the air retarder be undertaken. Aerodynamic braking deceleration is highly dependent on projected braking area. Maximum frontal envelope considered was car frontal area plus an area enclosed by car width and extending three ft. above the roof. For this area, most of the energy of a 250 MPH train can be absorbed by aerodynamic braking. At speeds below 100 MPH (very approximately) aerodynamic braking must be supplemented by friction braking to obtain sufficient deceleration rates. Existing aerodynamic test data for longitudinally spaced braking surfaces are not sufficient to obtain accurate predictions of the friction braking crossover point and the aerodynamic braking deceleration rate. Therefore a wind tunnel test program is recommended. The report includes an extensive bibliography and references covering related aerodynamic material. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-192454

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PB-192454

039343

**UTILIZATION OF ENERGY LOST IN BRAKING 212 ISPOLZOVANIE ENERGIJ, POGASHAEMOI V TORMOZAKY**

Atoyan, K Gulia, N Vfelesyana, L Nagornysk, G

Army Foreign Science and Technology Center, Charlottesville, Virginia FSTC-T7023012301

FSTC-HT-23-968-72, Apr. 1972, 9p

Trans. of Avtomobilni Transport (USSR) n7 p35-36 1971, by Trombley.

The paper describes a 'recuperative' brake system, so-called because energy derived from braking is retained to assist subsequent acceleration. Such a device lends itself well to vehicles making frequent stops and starts like buses. In a test vehicle using a recuperative brake system, acceleration to 19 miles per hour was achieved with only half the fuel normally required. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-745798

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AD-745798

041299

**THE POWER BRAKE LAW OF 1958**

Railway Educational Bureau, 1809 Capital Avenue, Omaha, Nebraska, 68102

The announcement for this book appeared in Railway Locomotives and Cars, V146, N8, September 1972.

On August 1, 1972, the regulations for initial terminal brake test and for brake tests on all types of unit trains were revised by the Federal Railroad Administration. This reprint of the Brake Law has the new sections identified so that all those involved with train inspections may readily familiarize themselves with the revised requirements.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Railway Educational Bureau, 1809 Capital Avenue, Omaha, Nebraska, 68102, Repr PC: \$1.25

041311

**SAFETY APPLIANCES AND POWER BRAKES**

Government Printing Office, Superintendent of Documents, Washington, D.C., 20402

This book was published by the Bureau of Railroad Safety, Federal Railroad Administration and announced in Railway Locomotives and Cars, V145, N9, September 1971.

This current compilation of standards established for cars and locomotives by Federal regulation is a successor to the ICC's Safety Appliance Standards, last published in 1946, and to the Power Brake Law pamphlet, issued in 1958. It incorporates requirements for today's rolling stock, including tank cars without underframes, hi-cube box cars and cars of special design.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

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Government Printing Office, Superintendent of Documents, Washington, D.C., 20402, Repr PC: \$2.5

041670

**BRAKE RIGGING EFFICIENCY OF RAILWAY FREIGHT CARS**

Carman, RW, Southern Railway

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

71-WA/RT-2, 1971

This paper was presented at the ASME Winter Annual Meeting, November 28-December 2, 1971. The notification of this paper appeared in Mechanical Engineering.

The dynamic brake rigging efficiency of freight cars, investigated by using a computer to analyze test track data, is compared with static brake rigging efficiencies. Computer simulations of constant grade braking are performed.

**ACKNOWLEDGEMENT**

Mechanical Engineering

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

041671

**NONFRICTION BRAKING METHODS FOR RAILWAY VEHICLES**

Cassidy, RJ, Cornell Aeronautical Laboratory

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

71-WA/RT-3, 1971

This paper was presented at the ASME Winter Annual Meeting, November 28-December 2, 1971. The notification of this paper appeared in Mechanical Engineering.

Performance potential and approximate cost estimates are presented for three nonfriction braking systems: air retarder, hydraulic retarder, and aerodynamic braking. It is shown that the air and the hydraulic retarders have potential to develop full braking deceleration in a speed range from 250 to 25 mph. Because of the air retarder's potential advantages in system weight, simplicity and cost, prototype development of the retarder is indicated. Aerodynamic braking deceleration is highly dependent on the cumulative effect of longitudinally spaced braking surfaces. Further wind tunnel testing is required for complete evaluation.

**ACKNOWLEDGEMENT**  
Mechanical Engineering

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**041677**

**BRAKE-SYSTEM OPERATION AND TESTING PROCEDURES AND THEIR EFFECTS ON TRAIN PERFORMANCE**

Blaine, DG, Westinghouse Air Brake Company  
Hengel, MF, Missouri Pacific Railroad

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

71-WA/RT-9, 1971

This paper was presented at the ASME Winter Annual Meeting, November 28-December 2, 1971. The notification of this paper appeared in Mechanical Engineering.

In the past 90 years, a number of train brake-system inspection and testing procedures have evolved to meet the requirements at various stages of railroad development in North America. From an engineering basis, the authors view the major procedures used today and examine their effects on train handling and stopping ability.

**ACKNOWLEDGEMENT**  
Mechanical Engineering

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**043522**

**BRAKE SHOES**

Abex Corporation, Valley Road, Mahwah, New Jersey, 07430  
Booklet, 8 pp

The announcement of this publication appears in Railway Locomotives and Cars, January 1973, Volume 147 Number 1:

Performance characteristic curves on the Samson brake shoe as well as general background information are the subjects of an eight-page booklet.

**ACKNOWLEDGEMENT**  
Railway Locomotives and Cars

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**044274**

**COMPUTER SIMULATION OF RAIL VEHICLE BRAKING PERFORMANCE**

Hart, JE, COBRA Shoe Engineering  
Grejda, FJ, COBRA Shoe Engineering

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

Paper 72-WA/RT-5, July, 1972, 11 pp, 10 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

The ability to predict rail vehicle braking performance has been of vital interest to the railroads and railway brake equipment suppliers. A computer program developed to simulate rail vehicle braking performance provides a practical and efficient method of calculating braking performance and permits study and analysis of all elements of braking. For background information this paper briefly reviews the factors that affect braking performance, provides information on how the data for evaluating these factors was obtained, and describes the logic used in devising the computer program. The accuracy of the program is demonstrated by comparing calculated test results with actual field test and dynamometer test data. The potential usage of the program for the analysis of rail vehicle braking is described in general terms.

**ACKNOWLEDGEMENT**  
American Society of Mechanical Engineers

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019555

**DESIGN AND DEVELOPMENT OF A PILOT TERMINAL CONTROL SYSTEM (TCS) WITH AUTOMATIC CONTAINER IDENTIFICATION**

Computer Identics Corporation, Southwest Park, Westwood, Massachusetts, 02090  
 Transocean Gateway Corporation, 26 Broadway, New York, New York, 10004

May 1971, 110pp, 28 Fig, 37 Tab, 2 Ref

Contract I-35434

Terminal Control Systems (TCS) employing Automatic Container Identification (ACI) employs optical scanning devices that read color code labels applied to marine freight containers. In a marine terminal, data from the scanners on inbound and outbound container movements, handled by rail or truck, and units being loaded and discharged from containerships, are transmitted directly to a central computer for on-line/real-time terminal control, terminal security and management reports.

**ACKNOWLEDGEMENT**

Maritime Administration

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037160

**TRAFFIC CONTROLLER-LOCOMOTIVE COMMUNICATIONS ON THE DOLE-VALLORBE LINE 212 LIAISON "REGULATEUR-LOCOMOTIVE EN MARCHÉ" SUR LA LIGNE DOLE-VALLORBE**

Toussaint, H

Revue Generale des Chemins de Fer (Societe Nationale des Chemins de Fer francais, 92 rue Bonaparte, 75 Paris 6e, France)

Vol. 89, July 1970, pp441-8

System described operates with two wires laid along the catenary line supports at locomotive roof height. The locomotives have two aeriels which enable communications to be established through the line when the train is stationary, in motion or passing through the tunnels. The traffic controller calls the locomotives by dialing two digits on an automatic telephone set. The electric-train drivers call the traffic controller by pressing a button. The system enables 98 locomotives to be contracted by carrier channel (two frequencies) and three channels can be transmitted on the overhead line.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 10356

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037163

**BAY AREA TRANSIT SYSTEM WILL HAVE AUTOMATED CENTRAL CONTROL**

Gibson, TR, Westinghouse Electric Corporation

Westinghouse Engineer (Westinghouse Building, Pittsburgh, Pennsylvania, 15222)

Vol. 30, No. 2, Mar. 1970, pp51-4

The rapid-transit system of the Bay Area Rapid Transit District now being built in the San Francisco area will include 23 route mi of underground and underwater construction, 25 route mi of aerial construction, and 27 route mi at grade—a total of 75 mi, double track. Thirty-four passenger stations will be located at major points of passenger origin and destination. A computerized control system will be used to maintain train schedules.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 47821

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037170

**MUSKINGUM ELECTRIC. HOW TRAINS RECEIVE COMMANDS**

Thomas, JED

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 62, No. 9, Sept. 1969, pp34-7

The wayside to train intermittent command communication system is used to give speed commands to the unmanned coal trains as they make roundtrips over the 15 mi railroad that is installed between the coal loading tippie and the Muskingum river power plant stockpile. Between terminals, the train receives commands every 4000 ft from inert coded units mounted between the rails.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 18241

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037171

**ELECTRIFIED RAILWAY OPERATES UNIT-COAL TRAINS AUTOMATICALLY**

Robertson, WB

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 62, No. 7, July 1969, pp22-3, 26

The Muskingum Electric Railroad, near Zanesville, Ohio, hauls a weekly minimum of 90,000 tons of coal 15 mi from Central Ohio Coal Co. tippie to the Muskingum river power plant stockpile. The General Electric automation system controls all train movements between the terminals of railroad, as well as the loading and unloading operations. The system consists of wayside sequence and interlocking controls at the terminals; on-board sensing, regulating, and safety control; and communications and supervisory control. The continuous communication is provided by type 52 tone modulated carrier current equipment.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 17989

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037172

**WAYSIDE CONTROLS ARE DIFFERENT**

Ryan, PT

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 62, No. 8, Aug. 1969, pp13-18

The Muskingum Electric's wayside control system described has several departures from tradition. Control functions are handled by industrial type relays. Traffic control is by microwave. The system is self-sequencing. Once both trains are in place on the system and the cycle is started, each event follows as a result of completion of the prior event. Cycle time depends on main line running time. The system has service proven the application of this new approach to automatic train control on a fully automated rail haulage system.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 17988



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**037196**  
**CN USES CTC FOR TERMINAL CONTROL**

Railway Systems Control (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 62, No. 2, Feb. 1970, pp18-21

Control on Canadian National's Lake Shore line along the north shore of Lake Ontario and near Toronto, Ont, is from four pushbutton centralized train control (CTC) machines in the Toronto yard administration building. Two machines control the Lake Shore line. A high-speed code control system provides the communications from dispatching headquarters to the field locations. The Lake Shore line code system operates at 2,000 bits/sec.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 42228

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**039264**  
**TRAIN CONTROL AND OPERATIONS**

Hergenrother, K

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-FRA-71-5, Final Rpt, June 1971, 34p

ATO (automatic train operation) and ATC (automatic train control) systems are evaluated relative to available technology and cost-benefit. The technological evaluation shows that suitable mathematical models of the dynamics of long trains are required before substantial improvements can be made to ATO systems, and the present ATC systems are presently near optimum. The cost-benefit analysis concludes that only railroads which find CTC (centralized traffic control) economically desirable will also find that ATC offers improved operating economies. ATO does not seem economically or politically practical in the general railroad environment. A brief evaluation is made of both the contribution of the railroad locomotive to air pollution and the possible means of controlling this pollution. (DOT abstract)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-202623

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**039295**  
**AUTOMATIC CAR IDENTIFICATION—AN EVALUATION**

Troup, KF, III

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

TSC-FAA-72-3, Tech Rpt, 7109-7201, Mar. 1972, 35 pp

Contract DOT-OS-212

In response to a Federal Railroad Administration request, the Transportation Systems Center evaluated the Automatic Car Identification System (ACI) used on the nation's railroads. The ACI scanner was found to be adequate for reliable data output while the label was found to cause most problems with ACI data accuracy. System costs are discussed with several considerations which, depending on the application, can minimize system cost. A number of effective applications of ACI are cited. In addition several reasons

why system implementation has not proceeded as planned are discussed. Finally, recommended Department of Transportation actions are included. (Author)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-209553

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**039797**  
**AUTOMATION SYSTEM AT TAKASAKI MARSHALLING YARD**

Fujui, R

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

Vol. 12, No. 1, 1971, pp 9-12

Automatic control procedure and control facilities for the cars thrown from the hump are described together with the electromagnetic type and the oil pressure unit type car retarders. The computer system in the yard automation is of a duplex system, with the active system normally in working condition and the secondary system in standby condition.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 72 51814

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**039798**  
**AUTOMATIC CHECK SYSTEM OF THE MOBILE STATION FOR THE NEW TOKAIDO RADIO TELEPHONE**

Baba, T

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

Vol. 12, No. 1, 1971, pp 13-18

The concept of developing automatic inspecting equipment and method devised to automate the check-up of the radio stations are described. Features of layout of equipment mounted on a train for the train radio telephony of the New Tokaido Line and outline diagram of automatic check-up device for mobile station.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 72 50728

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**040993**  
**MICROWAVE NETWORK IS VITAL TO IC'S TELEPROCESSING SYSTEM**

Taylor, JC, Illinois Central Gulf Railroad

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 6, No. 7, July 1972, pp 6-8, 2 Phot

Illinois Central's 900 mile microwave system between Chicago and New Orleans serves their MAIN Teleprocessing System, serves their centralized dispatching from Chicago, and provides voice communications for their telephone system. Information from 27 hotbox detectors is sent to MAIN over the microwave system, and

MAIN has two way radio communication with train crews as an integral part of the communications capability. Information from Automatic Car Identification installations is transmitted over the microwave system. Hot standby/space diversity is used for path protection. All microwave stations have an eight hour backup battery plant. GTE Lenkurt provided engineering, microwave equipment, and acted as prime contractor for the towers.

**ACKNOWLEDGEMENT**  
Railway System Controls

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040994

**LATEST SIGNAL TECHNIQUES LET RAILROADS DECREASE JOINT USAGE**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 7, July 1972, pp 9-10, 1 Tab

This article presents the results of a survey of new methods and equipment used to reduce the number of insulated joints in service. The survey covered: brands of insulated joints, circuits and equipment for rail-highway grade crossing protection, where can insulated joints be eliminated and where must they be retained, and other related areas.

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040995

**FCC GRANTS PETITION ON TONE MODULATION**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 7, July 1972, pp 11-12, 1 Tab

The Federal Communications Commission granted an AAR petition to permit tone modulation on a secondary basis to voice operations on railroad frequencies in the 160 MHz band and on certain 450 MHz band frequencies for remote control of locomotives and cab indicators. The FCC also agreed to permit use of two pairs of frequencies in the 450-460 MHz band, now reserved for slave locomotive control, for the additional functions requested. The FCC amended frequency tolerance rules to permit use of mobile transmitting equipment as base stations on two frequency pairs in railroad yards and terminals. The FCC denied the request to permit use of two splinter frequencies of 157.450 and 159.480 MHz for control of slave locomotives.

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040997

**CHICAGO ACI PROJECT UNDERWAY**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 7, July 1972, p 25

The Chicago General Managers Association has developed an ACI plan for the Chicago terminal area that involves 109 ACI scanners at 40 sites. The plan includes a central processor to handle the

ACI data and merge it with input data from the railroads. The system will collect data on the 17,410,500 freight cars moving on 512,460 trains per year moving into, out of, or through the Chicago terminal gateway. The major objective of the system is accurate, detailed and timely information on cars and trains. The Federal Government will contribute one-third of the \$9,000,000 cost of installation, operation, data collection, and analysis over five years.

**ACKNOWLEDGEMENT**  
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040998

**AUTOMATIC TRAIN CONTROL SYSTEMS ARE FEASIBLE AND COST EFFECTIVE**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 7, July 1972, pp 26-31, 1 Fig, 1 Tab, 1 Phot

This article is an abstract of Transportation Systems Center report No. RR01, entitled "Train Control and Operations."

Automatic Train Control and Automatic Train Operation systems have been studied and evaluated by the Transportation Systems Center for the FRA. The case chosen was operational and cost savings of an ATO system on an average U.S. Railroad operating passenger and freight trains. Maximum safety can be found in the general environment where the train is operated by an engineer who is protected from making gross errors by an electronic monitor. Crewless ATO is a special case, generally in mining type operations. The principal technological deficiency in ATO is the poor understanding of the dynamics of long trains. It is convenient to think of ATO as divided into a subsystem for solving problems of train movements and a subsystem for reducing these solutions to detailed commands on board the individual trains. The principal motivations for ATO are to increase safety, more economical operation, or service improvement. The greatest improvement in safety would be the reduction of train collisions.

**ACKNOWLEDGEMENT**  
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040999

**RAILROAD FAX USAGE HAS GROWN**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 6, June 1972, pp 8-12, 11 Fig

This article summarizes the replies of thirteen railroads to a survey of railroad usage of facsimile transmission. Southern Railway's LDX system, with 38 locations transmitting to Atlanta, is the largest installation. Fax usage on the thirteen railroads includes both short distance yard and terminal applications and long distance inter-city applications. Information transmitted includes passenger reservations, switch lists, work orders, waybills, car inventories, train lists, office memos, and general operating information.

**ACKNOWLEDGEMENT**  
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041027

**SIGNAL RULES MAY BE CHANGED**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 11, Nov. 1971, 12 pp

The Federal Railroad Administration has proposed revisions to the rules, standards, and instructions for the installation, inspection, maintenance and repair of signal systems, devices, and appliances. The proposed revisions were sent to the Association of American Railroads and to the Brotherhood of Railway Signalmen. The article presents the FRA proposals, the AAR comments, and the B of RS comments. The article is continued in subsequent issues.

**ACKNOWLEDGEMENT**

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041037

**SANTA FE INSTALLS ACI AT YARD**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 6, June 1971, p 13

Santa Fe has made a full scale application of ACI with 10 KarTrak Automatic Car Identification scanners at Argentine Yard. The ACI will monitor all moves in and out of the yard, which average 6,200 cars daily and peak at about 8,000 cars daily. Each scanner is equipped with 500 label buffer, calendar clock, message generator, and the AAR communications interface for 8-level polled ASCII. Until the computer is programmed for automatic matching of wheel reports and ACI lists, the two are matched manually. Benefits of the ACI include: a more accurate list of cars in train order, elimination of car checking manpower, reduction in open car records, and a time and date for the arrival of every car.

**ACKNOWLEDGEMENT**

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041038

**AT&SF USES AAR STANDARD ACI-COMMS INTERFACE**

Thomas, LR, Atchison, Topeka and Santa Fe Railway

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 6, June 1971, pp 14-16, 1 Phot

The 10 Automatic Car Identification scanners at Argentine Yard are connected to an IBM 360 Model 40 computer by means of communications lines. The AAR standard ACI communications interface is used. This article describes the polling sequence and transmission sequence. Three phases are planned for computer handling of the ACI data. The first phase involves converting road codes to initials and printing an ACI list. The second phase will include computer matching of the ACI data with previously available information from other sources. The third phase will involve making everything as automatic as possible. Lead engine number will be used for matching inbound road trains wheel reports with their ACI lists. Cuts received in interchange will be identified by the locomotive label data.

**ACKNOWLEDGEMENT**

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041039

**SIGNALING HIGHLIGHTS MEETING**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 6, June 1971, pp 17-19, 1 Fig, 2 Phot

This article presents subjects discussed at the ASME/IEEE April 1971 Railroad Conference, principally a cybernetic system to improve line capacity and the impact of electrification on signaling and communications. An analysis of electrical noise currents in the running rails included: noise currents produced by conventional switched resistor and new chopper propulsion systems, currents produced by substation power systems incorporating rotary convertors and mercury and silicon controlled rectifiers. The best potential for electrification in North America is some 20,000 miles of track averaging over 40 trains per day. One thousand amperes flowing in the catenary with a deep ground return will induce about 500 to 700 volts per mile in parallel signal and communications lines at the usual locations. A completely new signaling system may cost less than a retrofit. Development of a cybernetic system to improve line capacity was reported by the French National Railroads for a route on which freight, passenger, and commuter trains all converge on two tracks. The cybernetic system consists of three subsystems: signaling and routes, traction control on commuter trains, and dispatching.

**ACKNOWLEDGEMENT**

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041040

**HOTBOX DETECTOR SCANS INSIDE**

Gallagher, CA, Servo Corporation of America

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 6, June 1971, pp 22-27, 5 Fig, 2 Phot

Increased train speeds, while increasing bearing temperatures, have also increased the cooling effect of the air stream and thus have made more difficult the early detection of bearing overheating. Bi-directional operation on single track has further complicated the situation, since the cooling effect is particularly noticeable when the train motion is toward the aperture. A rail mounted scanner, which scans inside the truck sideframe, offers significant advantages: the inside location is less effected by the air stream, is less effected by sun or prevailing wind loading, is less subjected to cooling effect by sun or prevailing wind loading, is less subjected to cooling effect of rainfall, avoids radiation from brake shoes, is indifferent to open or missing lids, and by offering a shorter scan path is less affected by swirling snow. The scanner, which is clamped to the rail, permits increased system gain and provides a more consistent scan, which is important for the increasing number of roller bearings in service. The rail mounted scanner features easy installation, and reduced maintenance since it is not dependent on a rail to tie relationship. The low basic system power requirement of 500 va makes it possible to use a 24 v battery as a standby source.

**ACKNOWLEDGEMENT**

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041043

**HOW GTE INFORMATION SYSTEMS AIDS RAILROADS**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 5, May 1971, pp 15-16, 2 Phot

Railroads have failed to meet the fifth deadline for equipping all cars used in interchange with Automatic Car Identification labels. Some railroads are reluctant to spend money to label cars when the railroad has no ACI scanners. Other railroads are reluctant to spend money for scanners when the cars are not all labeled. GTE Information Systems has made economic and operational analyses of ACI in these areas: terminal analysis procedure, ACI checking of pullout in a hump yard, ACI checking of inbound and outbound consists, ACI site survey worksheet, communications criteria for ACI. The ACI checking of pullout in a hump yard indicates a return of from 48 to 145 percent. Checking the inbound and outbound consists indicates a return of 29 percent. Copies of the reports are available to railroads.

**ACKNOWLEDGEMENT**

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041046

**CHICAGO TRANSIT AUTHORITY PUTS ACI TO WORK ROUTING TRAINS**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 4, Sept. 1971, pp 12-14, 1 Fig, 2 Phot

CTA operations on the loop require selective routing of trains at Tower 12. Northbound moves are over a trailing point switch and automatic interlocking is simple. Southbound moves are over a facing point switch and routing information must be provided to the interlocking system. Lake-Dan Ryan trains require the facing point switch to be lined normal. Loop Shuttle trains and Evanston trains require the facing point switch to be lined reverse. A WABCO laser ACI system is used to provide routing information for the forty southbound trains each hour. To minimize labeling costs, only Lake-Dan Ryan train cars are labeled. Detection of a label provides for the interlocking system to line the switch normal. Presence of a train with no label detection provides for the switch to be lined reverse. At the present time, only routing information is used, but plans are completed to transmit car number data to CTA headquarters where maintenance scheduling data can be compiled. To reduce vandalism, labels are mounted on folding doors which are turned inward so that the label is inside the car when the car is at the loading platform. If an incorrect route is established, or no route, the train must stop and the motorman must push a selector lever. The ACI label and system used are not the system approved by the AAR for railroads.

**ACKNOWLEDGEMENT**

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041049

**CP RAIL PLANS MAJOR USES OF ACI**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 3, Mar. 1971, pp 13-14

CP Rail will use Automatic Car Identification in three areas: as an important subsystem in a new computerized yard, as an integral part of a coupled weigh in motion scale for unit train service, and as

an integral part of interchange procedures. The CP Rail yard at Calgary will be controlled by a digital computer. Ten ACI systems will form an important part of the operation. One ACI scanner will be on the hump, and the other nine will be located at strategic points to scan arrivals, departures, and switching moves. The coupled weigh in motion operation uses an electronic scale, a computer, and an ACI scanner. The empty unit train crosses the scale and passes the scanner, then proceeds through the loading silos and around a loop, and finally passes the scale and scanner in the opposite directions as it departs. The system determines accurate weights for each car in the unit train and automatically records the weights for revenue billing. The interchange application is a joint venture with CN, with the ACI recording all movements in interchange at the test location.

**ACKNOWLEDGEMENT**

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041051

**HOW USER CAN EVALUATE ACI**

Crouch, CA, Atchison, Topeka and Santa Fe Railway

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 3, Mar. 1971, pp 20-22, 2 Fig

An AAR Communication and Signal Section Committee has prepared a 'Guide to ACI Operation On-Site or Customer Acceptance Tests' for use with Automatic Car Identification equipment. GTE Information Systems has manufactured a series of Test Labels. The procedures recommended in the Guide can form a basis for the writing of lease or purchase contracts and the evaluation of new equipment performance, and they can form a basis for evaluating the operating efficiency of individual parts of an overall ACI system. Maintenance of an ACI system, which may be divided among various crafts and companies, can be simplified by using the test procedures to identify problem areas, and to assign responsibility. This article presents a block diagram of a typical overall ACI system, and diagrams of two of the test labels.

**ACKNOWLEDGEMENT**

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041052

**RR CAN TEST ACI**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 3, Mar. 1971, pp 22-24, 1 Fig

An AAR Communication and Signal Section Committee has prepared a 'Guide to ACI Operational On-Site or Customer Acceptance Tests' for use with Automatic Car Identification equipment. GTE Information Systems has manufactured a series of Test Labels. Use of the test equipment will demonstrate that ACI systems will read and correctly output valid labels, not read labels not within the specifications, accurately indicate train count, accurately indicate unlabeled cars within the limitations of the car count logic, provide the message generation required for the prefix and suffix, output in the required code and discipline, correctly perform all other specified functions, and perform the above within the accepted environmental and power supply ranges. This article lists, describes, and explains the purpose of the Test Labels. It also describes the peripheral equipment tests.

**ACKNOWLEDGEMENT**

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**041053**  
**HOW TO TEST ACI**

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 3, Mar. 1971, pp 24-26

An AAR Communication and Signal Section committee has prepared a 'Guide to ACI Operational On-Site or Customer Acceptance Tests' for use with Automatic Car Identification equipment. GTE Information Systems has manufactured a series of Test Labels. GTE Information Systems has also prepared detailed on-site testing procedures for use with their Kartrak ACI systems. This article presents a Test Summary and presents the On-Site Kartrak Testing Procedures in detail.

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**041057**  
**CANADIAN NATIONAL CONNECTS ACI TO  
MINICOMPUTER IN REAL-TIME**

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 9, Dec. 1970, pp 14-18, 7 Fig

Canadian National has installed automatic car identification scanners at entrances to a small interchange yard near its large Montreal classification yard. At Parsley yard, CN interchanges approximately 120-150 cars daily with the Canadian Pacific. As part of the joint agreement with CP, the ACI scanners were also to be part of a stand-alone installation supplying standard Baudot Teletype listing to the CP yard office. The ACI scanners are connected to a minicomputer in real time using a high speed frequency modulated carrier link. The computer prints out on standard ASCII Teletype and also sends to the CP yard office teletypewriter. From a cost standpoint, CN found that the economic advantage of using the minicomputer comes about from not ordering existing options. It is assumed that the computer will do nothing more than produce the same output data as a standard scanner. Options not required at each installation include a calendar clock, message generator, core storage and carrier index, totaling \$9,460. Not estimated were costs for air conditioning and a 220-volt AC line. Typical costs for a minicomputer are \$7,900 or \$12,800 depending upon main memory size. The computer provides the ability to change the output format. Also, one computer could service 6 to 12 scanners depending upon the degree of sophistication required for operations.

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**041060**  
**AAR'S C&S SECTION DEVELOPS INTERFACE  
STANDARD FOR ACI**

Crouch, CA, Atchison, Topeka and Santa Fe Railway

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 8, Nov. 1970, pp 14-16, 2 Fig

Most standards are developed to improve reliability, reduce production costs (through mass production) and provide compatibility. This has been accomplished by the Communication & Signal Section, AAR, which has developed a communications interface specification for automatic car identification. The hardware interface is the device placed between the decoder output from the ACI scanner and the connecting communications lines. An important consideration in developing the interface equipment is to provide for the polling of the ACI equipment by a selector under the control of a computer or similar central processing unit. The committee gave careful consideration to the following: 1) Many railroads have already established the design criteria for their telecommunications networks. 2) ACI interface should not be the controlling factor in design of future telecommunications networks. 3) The majority of the existing telecommunications networks employ some form of polling. 4) All selectors will not have the same circuit arrangements. 5) The interface controls should be independent of the data signal code and the speed of transmission. 6) Interchange circuits should be consistent with EIA standard RS-232-C, in so far as practical. 7) A standard interface should not limit the manufacturer from making improvements or modifications in his product.

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**041061**  
**ACI INTERFACE SPECS APPROVED BY C&S MEN**

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 8, Nov. 1970, pp 17-19, 1 Phot

A committee of the Communication and Signal Section of the AAR has written specifications for a communications interface for use with Automatic Car Identification. This article presents the actual specifications as written.

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**041064**  
**L&N TRAINS COMMUNICATIONS MEN**

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 7, Oct. 1970, pp 15-16, 2 Phot

Louisville and Nashville has a training program for communications men. Most new men joining the communications department start with crews maintaining pole lines. L&N constructed a pole line for training. During the training period of about one month, the men play catch with a basketball while strapped to the poles. Such practice develop confidence and dexterity at heights. Train operations and safety are also reviewed for the men. They are encouraged to enroll for electronics correspondence courses.

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**041066**  
**HOW ONE FIRM OBTAINS LABEL QUALITY CONTROL**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 6, Sept., 1970, pp 17-20, 3 Fig, 1 Tab, 3 Phot

One method of labeling cars involves advance preparation of the Automatic Car Identification Label on a vinyl backing film or on a metal plate. The previously prepared label is later applied to the car. Computer Identics prepares labels for use by railroads. A computer is used to calculate the validity check digit and to print two label stickers for each car set of labels. After the labels are assembled, they are verified by a special test scanner connected to a computer. The computer printout verifies the actual data in the label and flags any assembly errors. The label stickers contain the word 'TOP' and the car reporting marks. People applying the labels in the field can check to be sure they have the correct car. Computer Identics also has a test site on the Penn Central with an ACI scanner, an oscilloscope, and a high speed 35 mm camera. Wheel count circuits open and close the camera shutter for each car. The camera will record any ACI signals from the car label regardless of whether or not the label is read by the ACI system. Daytime trains are spot checked by a person with a tape recorder and labeled cars are correlated with the printout from the ACI system.

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#### 041072

#### CAN ACI BE A DECONGESTANT FOR RAILROAD TERMINALS

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 5, Aug. 1970, pp 26-31, 3 Fig, 1 Phot

The Chicago General Managers' Association ACI Task Force has produced a report for an Automatic Car Identification Interchange and Information System. Objectives are: maintain a central interchange bureau, provide accurate and understandable information on cars involved in ACI scanner movements, report on a real time basis advance information on cars moving between railroads, provide an information bank of train, transfer, and car moves throughout the Chicago terminal. The hardware required includes 109 ACI scanners and 100 decoders installed at 40 strategic locations. Scanners will monitor 90 percent of the 25,000 interchange cars per day moving in more than 1,100 trains. Recommended is a central computer with buffered ACI scanner (decoders) and critical site functions duplexed. Monthly costs will be \$120,800 with lease maintenance, or \$112,900 if the GMA sets up its own maintenance force. The one time charge for installation will be \$560,300. If GMA assumes maintenance, a one time set up expenses charge will be \$74,400. Potential savings are estimated at \$10,750 per month. Twenty-two member railroads and seven other railroads would participate. Prior to an interchange move, a header card would be entered into the central computer. When the interchange move passes the designated scanner, the certified interchange is effected. Other savings include switch crew time waiting on lists. Per diem expense can be reduced since each road will get a list of owned cars reported by the last scanner location, and home route information will be shown. Advance consists will enable immediate identification of cars delivered without waybill information. Data will be available on empty available cars coming in interchange. It will take about 20 months to make the proposed system operational. Communications lines will be leased from the telephone company.

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#### 041078

#### SANTA FE FINDS A BETTER WAY FOR COMMUNICATIONS MAINTENANCE

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 1, No. 4, July 1970, pp 18-23, 1 Fig, 5 Phot

Atchison, Topeka and Santa Fe has some 10,000 communications units over 13,000 miles of line. About 100 men are employed to maintain these units that range from loudspeakers to data terminals or microwave stations. Heart of the maintenance operations is a system of communications shops located at 38 strategic points along the railroad. Financial aid is available for job-oriented correspondence courses, and men have been sent to manufacturers' schools. A wide range of testing equipment is available. Electronic Technicians have the use of Carryall type vehicles. Edge punched cards are used for maintaining records on radio equipment.

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#### 041090

#### STUDIES REVEAL BENEFITS OF ACI

Railway Signaling and Communications (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 63, No. 3, Mar. 1970, pp 22-23, 2 Phot

So far Automatic Car Identification has involved the expense of labeling cars. Some railroads have installed ACI scanners. The economic justification for ACI lies in three basic areas: direct labor savings, indirect labor savings as a result of eliminating open car records, and complete, timely, accurate data collection. Direct labor savings from ACI will be in five major areas; at yard entrances and exits to verify the cars and their position in the train, as a replacement for wayside TV verification systems, as a means of recording cars and locomotives operating over joint track, as a source of interchange information, and for billing at high volume billing locations. One railroad believes ACI will primarily be a supplement to their current data capturing system.

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#### 041093

#### WHAT METHODS TO USE IN MAKING AN ACI STUDY

Railway Signaling and Communications (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 63, No. 3, Feb. 1970, pp 22-23

Use of Automatic Car Identification requires a systems study to determine long and short range usage. One railroad made a complete study to determine operating information requirements. Next it was determined where ACI could help: accurate consists, no bills and overbills, open records, interchange records, switch lists, car and locomotive movement records, train identification, and new information. Scanner requirements were investigated in three areas: location, optional features, and communications and power supply. Scanner output modes involved: local, or local and central; or direct printout, or feed to computers. Priorities were based on: savings, improvement in quality of service, improvement of data quality, compatibility with information objectives, and other factors. A systems team was led by

an industrial engineer. Meetings were held with regional operating officers. Operating officers wanted more accurate and timely information rather than new information. ACI can help: purify advanced consists, provide passing reports, prepare outbound consists, prepare inbound consists, prepare switch lists, prepare interchange reports, provide yard inventories, provide terminal situation reports, permit car tracing. An inset gives Missouri Pacific ACI testing results.

**ACKNOWLEDGEMENT**

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**041095****BRUSSELS SUBWAY INSTALLS ACI FOR BETTER SERVICE**

Railway Signaling and Communications (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 63, No. 2, Feb. 1970, p 32, 2 Phot

Brussels subway system is under construction, and until it is completed, surface cars of many different routes will be using the portions that are already in service. As a result, display boards are used to indicate to passengers the arriving trains. Automatic Car Identification Labels are mounted on boards and inserted into a holder on the inside of a car window. ACI scanners have been placed outside the tunnels at the ends of the completed portion of the metro. The ACI scanners read the labels in the car windows and transmit the information to the station platform display boards and to the metro control center. A special close clearance design ACI scanner was used.

**ACKNOWLEDGEMENT**

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**041126****COMMUNICATIONS VITAL TO CTC**

Arnold, BL, GTE Lenkurt, Incorporated

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 12, Dec. 1972, 9 pp, 4 Fig, 1 Phot

There is a well established trend in railroading toward consolidation and centralization of CTC and other control Systems. A centralized traffic control protection system has been developed which may be used over any voice frequency or high frequency facility suitable for data or telegraph transmission. It employs full-duplex tone channelizing equipment. Redundant transmission is used to provide reliability. An alternative using dialup can be provided.

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**041127****PROBLEM: INDUCTIVE INTERFERENCE**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 12, Dec. 1972, pp 22-23, 2 Phot

This report was given at the 1972 meeting of Communication &

Signal Section, AAR's Special Committee on Inductive Interference.

The trend toward higher voltages for power transmission lines and the trend toward locating such power lines along railroad rights-of-way have caused increasing problems for railroad signal and communications facilities. These trends demand maximum protection against hazardous induced voltages and possible fault currents that can endanger personnel and affect signal systems. The most effective means of avoiding interference is sufficient separation between power lines and signal circuits. When separation is not practical, shielding may be used. When a power line parallels the railroad, the power line current magnetically induces a voltage in the rails. The major factor is earth return currents, power line earth return currents may enter the roadbed and rails even when the power line is not closely parallel to the railroad.

**ACKNOWLEDGEMENT**

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**041128****BN BURIES FIVE CONTROL CABLES**

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Vol. 3, No. 12, Dec. 1972, pp 24-25, 5 Phot

Burlington Northern has used a cable-laying machine to bury signaling and communications cables. Six cables were buried five feet deep along seven miles of main line. Five cables were buried along three miles of branch line. Static wire and cables were buried in 3,000 to 5,000 foot lengths. High voltage power lines parallel to the tracks were interfering with the railroad signals and communications. The ac induction into the tracks was dangerous. On the first pass, the cables are buried in the trench cut by the plow. Work train speed is one mile per hour. Plow operator and workmen on the reel car had radio contact with the locomotive engineer.

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**041129****KCS EXTENDS REMOTE CONTROLLED LOCOMOTIVE OPERATION AND CTC**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 12, Dec. 1972, pp 28-29, 3 Phot

By the end of 1972, Kansas City Southern will have 11 sets of remote locomotive control equipment installed in its units. Synchronous power to the rear permits slashing drawbar and knuckle failures 50% compared with all power at the head end. Location of rear consists must be varied depending on loading, train length, and weather. With remote control locomotives in the train, there is a reduction in slack action, faster charging of the brake pipe at terminals, an improvement in starting, and a reduction in sticking brakes. Since braking response is improved, train speeds can be increased. Splitting power reduces the potential for derailling long cars, and reduces wheel and flange wear. The characteristics of handling short trains are imparted to the longest. Heavier trains can be moved over the ruling grades.

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**041132**

**HOW TO MAKE ACI MORE EFFECTIVE**

Schiefelbein, RJ, Servo Corporation of America

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 9, Sept. 1972, pp.26-27, 1 Fig, 2 Phot

Data Enhancement is the technique of combining two lists from independent sources to provide a merged list which is more accurate and more complete than either of the two source lists. Data Enhancement may be performed manually or by computer. The Servo approach is to place ACI scanners at all approaches to the yard, and at such a distance to provide lead time for handling the data. A miniprocessor performs two functions: data concentration from the scanners, and data enhancement. The second source is a train consist entered via a card reader. The technique provides verification of advanced consists on trains arriving the yard. The enhanced list is said to be more accurate than an inbound physical check because a physical check is subject to clerical errors. The system points the way to the future by automating information flow for train arrivals in a yard. An example of an enhanced list is presented as an illustration.

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**041133**

**UPGRADING EXTENDS POLE LINE LIFE**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 8, Aug. 1972, pp 13-15, 1 Fig, 6 Phot

Illinois Central elected to upgrade the pole line on a railroad route where microwave was not required. The program included inspection, ground line treatment, and pole reinforcing. An initial sample of 500 poles indicated about 65% of the poles could be retained in service. The entire project took five years to upgrade the 6,000 poles. Osmose Wood Preserving Company was the contractor for the project. Experience over the last two winters resulted in no poles broken due to ice and wind. Generally, the pole line has two cross arms, one for signal circuits and one for communications circuits. Illinois Central is continuing to upgrade this communications line, with communications lines now being transposed for 30 kHz. Upgrading of the pole line is expected to extend its life 10 years.

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**041134**

**CROSSING HAS ONE CIRCUIT**

Pelikan, JM, Transcontrol Corporation

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 8, Aug. 1972, pp 16-17, 1 Fig, 1 Phot

A rail highway grade crossing on the East Erie Commercial at Erie presented some problems since the track is used by General Electric for testing of locomotives and transit cars. The track is equipped with catenary for 50,000 volts at 60 or 25 Hz, and speeds

can vary up to 80 miles per hour. Due to light trains a very high shunting sensitivity was required of the track circuit. Due to varying speeds, a constant warning time was required. Also, insulated joints were to be avoided. Transcontrol Corp. furnished a jointless, center fed track circuit using 387 Hz energy modulated at 180 code per minute. The constant warning time unit uses a short measuring section just ahead of the approach track circuit on each side. This unit meets all fail safe requirements.

**ACKNOWLEDGEMENT**

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**041135**

**WASHINGTON SUBWAY AUTOMATES**

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Vol. 3, No. 8, Aug. 1972, 6 pp, 5 Fig

The Washington Metro will be an automated transit system. Train operation will be automatic, but an attendant will be on board. Maximum speed will be 75 mph, with headways as close as 90 seconds. The control system, to be supplied by General Railway Signal Company, will consist of three control subsystems and a computerized central control facility. The subsystems are: automatic train protection, automatic train supervision, and automatic train operation. This article presents information on these subsystems, and includes block diagrams and illustrative diagrams. Train Detection, Automatic Speed Commands, Metro-Link Hardware, Flyby Receivers and Transmitters, and the Door Operating system are discussed. Also discussed are Dispatching of Trains, Interlockings, and the No-Break Power Supply.

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**041137**

**KNOWLEDGE OF ACI HELPFUL TO SYSTEMS ANALYSTS, PROGRAMMERS**

Seamon, JH, Missouri Pacific Railroad

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 7, July 1971, pp 14-17, 4 Fig, 2 Tab

Some basic knowledge of Automatic Car Identification data is essential for optimum use of ACI data in an information system. Basic ACI data includes reporting marks and position in train for every unit of rolling stock. ACI data can be used to correct reporting marks in a train file, correct the location of cars in a train file, detect no-bill cars in a train, and detect the omission of cars from a train. This article explains how the aci label data is handled by the ACI decoder and the ACI optional features, how the ACI check digit works, and how equipment information is encoded in the label. An example of ACI output data is analyzed and interpreted. Basic processing steps to be taken with ACI data are presented.

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**041138**  
**LABEL IS INFORMATION SOURCE FOR ACI SYSTEM**

Seamon, JH, Missouri Pacific Railroad

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 7, July 1971, 3 pp, 4 Fig

The label is the information source for the Automatic Car Identification System. The label is exposed to the railroad environment, and it has been found to be the source of most of the problems with ACI data. For the ACI to be of maximum usefulness and reliability, every unit of rolling stock must be labeled, the data in the label must be correct, and the readability of the label must be maintained. Critical to good label application practices are four points: correct data must be encoded in the label, the scanner must be able to see the label, can count logic requires proper horizontal placement, proper application and optimum location are essential for maximum label life. Avoid placing labels in dirty areas on the car, or in areas susceptible to damage. Generally, lower locations are dirtier, and the labels should be higher within the permitted area. Cars with curved sides may require flat vertical brackets for labels. Flat cars present some difficult location problems. Label location diagrams are presented. Proper label application practices will result in optimum label readability, minimum label maintenance, and maximum label life.

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**041139**  
**P&PU HAS ACI IN TERMINAL CONTROL SYSTEM AT E. PEORIA.**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 7, July 1971, pp 22-24, 2 Fig, 3 Phot

Peoria and Pekin Union has nine Automatic Car Identification scanners strategically located to record all inbound and outbound moves at East Peoria A and B yards. There are three scanners at the entrance to B yard (North End), three at the entrance to a A yard (South End), and three between the two yards. Three label decoder processors are used, each of which handles three scanners. Each LDP is considered to be a 1050 on the Central data system. The central computer is a Honeywell 115 with 32K memory. ACI data provides the official interchange time between the user railroads. From the ACI list of inbound trains, the central computer makes up the switch lists. By using data enhancement procedures involving advanced consists, unreadable label car data is matched with the waybill file.

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**041141**  
**MISSOURI PACIFIC CONTINUES ACI TEST**

Railway Signaling and Communications (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 63, No. 1, Jan. 1970, pp 32-37, 2 Fig, 5 Phot

Missouri Pacific has installed five Automatic Car Identification scanner/decoders at Dupo, Illinois. Four of the scanners are located on the double track main line, bracketing the yard, and one is on the TRRA interchange track. All movements into or out of the yard are

captured. The Sylvania units are equipped with 500 label buffer core storage, piggyback format control, message generator and calendar clock. The clock is battery fed. Carrier Indexes are on order. Transmission from the scanner sites is via 100 wpm teletype over leased lines to Model 28 ROTR paper tape punches at the yard office. Either printed copy or punched cards may be reproduced from the paper tape. Dupo was selected because it provided a high volume of rail traffic, could make good use of the ACI data, was easily accessible, and was typical of other terminals. About 50 percent of the cars passing the scanners are labeled, and almost 96 percent of the labels yield correct output. Problems have been noted with labels, particularly on certain types of cars. Two scanners are activated by crossing gate circuits, two by audio frequency overlay, and the interchange scanner by style C track circuits. Planning beyond the Dupo installation is continuing.

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**041160**  
**RR MEN MASTER TECHNOLOGY**

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Vol. 3, No. 10, Oct. 1972, pp 12-17, 4 Phot

Railroad departments and functions cannot afford to become too compartmentalized. There is a need for an interchange of ideas among those concerned with the different functions of the railroad which can lead to fruitful technological development. Those areas considered essential to continued progress are improved car utilization through information systems, advanced communications and signal systems. The advantages of these systems are becoming evident as railroads increasingly rely on automatic car identification, computers and car information systems.

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**041220**  
**NYCTA HAS COMMUNICATION NET**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 11, Nov. 1972, pp 22-23, 5 Phot

New York City Transit Authority is completing the installation of its two-way radio system for the subways. The system was designed to operate in the subways where radio transmission has always been a problem. A special two-way radio antenna was designed for the tunnels. The antenna has two wires separated by an air core in polyethylene insulation with an elliptical cross section. This design provided a significant reduction in installation costs. The heart of the system is the Transportation Command Center at the Brooklyn headquarters. When completed, the communications system will permit motormen and transit police to communicate with their command centers from any point on the 237 mile system, except for a few tunnel areas. The average monthly tally of communications for rapid transit and police is nearly 130,000 messages.

**ACKNOWLEDGEMENT**

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**041221**  
**SP WORKS INSULATED JOINTS INTO RAIL WELDING**

Dove, RE, Railway Track and Structures

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 11, Nov. 1972, pp 24-25, 6 Phot

Southern Pacific has adopted an approach to insulated joints in welded rail that involves the prefabrication of a bonded insulated joint between two 39 foot rails and the subsequent welding of the resulting 78 foot rail into welded strings at the welding plant. The insulated joints are assembled using an epoxy resin and Huck fasteners, and the epoxy is allowed to set for about 12 hours, after which the insulating value is tested with an Ohmmeter. The 78 foot rail must be backed into the welding machine. Such incorporation of the insulated joint into the welded rail string requires pre-planning the location of the insulated joints in the welded rail strings, and careful attention to the loading diagram when loading and unloading the welded rail train. The loading diagram is placed in a container at the loading end of the welded rail train.

**ACKNOWLEDGEMENT**

Railway System Controls

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.75

**041231**  
**ACI TERMINAL MANAGEMENT SYSTEM**

Dillenbeck, LI, Peoria and Pekin Union Railway

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

Dec. 1971, pp 6-11

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

This paper describes the Automatic Car identification used at East Peoria by the Peoria and Pekin Union Railway. Nine ACI scanners are located on yard lead tracks, and are handled by three Label Decoding Processors. Manual checking of inbound and outbound trains has been eliminated. The ACI information is automatically produced on punched cards for the yard inventory system. The ACI data is also used in preparation of joint facilities reports, for some demurrage records, and for repair shop work reports. The paper also describes the procedure for re-identification of 'no reads' or of incorrectly read labels. The paper also describes experiments with a secondary label for repetitive billing.

**ACKNOWLEDGEMENT**

Association of American Railroads

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AAR, Repr PC: \$6.00

**041239**  
**MOPAC'S ACI DATA ENHANCEMENT PROGRAM**

Scheibal, LL, Missouri Pacific Railroad

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

Dec. 1971, pp 113-129, 6 Tab

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Data Enhancement, when applied to Automatic Car Identification Data, is the technique of combining the ACI data with data from an independent source to produce data of higher quality. Missouri Pacific has developed a program to perform data enhancement on a computer in batch mode. This paper describe the matching routines and matching criteria, presents a proposed reliability index, presents examples of both computerized and manual data enhancement, and presents theoretical material on Data Enhancement including curves for the probability that enhanced data will be correct.

**ACKNOWLEDGEMENT**

Association of American Railroads

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

AAR, Repr PC: \$6.00

**041250**  
**MINI-COMPUTER APPLICATIONS WORKSHOP--MINI-COMPUTER FOR ACI DATA EDITING AND CONCENTRATION**

Webster, W, Canadian National Railways

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

Dec. 1971, pp 179-183

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

This report is a brief resume of the consideration given to the decision to install a mini computer to edit and concentrate Automatic Car Identification data at Canadian National Railways' Calder, Alberta Yard. It is also an implementation report of use and exploration of the data handling technique. The economics of ACI scanners at this location are not detailed.

**ACKNOWLEDGEMENT**

Association of American Railroads

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AAR, Repr PC: \$6.00

**041602**  
**KCS' DERAMUS YARD BECOMES AN "ACI" YARD**

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 1, Jan. 1973, pp 44-49, 1 Fig, 4 Phot

Automatic Car Identification has now been tied into the work of railroad classification yards. The rail Terminal management System has been developed by Kansas City Southern and ACI Systems Corporation. This system combines the ACI scanners, Abex Traffic Monitor directional wheel sensors, and mini-computers. Instant access can be had to information on the location of any car in the yard. Any car entering or leaving the yard area passes one of five ACI scanners. Four addition scanners monitor movements at strategic points in the yard. The active portion of the yard is blanketed with 252 wheel sensors to track the movement of cars. The yard has 31 classification tracks, and handles about 2,000 cars per day. Over 50 classifications are provided without reswitching of cars per day. Over 50 classifications are provided without reswitching of cars by making directional classifications into either end of tracks. Wheel passage over a sensor generates a pair of distinctive electrical outputs that provide unambiguous monitoring during stops or reversals. The yard data processor includes a car file with axle count by ownership and series. There are two wheel monitor processors and four label decoder processors. The ACI logic has three maps: the classification table, a sequential flow map, and a physical map of wheel sensors.

**ACKNOWLEDGEMENT**

Progressive Railroading

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Murphy-Richter Publishing Company, 9 South Clinton Street,  
Chicago, Illinois, 60606, Orig PC: \$

**041609**  
**STATUS, USE AND RELIABILITY OF ACI**

Seamon, JH, Missouri Pacific Railroad

Association of American Railroads Research Center, 3140 South  
Federal Street, Chicago, Illinois, 60616

Proceeding, Sept. 1970, pp 597-608

This paper was presented at the Tenth Annual Meeting of the  
Communication and Signal Section of the Association of  
American Railroads, San Francisco, California, September 15-17,  
1970.

Automatic Car Identification systems involve the labels on the  
rolling stock, the scanner/decoder and accessories, and the commu-  
nications link and output devices. At the time of writing (Sept. 1970)  
86% of the cars were labeled and 121 scanner/decoder systems were  
installed. Uses of ACI will develop in four broad areas: (1) stand al-  
one systems, (2) locally integrated systems, (3) centrally integrated  
systems, and (4) special applications. Because of incomplete labeling,  
a separate source of data and the 'Data Enhancement' technique  
are needed to produce a complete, correct list. Observations indicate  
that 3% of applied labels are bad labels. A list of scanner applications  
to date is included, as is a summary of data enhancement trials. An  
Estimating Check List for Field Installation is presented. Comments  
from the floor are included.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041610**  
**ELECTRIFICATION—ITS EFFECT ON SIGNALING AND  
COMMUNICATIONS**

Stinson, GE, Westinghouse Air Brake Company

Association of American Railroads Research Center, 3140 South  
Federal Street, Chicago, Illinois, 60616

Proceeding, Sept. 1970, pp 554-568

This paper was presented at the Tenth Annual Meeting of the  
Communication and Signal Section of the Association of  
American Railroads, San Francisco, California, September 15-17,  
1970.

Electrification of a railroad generally involves costly changes to  
the signaling and communications facilities. Electrification provides  
significant benefits to the railroads and to the public. Power circuits  
will produce extraneous voltages and currents in communication cir-  
cuits, caused by magnetic induction, electric induction, ground po-  
tential conduction, or accidental connection. Rails are grounded  
through ballast, and part of the return current flows through the  
ground. One means of reducing the induced voltages over long dis-  
tances is the three-wire system using autotransformers and a negative  
feeder. Fault currents can cause high induced voltages and currents.  
Unless preventive steps are taken, hazards can exist for personnel and  
equipment. Electrification will generally be applied to high density  
lines which already have extensive communications and signaling fa-  
cilities. Installation will have to be accomplished under traffic without  
disruption of traffic. The challenge is to make the changes to signal-  
ing and communications add to the benefits rather than just to the  
costs. Several diagrams are included illustrating the induction effects.

**ACKNOWLEDGEMENT**

Association of American Railroads

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
AAR, Repr PC: Req Price

**041626**

**RAILROAD OPERATION AND RAILWAY SIGNALING**

Phillips, EJ, Jr

Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013

This is a reprint of the 1953 edition. The price for 1 to 9 copies  
is \$5.95 each, and for 10 or more it is \$5.00 each.

The basic text which explains the relationship between train op-  
eration and railway signaling is now available in reprint form. The  
text is in the form of questions and answers so that the reader may  
know the objective of the information given, and to place emphasis  
upon the "why" and "how" of railway signaling and railroad oper-  
ation. Topics covered include fixed signals, block signaling, interlock-  
ings, centralized traffic control, cab signals and highway grade cross-  
ing protection.

**ACKNOWLEDGEMENT**

Railway System Controls

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: \$5.9

**041631**

**TELEMETRY APPLICATIONS IN GRADE CROSSING  
PROTECTION**

Hopkins, JB

Instrument Society of America, 400 Stanwix Street, Pittsburgh,  
Pennsylvania, 15222

Proceeding, 1971, pp 159-165

This report consists of the proceedings of the International  
Telemetry Conference, Washington, D.C., September 27-29,  
1971, Volume 7.

Two microwave system concepts are described, representing ap-  
plication of telemetry and radar to grade crossing protection. Princi-  
ple criteria for viable final components include simple installation and  
maintainance, low cost, very high reliability, and suitability to the  
difficult railroad environment.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 072055

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**041641**

**RETARDING FORCE OF ELECTRODYNAMIC CAR  
RETARDER**

Itakura, E, Japanese National Railways  
Tsuboi, M

Electrical Engineering in Japan (Scripta Publishing Corporation,  
Investment Building, Washington, D.C.)

Vol. 91, No. 4, July 1971, pp 135-143, 9 Ref

This paper describes a method of calculating the electromagnetic  
retarding force produced by the eddy current induced in rolling  
freight car wheels. Using a simplified model representing the effect of  
the eddy current, an approximated calculation formula for the re-  
tarding force is derived. Experiments conducted on a small-scale and  
actual car retarders show good agreement between the calculated and  
measured result.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 06674

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041659

**TELECOMMUNICATION SYSTEMS IN RELATION TO 50 HZ A.C. ELECTRIC TRACTION**Tierney, JR, British Railways Board  
Gross, BHInstitution of Electrical Engineers, Proceedings (Institution of  
Electrical Engineers, Savoy Place, London WC2R 0BL, England)

Vol. 119, No. 4, Apr. 1972, pp 441-455

Current methods for reducing the effects of inductive interference in lineside telecommunication cables on railroads, electrified at industrial frequency, are summarized. The methods employed by British Railways for calculating induced longitudinal voltages in cables are outlined, together with standard calculated values in tabular form. The degree of electromagnetic shielding which can be obtained by the use of high-conductivity cable sheaths and steel-tape armoring is illustrated. The effects of the method of traction-current control in motive-power units, with respect to the generation of noise in cables, are discussed.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 015056

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041993

**ELECTRIFICATION: ITS EFFECT ON SIGNALING AND COMMUNICATIONS**

Staples, CE, Westinghouse Air Brake Company

IEEE Transactions on Industry & Genl Applications (Institute of  
Electrical and Electronics Engineers, 345 East 47th Street, New  
York, New York, 10017)

Vol. IA-8, No. 4, July 1972

When an operating railroad is electrified, the propulsion power may produce effects on the signaling and communication facilities which require conversion for compatibility. This paper suggests a systems approach to electrification, on the basis that proper coordination of propulsion power with signaling and communication facilities can materially improve the return on investment for electrification.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 064353

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043018

**GOOD GROUNDING CUTS DAMAGE**Railway Signaling and Communications (Simmons-Boardman  
Publishing Corporation, 350 Broadway, New York, New York,  
10013)

Vol. 62, No. 5, May 1969, pp 13-18

How surge develops after cloud discharge and how this instantaneous release creates surges in conductors such as tails and line wires; method of connection of apparatus and arresters to prime ground terminal; use of buried pipe lines and ground rods; resistance of ground rods that varies with depth driven; data on and graphical presentation of various suggested ground connections.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 36892

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043019

**TWO-FREQUENCY COMBINATION TYPE AF TRACK CIRCUIT**

Ito, K Kiyosawa, S

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

Vol. 12, No. 2, June 1972, pp 89-91

It is shown that in the thyristor phase controlled car placed in practical service on the a-c electrified lines, higher harmonics are involved than in the conventional rectifier type cars and in consequence the existing amplitude-modulated AF track circuit is liable to make false action. A novel AF track circuit free from the interference of such high harmonics was developed.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 24036

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043020

**INTERFERENCE MEASUREMENTS**

Kunz, R

International Railway Congress Assn Monthly Bull (international  
Railway Congress Association, 17-21 rue de Louvain, 1000  
Brussels, Belgium)

Vol. 6, No. 10, Oct. 1969, pp 402-411, 8 Ref

The disruptive effect of the earthing contact of a 50-Hz three phase current open line and of a 16 2/3 Hz railroad contact wire on telecommunications equipment. Disturbance parameters such as inductive current, interference voltage, interference current, mutual coupling, reduction factors, effect of earthed, and metal components, are examined. Amounts of interference are also to be expected in the telecommunications field in respect to the cable sheathing reduction factor, earth transfer resistance, effect of the terrain and the dissymetry and sensitivity factor of the telecommunications equipment.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 47036

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

043021

**HOW TO APPLY SURGE PROTECTION DEVICES**

Kahl, FA

Railway Signaling and Communications (Simmons-Boardman  
Publishing Corporation, 350 Broadway, New York, New York,  
10013)

Vol. 61, No. 10, Oct. 1968, p 24

Nature of over-voltage transients is examined for design and construction of transistorized devices to be used to provide control and communication functions necessary to modern railroading.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 07626

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043533

**RHE GOULD BATTERY HANDBOOK**Gould Incorporated, Handbook Department, Box 3140, Saint  
Paul, Minnesota, 55165.

300 pp

The announcement of this book appeared in the March issue of the IEEE Spectrum, 1973.

This handbook covers many kinds of batteries, among them dry cells, alkaline manganese, mercuric oxide, zinc air, solid state, lead-lead dioxide, sealed Gelyte, Nicad, and silver zinc batteries. It also covers battery applications and battery charging. It contains curves, tables, illustrations, and photographs.

**ACKNOWLEDGEMENT**  
IEEE SPECTRUM

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Gould Incorporated, Handbook Department, Box 3140, Saint Paul, Minnesota, 55165, Orig PC: \$14.9

**043535**  
**RAILROAD DATA BOOK**

Arcata Communications Information, 665 National Press Building, Washington, D.C., 20004

The announcement for this book appeared in Railway System Controls, September 1971. Monthly updates of this publication are \$5.00 each.

A Railroad Radio Data Book provides information on more than 8,350 active stations authorized by the FCC in the railroad radio service. The directory alphabetically lists all carriers using radio, and gives locations of transmitters, call signs, specific frequencies authorized, plus the number of mobiles, bases and other types of stations authorized. Also included, in another portion of the book, is similar information for licensees in the motor carrier radio service.

**ACKNOWLEDGEMENT**  
Railway System Controls

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Arcata Communications Information, 665 National Press Building, Washington, D.C., 20004, Orig P \$40.00.

**043538**  
**BIGGER BUGS IN BART?**

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Mar. 1973, pp 32-37

Six months in partial service have raised questions about BART's automation and its safety features. On October 2, 1972 a computer-controlled BART train overshot the Fremont station and plunged the lead car onto a sand bank. The cause was a malfunction of a crystal oscillator on board the lead car. This article reviews some of the problems that have occurred, and summarizes some of the reports that have been released. A report by State Legislative Analyst Alan Post has two principal stipulations: (1) that BART's service began without adequate checks and with train control deficiencies, and (2) that BART was overcharged for the system engineering and construction-management services. Post's report explains that the low-power circuit in the tracks may not detect a train under certain conditions. BART has run 28 million passenger miles in automatic mode with manual block as backup for train separation. Present operations, according to BART, are fully automatic more than 95% of the time. A report by Battelle Institute concluded that under normal conditions the system appears to operate in a manner that is not unsafe; under conditions of single malfunctions no clearly defined unsafe operating condition was identified, and that the operating safety of the vehicle system depends on redundant rather than fail-safe circuits. The article also presents some of the reactions of the consultants and of the supplier of the automatic control system. The article notes that off-the-shelf mechanical wheel scrubbers may solve the train detection problem. The article concludes with some findings of a

blue ribbon panel.

**ACKNOWLEDGEMENT**  
IEEE Spectrum

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10 Repr PC: Req Price

**043594**  
**SOO LINE USES ACI AS A DAILY WORKING TOOL**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 4, No. 2, Feb. 1973, pp 12-13, 4 Phot

A condensed version of this article appeared in Railway Age, March 26, 1973.

By covering all entrances-exits of its Schiller Park yard with automatic car identification, Soo Line has obtained better control of its operations. Over 800 cars are scanned daily at the north end and over 1,600 cars are scanned each day at the south end. One scanner covers the single track north of the yard, while two aci scanners cover the double-track line at the south end. Soo's central computer at Minneapolis polls the aci equipment. The aci list-reversed in car order by the computer and enhanced by matching with an advanced consist when available-is returned to the yard office usually within 15 minutes after a train passes the scanner.

**ACKNOWLEDGEMENT**  
Railway System Controls

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**043595**  
**INDUCTIVE COORDINATION GETS SYSTEMS APPROACH**

Judkins, RE, Northern States Power Company  
Thorson, JM, Jr, Northern States Power Company

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 4 N2, Feb. 1973, 16 pp, 4 Fig, 2 Tab, 1 Phot

This article is essentially the full text of a paper delivered at the Communications and Signal Section, AAR, 1972 annual meeting.

To help solve the problems of inductive interference that might result when a high-voltage power line is constructed along a railroad right-of-way, Northern States Power Co. used the system approach. When NSP was about to build an 11-mile parallel of high-voltage transmission lines along Burlington Northern lines in Minnesota, the approach taken was to determine correct solutions for the problems that the induced voltages might cause. Subjects considered high-speed protective relaying, protection for signal and communications circuits, and grounding, among others.

**ACKNOWLEDGEMENT**  
Railway System Controls

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Simmons-Boardman Publishing Company, 350 Broadway, New York, New York, 10013, Repr PC: \$0.75

**043601**  
**AUTOMATIC CAR IDENTIFICATION LABEL EVALUATION AND REPAIR PLAN. PRELIMINARY REPORT**

Association of American Railroads, 3140 South Federal Street,

Chicago, Illinois, 60605 Proj No 71-R-39  
R-112, Dec. 1971, 14 pp, 1 Fig, 4 Tab, 1 Phot

Field experience with ACI indicates there are labels on equipment that require some form of attention. These labels are identified as problem labels and include improper label applications and labels which failed to output correctly due to dirt and damage or other defects common to the operating environment. The AAR Research Center initiated and conducted a comprehensive field study in order to make an objective assessment of problem labels. This study was conducted in the Chicago Terminal District where data were accumulated on a 24-hour basis for 30 days. This is a preliminary report on the ACI label evaluation study conducted by the AAR Research Center in the Chicago Terminal District from June 28 to July 31, 1971. A total of 61,119 freight car sides were sampled and inspected. Of these, 91.43 percent were labeled. Of the labeled sides, 52,423 exhibited valid or useful labels resulting in an Overall User Value of 85.77 percent. The Overall User Value is an indication of how much good data is obtained from all of the cars. A total of 3,456 or 6.18 percent of the labels were identified as problem labels. Problem labels include label defects resulting from the operating environment and label defects due to application errors. Approximately 54 percent of the label defects resulted from the operating environment and 46 percent were due to application errors. Of the environmental defects, approximately 52 percent were due to dirt and the balance due to damage, missing labels, etc.

ACKNOWLEDGEMENT  
Association of American Railroads

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**043602**  
**AUTOMATIC CAR IDENTIFICATION LABEL**  
**EVALUATION**

Githin, V Taylor, CE

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

June 1972, 24 pp, 7 Tab, 1 App

Growing concern over the number of ACI labels that fail to output correctly prompted a comprehensive label study by the AAR Research and Test Department. The study was conducted in the Chicago Terminal District in July 1971. Data were collected by AAR personnel on a twenty-four hour basis for thirty days. In this period, 61,119 car sides and 1,814 truck-trailer sides were scanned by two KarTrak 800 Series ACI Scanners, and then were inspected by study team personnel. All labels that failed to read correctly were closely inspected and their condition noted on label inspection forms. The data on these inspection forms were key punched for computer processing and analysis. Statistically valid label data for 30,282 car sides scanned and inspected during the AAR's ACI label evaluation study were distilled from an original sample population of 61,119 car sides. Over 8.4 percent of the 30,282 car sides were unlabeled, with the percentage of unlabeled tank cars, TOFC flat cars and covered hopper cars substantially higher than the overall average. Of the 91.6 percent of the cars that were labeled, 8.3 percent exhibited one or more label problems which prevented the ACI scanner from producing a valid record. Over 50 percent of the labels which failed to read correctly were dirty, damaged, or missing. Approximately 38 percent were assembled or applied incorrectly. Over 43 percent of the labels on TOFC flat cars failed to read due to dirt; about 10 percent of the open hopper cars had damaged or missing labels. The analysis also revealed a functional relationship between label dirt accumulation and the duration of exposure to the operating environment, particularly in the case of TOFC flat cars. The high mileage cars grew at a rate of over 30 percent per year. Finally, of the 1,814 truck-trailer sides sampled, 21.3 percent were unlabeled and 13.4 percent of those labeled had one or more problems that resulted in invalid scanner messages. The invalid messages were due primarily to damaged and

missing labels.  
ACKNOWLEDGEMENT  
Association of American Railroads

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**044007**  
**COMMUNICATIONS-COMPUTER FOR ALL OF PENN**  
**CENTRAL**

Progressive Railroading (Murphy-Richter Publishing Company, 9  
South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 2, Mar. 1973, 3 pp, 4 Phot

The Penn Central is converting its communications network to a system that goes well beyond anything used by a railroad. It is an essential component in Penn Central's new TABS transportation and billing system. TABS will provide a uniform, real-time system for processing transportation data and billing to customers. The new communications system also ties together in one network the many different telecommunications systems now on the Penn Central, and takes a big step toward the dual objective of enhancing or updating information as its status changes, and of eliminating repetitive inputting of the same information as cars and trains move. Finally, it can give the Penn Central's telecommunications network, both the capacity and the capability of handling the sheer volume of information flow of the railroad that embraces practically the northeast quadrant of the United States

ACKNOWLEDGEMENT  
Progressive Railroading

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Murphy-Richter Publishing Company, 9 South Clinton Street,  
Chicago, Illinois, 60606, Repr PC: \$

**044016**  
**EXPANDING ROLE OF THE TRAIN DESCRIBER**

Tyler, JFH

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 1, Jan. 1972, pp 9-12

The train describer provides a base on which a complex network of reporting and control systems may be erected. Computer-controlled train describers now being installed between Weaver Junction and Glasgow will output selected operating data automatically, and the computer may be interrogated direct without disturbing the signalman. Simple routing decisions in accordance with priority rules are within the capacity of the equipment being installed.

ACKNOWLEDGEMENT  
British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044026**  
**FULLY-AUTOMATED FREIGHT TRAINS: FIVE SYSTEMS**  
**SHOW THE WAY**

Mellitt, B

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 129, No. 1, Jan. 1973, 7 pp, 9 Phot

North America has two standard-gauge automated mineral railways in commercial operation on which no train crews are employed, and others are under construction. As the systems being automated become more complex, control techniques are being developed which have to marry the driving function with traffic regulation, as well as supervising loading at terminals. The author analyses the cybernetic elements required for the operation of these unmanned freight trains, and pointed out that the same techniques will soon be applied to railways with more elaborate traffic patterns.

## ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

044027

**BR PROVES THE VALUE OF HOTBOX DETECTORS**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 129, No. 1, Jan. 1973, 2 pp, 1 Fig, 2 Phot

British Railways is now installing hotbox detectors in areas which are being resignalled, following a five-year period of evaluation: Hawker Siddeley Dynamics Engineering is supplying a further 22 detectors, bringing the number in service to over 100.

## ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

044045

**WASHINGTON OPTS FOR STAND-ALONE AUTOMATION**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 8, Aug. 1972, pp 298-302

While including all the features which make BART the first fully automated transit operation, Washington metro has specified stand-alone capability in its signalling and train regulation systems so as to allow manual operation of the full scheduled service in the event of a computer or communication failure.

## ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

044052

**A SCHEME FOR INSTALLING C.T.C. ON THE CHEAP**

Thornber, D

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 11, Nov. 1972, pp 416-419

Centralised traffic control is almost invariably introduced in under-developed countries to increase the capacity of busy sections of line. Indeed, the associated reduction in station staff can be an embarrassment rather than an advantage where high unemployment is a problem. David Thornber points out that c.t.c. can be introduced at perhaps one-fifth of the present cost if it is regarded only as a better means of communication between the controller and signalmen, while still achieving the desired increase in line capacity.

## ACKNOWLEDGEMENT

British Railways Board

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044053

**INDUCTIVE SIGNALLING FOR SPEED RESTRICTIONS ON THE GERMAN FEDERAL RAILWAY**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 12, Dec. 1972, PP 465-466

With the advent of higher speeds, the DB has adapted its inductive signalling and train control to ensure reduction of speed over restricted lengths even if the driver fails to slow down.

## ACKNOWLEDGEMENT

British Railways Board

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044201

**TWO-WAY RADIO COMMUNICATION MASS TRANSPORTATION DEMONSTRATION PROJECT**

New York City Transit Authority, 370 Jay Street, Brooklyn, New  
York, 11201 Ny-mtd-8

Existing equipment prior to the demonstration required that train crews descend to the tracks to report trouble, while police had to rely on conventional telephones available only in station clerks' booths. A variety of alternative mobile systems and components were considered, including train-to-wayside intercom systems currently used in Chicago, Toronto, and London. These proved too limited in scope for the complex New York City subway network. A portable, transistorized transmitter/receiver was judged ideal, particularly for the policemen who required compact, durable equipment. The engineering, operation, and maintenance of the selected system is documented. The improved communications were evaluated primarily in terms of reduced train delays and police reaction time. The latter was demonstrated to be particularly effective. Message delays between police dispatchers and transit patrolmen were reduced by 99%, and the ratio between crimes and arrests improved by 8% during daylight hours and rose to 95% at night. Overall operational efficiency also showed substantial improvement. The average number of train delays per month decreased 41%, and the average duration of such delays decreased 9% in the test area as compared with the system as a whole. Ridership within the test area was also shown to increase during the demonstration. It is concluded that overall, the project was successful enough to warrant the use of two-way radio equipment throughout the New York subway system. Appendices deal with capital and overhead costs for the project, and requirements for extension of the system to other divisions of the subway network.

## ACKNOWLEDGEMENT

Urban Mass Transportation Administration

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044202

**SURVEY OF ELECTRONIC COMMAND AND CONTROL SYSTEMS**

General Electric Transportation Systems Division, 2901 East Lake  
Road, Erie, Pennsylvania, 16501 Nss-6

Aug. 1967

Electronic command and control systems are studied. Vehicles considered are fixed guideway vehicles such as commuter and rapid transit cars, and roadway vehicles such as private automobiles, taxis, and buses operating on streets, highways, and commuter corridors. The command and control systems refer to electronic and electric systems in the broad sense, to include lasers, transponders, radar, computers, and other advanced means of controlling vehicles. The systems of command and control include the following functions: (a) sensing to acquire data on location and classification of vehicles and to make measurements of traffic conditions; (b) communication of data to central processing facilities; (c) analyses of data to allow decision making with either automatic or manual strategy selection processes and display; (d) communication of commands to execute control of vehicles either automatically or through driven advisory equipment; and (e) automatic fare collection and inventory systems. A comprehensive survey is conducted of state-of-the-art command and control systems for urban transportation systems and vehicles. The types of systems surveyed are: data requisition, vehicle control, priority and routing, supervisory, inventory, and fare collection.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044203**

**THE APPLICABILITY OF DATA COMPRESSION SCHEMES TO URBAN LOCATION AND COMMUNICATIONS SYSTEMS**

IIT Research Institute, 10 West 35th Street, Chicago, Illinois,  
6912 Md-Mtd-4

Dec. 1969

Alternative techniques for data compression which could be employed by location and communications systems to reduce bandwidth requirements for radio transmission are examined. The authors note that selection of a data compression technique first requires the delineation of information requirements and definition of desired tolerance levels for data scope and flow. Data compression techniques are detailed within two generic concepts: (1) methods to reduce information volume; and (2) time sharing. Techniques to reduce the amount of data which must be transmitted are examined assuming the eventual system will not rely upon voice communications. Two alternatives are considered in which only changes in certain operational variables are transmitted. Such changes could correlate either with preceding inputs or with predictions. In the latter case, the system would estimate vehicle performance, and display only those transmissions which deviate from the projections. Several coding methods for data compression are also discussed, such as the "ten-code" used in voice communications between police units and dispatchers. Mathematical techniques used to predict vehicle performance are employed to reduce data requirements to those which indicate deviations from the predictions. Several interpolation compressors and sampling methods are analyzed with reference to bandwidth utilization.

**ACKNOWLEDGEMENT**

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**044204**

**DIGITAL-VOICE OVERLAY FOR LAND MOBILE COMMUNICATIONS**

Scales, WC

IIT Research Institute, 10 West 35th Street, Chicago, Illinois,

60616 Md-mtd-4

Nov. 1970

The technical feasibility of alternative means of multiplexing data and voice transmissions in a vehicle location and communications system is treated. Multiplexing refers to the sharing of a transmitter, a receiver, and a radio frequency channel by different users. Two multiplexing techniques are discussed: "time division" methods (tdm), in which each broadcaster is given a particular time slot during which he may transmit data and all other users remain silent; and frequency slot separated by guard bands to minimize cross-channel effects. Because tdm technology cannot easily or economically handle both voice and digital transmissions, the report focuses on fdm applications. Fdm systems necessarily employ equipment to modulate voice and data inputs in order to channel them into their appropriate slots. Considerations in applying channel modulation in location and communications systems are (1) frequency modulation, which is standard for land mobile services but requires potentially undesirable bandwidth occupancy requirements; (2) amplitude modulation, which suffers potential fading and drifting problems; (3) frequency shift keying; (4) phase-shift keying; and (5) on-off keying. Bandwidth requirements and data rate capability are discussed with reference to alternative fdm applications. Trade-offs in voice-data multiplex are considered in terms of power requirements for switching between voice and digital transmissions in the same frequency sub-channel. Baseband spectrum occupancy, power requirements, and on operational considerations are also examined. The report concludes with a brief discussion of federal communications regulations that apply to implementation.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044312**

**USE OF MINICOMPUTERS IN CTC OPERATION**

Marsh, DB, General Railway Signal Company

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

Paper C73926-3-IA, Jan. 1973, 8 pp, 13 Fig

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

This paper is organized into four divisions such that each division is an attempt to answer one of four questions. The four questions are: (1) What is computerized cTc? (2) How does computerized cTc function? (3) What need does computerized cTc fill? and (4) To what will the acceptance of computerized cTc lead: what may be the time frame? Centralized Traffic Control (cTc) is a method for controlling the traffic on a railroad system from a central location. The application of cTc has generally been restricted to main line operation between distant points so that railroad lines covering hundreds of miles are controlled over a telemetry system from a single location. The cTc system may therefore be considered in three parts; that is, the field circuits or field stations, the communications circuit or circuits which link the field to the single central location (office), and the central location or office itself. Computerized cTc is an office device which interfaces to the communications circuits to interrogate the status of the field locations and control these field locations. As computerized cTc is presently viewed by General Railway Signal, the computerization of the office need have no immediate impact on any existing field circuit design.

**ACKNOWLEDGEMENT**

Institute of Electrical and Electronics Engineers



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**044511**  
**THE LOUVRED LABEL FOR AUTOMATIC CAR IDENTIFICATION**

Seamon, JH, Missouri Pacific Railroad

Missouri Pacific Railroad, Missouri Pacific Building, 210 North  
13th Street, St. Louis, Missouri, 63103

Feb. 1971, 27 pp, 22 Fig

This report was originally prepared for use of the AAR Ad Hoc  
Committee on Automatic Car Identification Implementation. A  
condensed version of this paper appeared in Railway System  
Controls for June 1973.

Testing and observation have indicated some serious problems  
with readability of ACI labels. Low mounted labels are difficult to  
read because: (1) scanner optics are somewhat less efficient for low  
labels, (2) the reflectivity of the label material is reduced because of  
the angle at which the light strikes the label, and (3) low labels are  
particularly susceptible to dirt and to damage. Where possible, the  
location of the label should be raised. However, it is not possible to  
raise the label on a flat car. To improve the readability of low labels,  
a louvred label has been designed that positions each label module  
such that the incident light from the scanner beam strikes the module  
perpendicularly for maximum reflectivity. Test plates have been ma-  
nufactured and applied to flat cars. Exhibits include reflectivity  
curves, oscilloscope traces, and diagrams and sketches of the louvred

label. Several configurations make possible mounting of the label on  
tight clearance locations of flat cars. Mounting instructions are  
included.

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**044562**  
**C&S: BIG SPENDING YEAR SHAPES UP**

McKnight, RW

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 41-42, 1 Fig

Equipment manufacturers and system control suppliers should  
find 1973 a satisfying year. Total spending for such material by U.S.  
and Canadian railroads will amount to some \$345 million, an 8% in-  
crease over last year. Transit authorities are planning to spend \$71.7  
million, a 106% increase over the 1972 figure. U.S. and Canadian  
authorities are planning 1973 expenditures as follows: Communica-  
tions up 18%, data processing up 382% and signaling up 109% from  
1972 spending plans. Automatic Car Identification is a major item in  
railroad plans for this year.

**ACKNOWLEDGEMENT**

Railway Age

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York, New York, 10013, Repr PC: No charge

043284

**HUMAN FACTORS SURVEY OF LOCOMOTIVE CABS**

Jankovich, JP

Naval Ammunition Depot, Crane, Indiana

June 1972, 237 pp

The purpose of the investigation was to review design of locomotive cabs from the human factors point of view. The following areas of human factors engineering are discussed: construction of cab interiors; design of controls and displays; atmospheric conditions in the cab; noise and vibration; seat design; physiology and vigilance of train driving. Discussion of each subject is divided into three sections: survey of relevant literature, conditions on domestic locomotives, and recommendations to improve present models and future design. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213225 /

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043286

**THE MOTION COMMOTION HUMAN FACTORS IN TRANSPORTATION**

Millar, AEJ Rosen, RL Gibson, JD Crum, RG

Old Dominion University, Research Foundation, Norfolk, Virginia

NASA-CR-129092, 1972, 244 pp

Contract NGT-47-003-028

Sponsored in part by American Society of Mechanical Engineers.

The program for a systems approach to the problem of incorporating human factors in designing transportation systems is summarized. The importance of the human side of transportation is discussed along with the three major factors related to maintaining a mobile and quality life. These factors are (1) people, as individuals and groups, (2) society as a whole, and (3) the natural environment and man-made environs. The problems and bottlenecks are presented along with approaches to their solutions through systems analysis. Specific recommendations essential to achieving improved mobility within environmental constraints are presented.

**ACKNOWLEDGEMENT**

National Technical Information Service, N73-1189

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043621

**DESIGN AND CONSTRUCTION OF A PORTABLE OCULOMETER FOR USE IN TRANSPORTATION ORIENTED HUMAN FACTORS STUDIES**

Davis, PW Lutz, JS Warner, A Iannini, AA

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-OST-71-13, Tech Rpt, Aug. 1971, 44 pp

The report describes development of an instrument designed to acquire and process information about human visual performance. The instrument has the following features: It can be operated in a variety of transportation environments including simulators, cars, trucks, trains, and air traffic control stations; The visual performance measurements are made without alteration of the subjects' normal visual behavior; and The data can be presented to the experimenter

as either a video picture of the scene with the fixation point superimposed, or as derived eye-motion parameters. (Author)

**ACKNOWLEDGEMENT**

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043787

**THE INCIDENCE OF DRUGS IN FATALLY INJURED DRIVERS**

Woodhouse, EJ

Midwest Research Institute, Kansas City, Missouri MRI-3540-C

Final Rpt, 7206-7209, Sept. 1972, 77 pp

Contract DOT-HS-119-1-173

Methods for the collection of blood, urine, bile and alcohol washes of face and fingers from fatally injured drivers were developed. Specimens were collected from the Alcohol Safety Action Project areas. The samples were supplied by coroners and medical examiners from fatally injured drivers who were dead on arrival at the hospitals. Nine hundred and twenty-nine specimen collection kits were distributed to 44 different areas. Methods for analysis of blood, urine and bile for 44 commonly abused drugs were developed. These methods consisted of extraction of the fluids, followed by a qualitative thin-layer chromatographic screen. Alcohol washes of face and fingers were examined for evidence of marihuana. The analytical results indicated that 51% of the drivers had ingested alcohol and 33% of the drivers were legally drunk (alcohol content of blood greater than 0.15%). Twenty-four percent of the specimens examined evidenced the presence of drugs other than alcohol: 11% evidenced drugs and no alcohol; 13% evidenced drugs and alcohol. (Author)

**ACKNOWLEDGEMENT**

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043793

**HUMAN FACTORS CRITERIA FOR VEHICLE CONTROLS AND DISPLAYS**

Malone, TB Krumm, RL Shenk, S Kao, H

Essex Corporation, Alexandria, Virginia

Final Rpt, 7107-7208, Sept. 1972, 54 pp

Contract DOT-HS-120-1-174

See also report dated Sep 72, PB-214 069.

The study was directed toward developing valid criteria for the standardization of control and display location, coding, and operation in passenger cars, trucks, and buses. Five tasks were accomplished. Task 1 comprised an analysis of the commonality of control-display design arrangements in existing vehicles, and an assessment of the degree of the nonstandardization problems. Tasks 2 and 3 were directed toward developing criteria for C/D location and coding/operation respectively. Task 4 involved a study of 3 beam headlamp system control concepts. Task 5 comprised an experimental program to support Tasks 1, 2 and 3. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214352/7

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043794

**HUMAN FACTORS CRITERIA FOR VEHICLE CONTROLS AND DISPLAYS: APPENDIX A**

Malone, TB    Krumm, RL    Shenk, S    Kao, H

Essex Corporation, Alexandria, Virginia

Final Rpt, 7107-7208, Sept. 1972, 204 pp

Contract DOT-HS-120-1-174

See also report dated Sep 72, PB-214 067.

The study was directed toward developing valid criteria for the standardization of control and display location, coding, and operation in passenger cars, trucks, and buses. Five tasks were accomplished. Task 1 comprised an analysis of the commonality of control-display design arrangements in existing vehicles, and an assessment of the degree of the nonstandardization problems. Tasks 2 and 3 were directed toward developing criteria for C/D location and coding/operation respectively. Task 4 involved a study of 3 beam headlamp system control concepts. Task 5 comprised an experimental program to support Tasks 1, 2 and 3. (Author)

**ACKNOWLEDGEMENT**

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043795

**HUMAN FACTORS CRITERIA FOR VEHICLE CONTROLS AND DISPLAYS: APPENDIX B**

Malone, TB    Krumm, RL    Shenk, S    Kao, H

Essex Corporation, Alexandria, Virginia

Final Rpt, 7107-7208, Sept. 1972, 118 pp

Contract DOT-HS-120-1-174

See also report dated Sep 72, PB-214 066 and PB-214 068.

The steps followed in developing the standard C/D panels for each vehicle class are presented.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214067/1

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043796

**HUMAN FACTORS CRITERIA FOR VEHICLE CONTROLS AND DISPLAYS: APPENDIX C**

Krumm, RL    Malone, TB    Kao, H    Shenk, S

Essex Corporation, Alexandria, Virginia

Final Rpt, 7107-7208, Sept. 1972, 82 pp

Contract DOT-HS-120-1-174

See also report dated Sep 72, PB-214 067, and PB-214 069.

Contents: Base line experiments; Comparisons of driver performance using alternative panels within vehicle classes; Analysis of driver performance across vehicle classes.

**ACKNOWLEDGEMENT**

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043797

**HUMAN FACTORS CRITERIA FOR VEHICLE CONTROLS AND DISPLAYS: APPENDIX D**

Krumm, RL    Malone, TB    Kao, H    Shenk, S

Essex Corporation, Alexandria, Virginia

Final Rpt, 7107-7208, Sept. 1972, 22 pp

Contract DOT-HS-120-1-174

See also report dated Sep 72, PB-214 068.

A 3-beam headlight control study included concept development and experimental study.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214069/7

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043998

**DETECTION AND RECOGNITION OF COLORED SIGNAL LIGHTS**

Reynolds, RE    White, RM    Hilgendorf, RL

Human Factors (Johns Hopkins Press, Homewood Campus, Baltimore, Maryland, 21218)

Vol. 14, No. 3, June 1972, pp 227-236

Two experiments were designed to determine effective colors for stimulus lights as measured by speed of detection and accuracy of identification. In addition, the nature of the interactions between stimulus color, background color, and amount of ambient illumination was assessed. Responses to four stimulus lights (red, green, yellow, and white) were evaluated against four colored backgrounds (copper, tan, blue, and green) under two levels of ambient illumination. The overall ordering of stimulus colors as measured by speed of responding was, from fastest to slowest, red, green, yellow, and white. For errors in color naming, the order from least to most was green, red, white, and yellow. Detection and identification were more difficult under bright ambient illumination. The addition of an identification task added about 0.25 second to the response times for each color.

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044187

**ACCELERATION AND COMFORT IN PUBLIC GROUND TRANSPORTATION**

Gebhard, JW

Applied Physics Laboratory, 8621 Georgia Avenue, Silver Spring, Maryland, 20910 Trd-43

Feb. 1970

Conventional transportation systems such as subway trains and buses are now designed to accelerate at about 4 ft/sec/sec (3 mph/sec). Electrically powered rapid transit cars of the last 10 years have an initial-acceleration range of 2.5 to 3.2 mph/sec (0.11 to 0.14 g). This performance will accelerate a vehicle to a speed of 30 mph in 10 seconds. Crucial to the longitudinal acceleration level that can be accepted by passengers is the preparedness of the passenger at the onset of motion. When the traveler is seated and expectant, the smooth

takeoff of a jet airliner is not at all uncomfortable, although at 0.5 g some difficulty would be found in leaving the seat. Nevertheless, when the trains in the Paris metro system were fitted with rubber-tired wheels and acceleration was increased, complaints forced a return to the previous standard of about 3.3 mph/sec that had been used with steel wheels. Sudden jerks on starting or stopping are especially objectionable, since they can cause an unwary standee to lose his balance. Longitudinal accelerations and decelerations judged comfortable and acceptable on the basis of rider ratings were in the range of 0.11 to 0.15 g, and lateral accelerations were in the range of 0.06 to 0.22 g. However, existing data are inadequate for specifying acceleration limits for future systems. Since the acceleration values found are about 0.10 g lower than those that are accepted by automobile users, it may be worthwhile to investigate methods for making higher accelerations acceptable to mass transportation passengers.

#### ACKNOWLEDGEMENT

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044188

#### HUMAN SENSITIVITY TO WHOLE-BODY VIBRATION IN URBAN TRANSPORTATION SYSTEMS: A LITERATURE REVIEW

Hanes, RM

Applied Physics Laboratory, 8621 Georgia Avenue, Silver Spring, Maryland, 20910 Trd-43

May 1970

The survey indicated that a majority of relevant data came from only a few sources whose results were frequently divergent. That is, no reliable guidelines for passenger comfort were yielded by the data; rather several conflicting results were obtained which did not provide any satisfactory basis for choosing any one of the recommended comfort limits in preference to another. The literature survey revealed two basic data sources: (1) those obtained on "shake tables" in the laboratory; and (2) those obtained in field testing. In both cases, testing considered vertical, horizontal, and sinusoidal vibrations on

standing and seated vehicle passengers. The data proved either contradictory or non-correlative, widely divergent testing methods and procedures further impaired reliable correlation of the data. Appended material includes a full bibliography of sources used, relevant details from selected reports, ride indices recommended by various investigators, and selected data and analysis of anatomical and physiological effects of vibration.

#### ACKNOWLEDGEMENT

Urban Mass Transportation Administration

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044339

#### RAILROAD ENGINEMAN TASK AND SKILL STUDY

McDonnell Douglas Electronics Company, St. Charles, Missouri, 63301

MDC-M0015, Final Rpt, 7206-7208, Aug. 1972, 169 pp

Contract DOT-FR-20036

The report describes the principal tasks performed by a locomotive engineman during over-the-road freight operations utilizing diesel-electric locomotive equipment. Sixty-four basic tasks are identified and classified into seven task groupings. Each step is described in terms of input to the engineman (rules, signals, display, and other information), information processing and decision making by the engineman, the output of the engineman (control action, communication and the like), feedback of action consequences to the engineman and interactions with other crew members. Each task is also given ratings for difficulty, hazards and criticality for safe operation of the train. The report is intended to provide data in support of further efforts toward relating the engineman's skill requirements (aptitudes, proficiency, training) and working environment to the safety of railroad operations. (Author)

#### ACKNOWLEDGEMENT

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039175

**A PROGRAM DEFINITION STUDY FOR RAIL-HIGHWAY GRADE CROSSING IMPROVEMENT**

Schoppert, DW

Voorhees (Alan M) and Associates, Incorporated, McLean, Virginia

AMV-R-71-1028, Final Rpt, Oct. 1969, 171 pp

Contract DOT-FR-9-0028

The report describes in general terms the present status of grade crossing inventories, improvement programs and other significant considerations. It identifies available information with respect to the cost of accidents and motor vehicle operations, as well as the preparation of estimates of the number of crossings in classes related to the volume of train movements and the volume of vehicle traffic. From these estimates, the number of crossings at which improvements would yield benefits in excess of costs was estimated, together with the reduction in accidents which those improvements could be expected to bring. It develops a five-year program of study related to policy formulation, program administration and research; also, it identifies and describes projects which can be initiated as action programs, research and special studies. This includes a recommended program to correct data deficiencies and develop a comprehensive information system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190401

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039248

**TECHNOLOGICAL INNOVATION IN GRADE CROSSING PROTECTIVE SYSTEMS**

Hopkins, JB Hazel, ME

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-FRA-71-3, Tech Rpt, June 1971, 89 pp

The constraints on innovative grade crossing protective systems are delineated and guidelines for development indicated. Inventory data has been arranged to permit an estimate of the classes of systems needed, the allowable costs, and contribution of various types of crossings to accidents. A number of approaches are discussed for the intermediate cost classes, based on use of conventional signals with low-cost activation systems. Use of similar elements, singly or in combination, is suggested to improve effectiveness of more expensive systems. The very high cost locations may well benefit from interconnection of train and vehicle detectors and small computers. Extensive analysis and laboratory investigation has been carried out relating to a microwave telemetry alternative to conventional track circuits and possible crossing-located radar and impedance train detection systems. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201624

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039261

**THE VISIBILITY AND AUDIBILITY OF TRAINS APPROACHING RAIL-HIGHWAY GRADE CROSSINGS**

Aurelius, JP Korobow, N

Systems Consultants, Incorporated, New York, New York

Final Rpt, May 1971, 163 pp

Contract DOT-FR-00006

See also Addendum Rept. dated Jul 71, PB-202 669.

The study investigates devices and color schemes, proposed or in use on locomotives, which serve to make the train visible or audible to motorists approaching grade crossings. A color scheme using two contrasting colors, each color at least 3 1/2 x 5 feet in area, is recommended for visibility at 1000 feet. One color should be very bright, such as fluorescent or bright yellow. Two high-output xenon strobe lamps are recommended, one on each side of the cab roof, to flash alternately whenever the train is moving. At night, lighted panels are recommended as supplements to the strobe lamps. The sound level required to reliably alert a motorist was found to be 105 dB just outside the vehicle. In high speed encounters, present horns cannot reliably warn motorists early enough. A horn with enough output to be totally effective would not be an unacceptable nuisance. The report includes a bibliography and tables of required ranges. (Author)

**ACKNOWLEDGEMENT**

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039355

**ATCHISON, TOPEKA AND SANTA FE PASSENGER TRAIN NO. 212 COLLISION WITH STILLWATER MILLING COMPANY MOTORTRUCK AT 116TH STREET NORTH, GRADE CROSSING NEAR COLLINSVILLE, OKLAHOMA, APRIL 5, 1971**

National Transportation Safety Board, Washington, D.C.

NTSB-RHR-72-1, May 1972

45 pp

Railroad/Highway Accident Report

A grade crossing accident in Oklahoma is described in which a loaded motor truck struck a passenger train. A report of the accident investigation is given.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210992

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039793

**RAIL-HIGHWAY GRADE CROSSING SAFETY IMPROVEMENTS ARE SUGGESTED BY TEAM**

Texas Transportation Researcher (Texas Transportation Institute, Texas A&amp;M University, College Station, Texas)

Vol. 7, No. 4, Oct. 1971, pp 6-7

Technical study of 36 rail-highway grade crossings by a diagnostic team has provided safety recommendations. New advance warning signs were designed and standards for application were prepared. These standards covered the following types of crossings and visibility conditions—protected crossing with obstructed view, protected crossing with unobstructed view, nonprotected crossing with obstructed view, and nonprotected crossing with unobstructed view. These new standards were implemented at eight rail-highway crossings. Evaluations of the crossings using the diagnostic team showed that the advanced warning signs were highly effective.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 50018

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039840

**REPORT TO CONGRESS. RAILROAD-HIGHWAY SAFETY,  
PART I: A COMPREHENSIVE STATEMENT OF THE  
PROBLEM**

Federal Highway Administration, Washington, D.C.

Nov. 1971, 134 pp

Prepared in cooperation with the Federal Railroad  
Administration, Washington, D.C.

The report identifies the extent and nature of the safety problem associated with railroad-highway intersections nationwide and to pedestrians along railroad rights-of-way, particularly within and near urban areas. A cost-benefit analysis is employed to present the problem in order of magnitude. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206792

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041161

**CROSSING SAFETY GAINS SUPPORT**Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 10, Oct. 1972, pp 20-21, 1 Phot

A grade crossing information system has been announced. The project includes planning and design of the highway-rail intersection information and numbering system. The second Phase of the project encompasses a field test of the inventory and numbering phases and paper flow procedure of the information system. The third phase calls for the collection of highway-rail intersection data on all highway-rail crossings in the U.S. The final phase will prepare information for automatic data processing and the coordination of additional input from the FHA and state and local highway authorities.

**ACKNOWLEDGEMENT**

Railway System Controls

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York, New York, 10013, Repr PC: \$0.7

041162

**CROSSING SAFETY DEPENDS ON GOOD MAINTENANCE**

De Priest, JR, Seaboard Coast Line Railroad

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 10, Oct. 1972, pp 21-25, 2 Phot

This article was originally a paper presented at the 4th Annual Crossing Safety Conference of the AAR, held at Ohio State University, Columbus, Ohio, on August 29-31, 1972.

It is estimated there are 231,750 highway-railroad grade crossings in the United States. Of these, 20,730 were protected by highway crossing signals, gates or other active protection devices for the motorist. To be useful, these protective devices must be maintained in proper working order for use at anytime. Annual maintenance charges may range from \$650 for the simplest type crossing signal to \$1,250 for a gate installation.

**ACKNOWLEDGEMENT**

Railway System Controls

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041635

**TOUGH LOCATION IS CHOSEN FOR NEW-TYPE ROAD  
CROSSING**Railway Track and Structures (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10017)

Vol. 68, No. 7, July 1972, pp 20-22

Railbound concrete slabs were installed where heavy vehicular traffic from steel plant crosses over railroad diamond crossing. At the site selected for the crossing-slab installation the road from the steel plant uses the deck of a railroad lift bridge over the channel. Making a sharp turn to the left, this road crosses the railroad diamond crossing at an angle. Road traffic includes about 240 daily runs of heavy (60 tons) slag trucks, 20 coke-loaded trucks from the screening operation, 1000 automobiles, steel-loaded flatbeds, and a 64-ton fly-loader with chain-wrapped rubber-tires.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 072041

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043620

**REPORT TO CONGRESS. RAILROAD-HIGHWAY SAFETY  
PART II: RECOMMENDATIONS FOR RESOLVING THE  
PROBLEM**Federal Highway Administration, 400 7th Street, SW,  
Washington, D.C., 20590

Final Rpt, 7012-7209, Aug. 1972, 119 pp

Prepared in cooperation with The Federal Railroad  
Administration, Washington, D.C. See Also Part I, PB-206792.

A comprehensive analysis is made of the railroad-highway grade crossing problem nationwide. An economic analysis is employed to assess the need for improving public grade crossings. Alternative levels of improvement needs on a nationwide basis are set forth including the number and type of improvements, costs, anticipated reductions in accidents and casualties, and total benefits. Alternative methods of financing an expanded program of public grade crossing improvements are presented to aid the Congress in their deliberations on this matter. An equitable allocation of improvement costs among the railroads, the Federal government, and others is recommended. Specific attention is given to the problems of pedestrian safety along railroad rights-of-way in densely populated urban areas; private crossings; high-speed rail corridors; and railroads in urban areas.

**(Author)****ACKNOWLEDGEMENT**

National Technical Information Service, PB-213115

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044313

**RAILROAD-HIGHWAY VEHICULAR MOVEMENT  
WARNING DEVICES AT GRADE CROSSINGS**

Longrigg, P, Forney Engineering Company

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017

Paper C73930-5-IA, Mar. 1973, 10 pp, 16 Fig, 4 Ref

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

Railroad operations have for many years been plagued with poor safety performance at grade crossings. Many lives are lost each year in accidents at crossings, to say nothing of costly injuries and property damage sustained. The situation has gotten worse with the advent of the soundproofed car, being driven at high speed in conditions of poor visibility. Clearly then some improved method of warning motorists as they approach a grade crossing is needed. Analysis of a critical encounter between a road vehicle and a locomotive reveal that the presently used equipment is inadequate to meet the needs of present day high speed vehicles. A system of vehicular movement warning devices is described in this paper, that might improve to some extent, the safety of grade crossing operations. Two methods are detailed; one involves static directional sonic devices positioned at the crossing; warning activation is made on a real time closing velocity determination. The other system employs a special variety of cattle guard in the roadway, to issue a tactile warning. Both systems are designed to give adequate warning to a motorist in a critical encounter situation as he approaches the crossing with a convergent locomotive on the track(s). A bonus feature in the use of selectively activated static directional sound warning sources, would be the curtailment of urban noise levels, where trains presently use the mobile audible source to issue warnings.

**ACKNOWLEDGEMENT**

Institute of Electrical and Electronics Engineers

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**044319****NATIONAL CONFERENCE ON RAILROAD-HIGHWAY  
GRADE CROSSING SAFETY, AUGUST 29-31, 1972**

Ohio State University, Columbus, Transportation Research Center,  
Columbus, Ohio, 43210

Proceeding, Aug. 1972, 63 pp

The keynote speaker of the conference noted that 12,000 motor vehicle-train collisions occur annually. Papers presented are addressed to problems of reducing this number through technology or by altering present traffic patterns. The solution of universal grade separation seemed to be too expensive an investment, and lines of authority and responsibility are not clear. The large number of crossings that carry low volumes of both vehicular traffic and railroad movement complicate possible solutions economically. The technology of passive devices and protective and warning needs were studied.

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013834

**LINEAR ELASTIC FRACTURE MECHANICS IN THE UNITED KINGDOM. WORK OF THE BISRA FRACTURE TOUGHNESS ( HIGH STRENGTH STEELS ) COMMITTEE**Cottrell, CLM, Bristol Aerojet, Limited  
May, MJ

BISRA Open Report (British Iron and Steel Research Association, 24 Buckingham Gate, London SW1, England).

MG/E/160/69, 1969, 8pp, 3 Fig, 4 Ref, 1 App

The paper reviews the background to the formation of and the current work of the BISRA Fracture Toughness ( High Strength Steels ) Committee. Details are given of the main conclusions arising from the collaborative fracture toughness testing programmes carried out by members of the Committee. This information has guided the Committee in drafting a proposed British Standard for Plane Strain Fracture Toughness Testing.

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016684

**EFFECT OF TENSION-COMPRESSION CYLING ON FATIGUE CRACK GROWTH IN HIGH-STRENGTH ALLOYS**

Crooker, TW

Naval Research Laboratory, Washington, D.C.

NRL-7220, Jan. 1971, 11pp

Virtually all of the fatigue crack propagation data reported in the literature for structural alloys are generated under simple zero-tension cycling. The direct application of this data to problems involving large welded structures subjected to operating stress cycles approaching fully-reversed tension-compression is questionable. The present study shows that the compression portion of fully-reversed tension-compression cycling can contribute substantially to fatigue crack growth rates in plate-thickness, medium-to-high-strength alloys. Data from several alloys show a 50 percent increase in fatigue crack growth rates due to tension-compression cycling. The implications of these findings and methods for applying the results of this study are discussed. (Author)

**ACKNOWLEDGEMENT**

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016710

**WELDING AT TEMPERATURES LOWER THAN NORMAL WORKSHOP TEMPERATURE, PLUS 15 DEGREES CENTIGRADE**

Valanti, VO

Svetsaren-English Edition (Elektriska Svetsning Aktiebolaget, Box 8850, S-402 71, Goteborg 8, Sweden)

Vol. 6, No. 3, 1970, pp 6-12, 8 Tab, 3 Ref

Printed in English, French, German and Swedish

An example of the difference between Finnish regulations, Lloyds Register of Shipping, Det Norske Veritas (Finland), The Russian Shipping Register and RIL (Assn. of Finnish Civil Engineers) is cited showing clearly diversified opinions concerning cold weather welding. Because of the variety of opinions, this report has examined the effect of cold weather welding on the quality of the welded joint and the behavior of the welded structure after welding.

The following are discussed in considerable detail: 1) The effect of the low temperature on the welder's performance, and his ability to obtain the required weld quality. 2) The effect of cold weather welding on the strength of the welded joint. The influence on a. the microstructure of the heat affected zone, b. the microstructure of the weld, c. the distribution of gases in the molten pool. 3) The effect of cold weather welding on the risk of brittle fracture. 4) The effect of ice, snow, frost, and water on the workpiece, as regards the quality of the welded joint. 5) The effect on the final result of preparing the joint or backchipping for a sealing run or repair if carried out in the cold. 6) The effect of cold on the welding equipment. Since this article was originally published in Finland further practical knowledge has been gained about welding under cold conditions. Many welding engineers in Finland are of the opinion that the only limiting factor is the human factor, namely the welder, and in this the difficulties begin at around minus 15 degrees centigrade.

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019415

**FATIGUE CRACK PROPAGATION THROUGH WELD HEAT AFFECTED ZONES**Dowse, KR, Central Electricity Generating Board  
Richards, CE

Metallurgical Transactions (Metallurgical Society, 345 East 47th Street, New York, New York, 10017)

Vol. 2, No. 2, Feb. 1971, pp 599-603

Published Jointly by Metallurgical Society of American Institute of Mining, Metallurgical and Petroleum Engineers and American Society for Metals.

Fatigue tests were performed on specimens containing weld heat affected zones at two orientations to the stress axis. Two steels were used, one a low alloy steel and the other a mild steel. It is stated that, since the tests were performed on actual heat affected zones under known stress conditions, the conclusions can be applied to the behavior of fatigue cracks in actual structures under operating conditions. The observations suggest that, when fatigue cracks are present, the integrity of a welded structure may depend on the toughness of the component with the lowest flow stress.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 42841

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019607

**TANK COATINGS FOR CHEMICAL CARGOES**

Rogers, J

Institute of Marine Engineers-Transactions (Memorial Building, 76 Mark Lane, London EC3, England)

Vol. 83, No. 5, pp 139-145, 1 Fig, 1 Tab, 4 Phot, 6 Ref

Increased ocean transport of bulk chemicals has led to increasing demands for chemically resistant tank linings to prevent contamination or deterioration of the cargo and to reduce corrosion. At the same time such linings contribute to improved safety and lower costs resulting from easier tank cleaning and inspection. Satisfactory performance of these linings depends not only on the correct selection of lining for any particular cargo—there is, as yet, no "universal" lining—but also on correct formulation and application. The latter includes suitable blast cleaning of the metal surface prior to applying properly prepared coating material and subsequently ensuring that the lining is fully cured to give the required mechanical and chemically resistant properties. The main types of lining in current use are described, together with some recent developments in this field. Some



indication is also given as to the suitability of these types of linings for certain cargoes, but emphasis is laid on the fact that in many cases factors other than a knowledge of the type of coating and intended cargo will determine whether any particular lined tank is acceptable for any given cargo.

#### ACKNOWLEDGEMENT

United States Merchant Marine Academy, N-095

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London EC3, England, Repr PC: R Price

019610

#### STAINLESS STEEL FOR CHEMICAL TANKERS

Sales, GL Todd, B

Holland Shipbuilding (National Institute of Shipbuilding and Shipping, 10 Burgemeester and Jacobplein, Rotterdam, Netherlands)

Vol. 20, No. 6, Aug. 1971, pp158-160, 2 Tab

This article describes 3 methods for the use of stainless steel plating for tank linings in tanks used for the carriage of chemical cargoes. They are tanks constructed of solid stainless steel plate, carbon steel plate to which a thin layer of stainless steel has been bonded, and tanks constructed first of carbon steel plate and then lined with a layer of stainless steel plate. The advantages and disadvantages of each are discussed with particular regard to cost and stress corrosion cracking and other stresses that can be caused by improper welding. It is concluded that tanks constructed of pure stainless steel plate are generally higher in initial cost, but they are more economical over the life of a vessel due to savings in maintenance and repair costs. Also described are properties of stainless steel of the high stress proof types containing nitrogen and those that are warm worked. Design and fabrication aspects are given for the 3 types of tanks with respect to ballasting, heating ducts and coils, pumps, valves, piping, and tank finishing. Where information is available from actual usage of the 3 methods, it is listed.

#### ACKNOWLEDGEMENT

United States Merchant Marine Academy, N-098

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024763

#### A STUDY OF PRE-CRACK FATIGUE. PART I

Zisfein, MB

Franklin Institute Research Laboratories, Philadelphia,  
Pennsylvania FIRL-F-C2231-2

AFOSR-TR-71-1802, Final Rpt, May 1971, 94pp

F44620-68-C-0068

The report is an examination of current technological posture in materials fatigue, especially that area of fatigue before the formation of a finite or 'technical' crack. A computerized search of the literature was performed by the Defense Documentation Center leading to the establishment of a bibliography which was intensively examined. The various concepts and rules of fatigue damage were critically examined as were their effects on fatigue analysis. The fatigue implications of Non-Destructive Evaluation (NDE) were also reviewed with the objective of recommending new approaches. Throughout all, a number of specific recommendations for future activity were made and discussed. These are summarized at the conclusion of this report. (Author)

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National Technical Information Service, AD-728292

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025710

#### UTILIZATION OF PRESTRESSED CONCRETE IN ARCTIC OCEAN STRUCTURES

Gerwick, BC, Jr, Santa Fe-Pomeroy, Incorporated

POAC Conference

Abstract of paper delivered at the First International Conference on "Port and Ocean Engineering under Arctic Conditions" held at Trondheim, Norway, August 23-30, 1971

In the materials field, a very interesting development is taking place with polymer-impregnated concrete. Precast concrete, immersed in a monomer, is then exposed to irradiation or thermal treatment which converts the monomer to a polymer. The resultant concrete is very high strength up to 1600 kg/cm squared, impermeable, and with excellent abrasion resistance. While commercial production has not yet commenced, and the detailed application to barges and caissons must be worked out, this material would appear to be of major significance for future structures in the Arctic. Concrete, and especially high quality prestressed concrete, appears to be highly suited for the construction of a wide variety of Arctic structures. It possesses excellent properties for resisting the environmental loadings and conditions, and is inherently practicable and economical.

#### ACKNOWLEDGEMENT

Arctic Institute of North America

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028769

#### PAINTED METALLIC COATINGS ON STEEL STRUCTURES

Stanners, JF

BISRA Open Report (British Iron and Steel Research Association, 24 Buckingham Gate, London SW1, England)

Vol. 52, BISRA/CH/37/70, Jan. 1971

The combination of metal coatings with paint to protect structural steel leads to the possibility of reduced maintenance costs. That such reductions are not always achieved is largely due to the fact that those directly involved are not fully aware of the best ways of selecting, applying and handling these composite coatings. The metallic coating is usually zinc or aluminum. Paints suitable for use over these are considered, with special emphasis on the value of pre-treatment primers. A well-chosen system may fail to give satisfaction if applied badly or at the wrong time in the erection schedule. The need for a good specification, for good workmanship and for a proper system of inspection is stressed. Experience and research in the use of metal coatings and paints together is reviewed.

#### ACKNOWLEDGEMENT

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032641

#### MARINE BORERS, FUNGI AND FOULING ORGANISMS OF WOOD

Organization for Economic Cooperation and Development, Suite 1306,  
1750 Pennsylvania Avenue, NW, Washington, D.C., 20006

1971, 364pp, 741 Ref

List of applicable references follows each chapter

This volume is the culmination of an effort which began modestly, developed ambitiously, and became, ultimately, a comprehensive and authoritative text. It comprises, on the one hand, a record of the Workshop on Preservation of Wood in the Marine environment, arranged by the Organization for Economic Co-operation and development (OECD), and held at the Portsmouth College of Technology, Portsmouth, England, 1968. It represents, on the other hand, an up to date account of developments in the biology of marine wood deterioration and fouling covering. Methods of identification of marine borers and fungi; Identification of wood-boring crustaceans; Isolation and identification of filamentous marine fungi; Primary fouling of bacteria; Algae as fouling organisms; Bryozoa (Polyzoa) and marine fouling; A guide to the identification of hydroids; Annelids as fouling organisms; Ascidians as fouling organisms; Barnacles and fouling; The biology of marine borers and fungi; the Ecology and rotting ability of marine fungi; Biology of marine wood boring molluscs; On the biology, physiology and ecology of marine wood-boring crustaceans; Marine Borers and fungi; Preservation and durability of wood and the natural resistance of tropical timbers to attack by marine wood-destroying organisms.

#### ACKNOWLEDGEMENT

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035576

#### CRITICAL REVIEW OF FRACTURE AND FATIGUE ANALYSIS

Lomacky, O Vanderveldt, H

Naval Ship Research and Development Center, Bethesda,  
Maryland

Mar. 1972, 276pp

The state of knowledge in fracture and fatigue analysis is reviewed in order to provide a technical background for the development of fatigue design procedures for submarine hulls. Special emphasis is placed on analytical fracture mechanics approach. Results are presented for the stress and strain distribution near the crack tip. Current fracture criteria and subcritical crack initiation and propagation laws are summarized including the environmental effects.

#### ACKNOWLEDGEMENT

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043531

#### THE 1972-1973 LIST OF ASTM PUBLICATIONS

American Society for Testing and Materials, 1916 Race Street,  
Philadelphia, Pennsylvania, 19103

30 pp

Announcement of this publication appeared in the Winter issue of the AREA News, 1973.

This book is revised annually. The current issue contains 30 pages and lists more than 600 ASTM publications dealing with the standardization of methods of test and specifications for materials, the knowledge of materials, and materials evaluation. A single copy of the publication, requested on company letterhead, will be sent free

of charge.

#### ACKNOWLEDGEMENT

AREA News

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043922

#### RELATIONSHIP BETWEEN STRENGTH AND THE COMPOSITION AND FINENESS OF CEMENT

Alexander, KM

Cement and Concrete Research (Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 2, No. 6, Nov. 1972, pp 663-680

Data from new experiments and from work published during the past 40 years are subjected to regression analysis to determine the relationship between strength and the composition and fineness of cement. The original authors differed in their opinions on the relative importance of C3S and C3A. The controversy is examined against a background of experience with a group of materials that are representative of portland cement in general and in terms of an analysis based on a model in which, during the first weeks of hardening, the strength developed by C3S depends on the proportion of C3A in the cement.

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043995

#### CONCRETE-POLYMER MATERIALS DEVELOPMENT, A GOAL-ORIENTED PROGRAM

Steinberg, M

Nuclear Science Abstracts (Superintendent of Documents, Washington, D.C., 20402)

Vol. 26, No. 12, Abstr. 28665, June 1972, 37 pp

Lecture Series 105, given at Brookhaven National Laboratory, October 6, 1971.

The principles of applied research are briefly reviewed, and the concrete-polymer materials development program is described in detail as an example of goal-oriented research. In this program the ancient technology of concrete is mated with the recent technology of polymers. The composites are classified as polymer-impregnated concrete (PIC), polymer-cement concrete (PCC), cementless polymer-concrete (PC), and concrete with coating in depth (CID). The tasks in the program include monomer survey, process technology, measurement of properties, applications development, economic evaluation, and administration. The materials obtained and their characteristics are described. The durability and structural strength of concrete-polymer are much improved over those of conventional concrete. A number of government agencies, industrial associations, universities, and foreign firms have taken up this research, and preliminary marketing evaluations are in progress. Major potential applications include piping, building panels, bridge decking, distillation vessels, and mine supports. Costs versus product value are briefly discussed.

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**044068**  
**ANISOTROPY OF CONCRETE AND ITS PRACTICAL IMPLICATIONS**

Johnston, CD, Calgary University

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 423, 1973, pp 11-16, 3 Fig, 2 Tab, 1 Phot

The influence of anisotropy induced by different methods of casting on the uniaxial tensile and compressive strength of concrete cast with the axis of loading vertical is about 8 percent less for tension and 8 percent more for compression than that of corresponding concrete cast horizontally. Consequently, the ratio of tensile to compressive strength for concrete cast with the axis vertical is about 15 percent less than that for corresponding concrete cast horizontally. Some practical situations where a knowledge of these effects should influence the evaluation of concrete quality from tests on standard molded specimens, drilled cores, and sawed beams are also discussed.

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**044069**  
**MOISTURE PENETRATION IN CONCRETE WITH SURFACE COATINGS AND OVERLAYS**

Ingram, LL, Texas Transportation Institute  
 Furr, HL, Texas Transportation Institute

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 423, 1973, pp 17-26, 5 Fig, 5 Tab

Report Number 423 concerns Concrete Properties and Performance.

Tests were made on concrete specimens coated with four waterproofing materials to determine how deeply the coatings penetrated into the concrete. Also, coated surfaces and overlaid specimens were ponded with salt water and tap water to determine the effectiveness of each in preventing the penetration of moisture into the concrete specimens. Freeze-thaw tests were made on asphaltic overlays to determine the effect of freeze-thaw cycling on the overlays and the portland cement concrete beneath the overlays. Shear tests were made to determine the shear strength of concrete overlays bonded to concrete test blocks. It was found that the deepest penetration of coatings, 0.054 to 0.062 in., was made by a mixture of linseed oil and kerosene. No damage was found under the asphaltic overlay after 59 freeze-thaw cycles. Shear bond strengths ranged from 61 to 578 psi when the cube surfaces were treated with surface coatings and from 367 to 597 psi when the surfaces with coatings were sandblasted before overlaying.

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**044070**  
**CONCRETE VARIABLES AND CORROSION TESTING**

Spellman, DL, California Division of Highways  
 Stratfull, RF, California Division of Highways

Highway Research Record (Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418)

No. 423, 1973, pp 27-45, 8 Fig, 12 Tab

Report Number 423 concerns Concrete Properties and Performance.

We partially submerged 710 reinforced concrete blocks in a saturated sodium chloride solution. Based on the test criterion that a sufficient quantity of chloride-absorbed concrete causes the steel to change from a passive to an active or corroding half-cell potential, the test results showed that increasing the cement factor and increasing the length of water curing increased the time to an active half-cell potential. Steam curing of the concrete resulted in a reduction of the time to an active half-cell potential as well as a reduction in absorption as compared to just water curing. The test procedure used verified capillary action as the primary mechanism of water absorption. The chloride content of the concrete was determined. Of the three tested admixtures and corrosion inhibitors, only pozzolan appeared to result in a significant benefit even though this concrete had the greatest absorption and also the greatest drying shrinkage.

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**044321**  
**CREEP CHARACTERISTICS OF POLYESTER CONCRETES**

Howdyshell, PA

Army Construction Engineering Research Laboratory, P.O. Box 4005, Champaign, Illinois, 61820

M-23, Tech Rpt, Nov. 1972, 15 pp

Results of testing for this project indicated that aggregate and cement particle-filled polyesters are viscoelastic in nature and creep when subjected to sustained loads. Although the creep strains of the filled polyesters were similar in nature and magnitude to what could be expected from equivalently loaded portland cement concrete, the creep characteristics of the polyesters appeared to be very sensitive to small temperature variations. Also, the polyesters exhibited creep failure tendencies at lower stress-to-strength ratios than would be expected from portland cement concretes.

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**044324**  
**LOW WATER TO CEMENT RATIOS CONCRETES**

Skalny, J Phillips, JC Chan, DS

Cement and Concrete Research (Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 3, No. 1, Jan. 1973, pp 29-40

Compressive and flexural strengths, dimensional changes, and freeze-thaw resistance of concretes made with low water-to-cement ratios were evaluated. In addition, exploratory studies of the rheological properties of low water content cement-aggregate-admixture systems were performed. The results indicate that, under well-controlled conditions, workable concrete mixes can be obtained with water-cement ratios as low as 0.28. Additionally, concretes having higher strengths as well as better freeze-thaw resistance and other engineering properties could be obtained. Unsolved problems connected with production of low water-to-cement ratio concretes are briefly discussed.

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 Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523, Repr PC: Req Price

**008819**  
**DEVELOPMENT OF STUDIES ON NOISE AND VIBRATIONS IN RAILROAD TRANSPORTATION AND THEIR RESULTS**

Volkov, AM

Wright-Patterson Air Force Base, Foreign Technology Division,  
 Dayton, Ohio

FTD-MT-24-358-68, Nov. 1968, 13 pp

Edited Machine Trans. of Gigiena Truda I Professionalizye  
 Zabolevaniya ( USSR ) VII, N11 p58-60, 1967

The report is a survey of studies on the adverse effect of noise and vibration in railroad cars. Further studies, started in 1948, used EEG and EKG to determine the function of analyzers, thresholds of acoustic sensitivity and vestibular chronaxy and effects on the cardiovascular system; model vibratory platform was constructed. Characteristics of noise and vibration were divided into 3 groups according to noise and 2 according to vibratory parameters; these were determined for the various types of passenger coaches. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-685497

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 AD-685497

**019750**

**ON THE GENERATION AND REDUCTION OF AUTOMOTIVE AND RAIL-VEHICLE NOISE**

Bender, EK, Bolt, Beranek and Newman, Incorporated

Institute of Environmental Sciences, 940 East Northwest  
 Highway, Mount Prospect, Illinois, 60056

Proceeding, Apr. 1970, pp221-227, 6 Fig., 22 Ref

1970 Annual IES Meeting, Boston, Mass.

To reduce noise generated by surface vehicles, one requires information concerning the contribution from vehicle components to the noise level emitted by the entire vehicle. On the basis of this information, and an understanding of the mechanism of noise generation, one would proceed to quiet the most serious sources of noise. In this paper, we discuss some mechanisms by which noise is generated, steps that may be taken to reduce the noise, and research needed to further our understanding of noise source mechanisms.

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**019760**

**NOISE PROBLEMS OF HIGH SPEED GROUND TRANSPORTATION**

Bender, EK, Bolt, Beranek and Newman, Incorporated  
 Dietrich, C  
 Franken, PA

High Speed Ground Transportation Conference Proc ( )

TRI Res Rep 3; May 1969, pp 141-156, 20 Ref

Proc of Carnegie-Mellon Conf, May 13-15 1969, Pittsburgh, Pa.

This paper discusses the principal sources of noise generated by high-speed ground vehicles and the impact of this noise on both the community and the passengers. Authors anticipate that noise levels will be exceedingly high, making land within approximately 1000 ft of some (surface) vehicle guideways unfit as residential areas. Noise levels inside vehicles are predicted to be sufficient to cause temporary

hearing loss for occasional exposure and permanent hearing loss for lengthy exposures.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 43813

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**019921**

**BRIDGE AND APPROACHES OVER SEABOARD COASTLINE RAILROAD, CITY OF RICHMOND, VIRGINIA**

Federal Highway Administration, Richmond, Virginia

May 1971, 8pp

**Environmental Impact Statement**

The purpose of this project is for the replacement of an inadequate existing structure to satisfactorily handle the existing and anticipated traffic. The construction of this project will help the environment along the existing route through the city by reducing noise, air pollution and traffic congestion with practically no detrimental effect along the proposed route.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-199634D

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**019946**

**ARKANSAS-T-8020(3), (BATESVILLE TOPICS), INDEPENDENCE COUNTY (OVERPASS ACROSS THE MISSOURI PACIFIC RR AND POLK BAYOU), (WAS SH 69)**

Federal Highway Administration, Little Rock, Arkansas

June 1971, 11pp

**Environmental Impact Statement**

The project consists of the construction of an overpass across the Missouri Pacific Railroad tracks and Polk Bayou. The length of the project, including the bridge and approaches, will be approximately 1,500 feet. An increase in noise and air pollution will result. Some stream silting will occur to Polk Bayou during construction.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-200209D

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**024930**

**HIGHWAY/MOTOR VEHICLE SYSTEM COMPUTER MODEL AND TRAIN SYSTEM COMPUTER MODEL**

Serendipity, Incorporated, 2001 Jefferson Davis Highway,  
 Arlington, Virginia, 22202

July 1971, 63pp

The report contains computer listings of the highway/motor vehicle computer model and the train system computer model developed during the course of a study on transportation noise as contained in Report No. OST-ONA-71-1, 'A Study of the Magnitude of Transportation Noise Generation and Potential Abatement,' November 1970. Report No. OST-ONA-71-1 is printed in seven volumes. Volumes 4 and 5 contain descriptions of the development of the subject computer models and instructions for their use. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202575

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024932

**NOISE AND VIBRATION CHARACTERISTICS OF HIGH SPEED TRANSIT VEHICLES**

Ihrig (Wilson) Associates, Incorporated, 2344 Sixth Street,  
Berkeley, California, 94710

June 1971, 99pp

The rapidly expanding problems of urban transportation have resulted in intensified activity in the development and construction of new fixed route, high speed rapid transit systems and equipment. The community noise and ground vibration caused by such systems and vehicles is a very important factor influencing public acceptance of these systems. Noise and vibration measurements obtained with modern operational and experimental transit vehicles provide a basis for determining the expected wayside or community airborne noise and ground-borne vibration levels for different types of new transit systems. Through the use of modern design concepts and equipment intended to provide reduced noise and vibration, the wayside noise and vibration caused by rapid transit system vehicles can be made acceptable and the operations can be much quieter than traditionally expected despite the general increase in speed of the newer systems which tends to increase noise and vibration. The purpose of this report is to present a review of the available information on wayside noise and vibration generated by rapid transit vehicles, primarily rail transit vehicles, including projection of the expected noise and vibration levels for higher speed vehicles being considered for future applications. (DOT abstract)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202871

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PB-202871

025571

**SOUND ATTENUATION BY BARRIERS**

Kurze, UJ, Bolt, Beranek and Newman, Incorporated  
Anderson, GS, Bolt, Beranek and Newman, Incorporated

Applied Acoustics (Elsevier Publishing Company, Limited,  
Rippleside Commercial Estate, Ripple Road, Barking, Essex,  
England)

Vol. 4, 1971

This study was partially supported by Serendipity, Inc.,  
Arlington, Virginia, under Contract No. DOT-OS-A9-018.

Experimental data on sound attenuation by barriers and an engineering prediction scheme recently proposed by Rathe are compared with results of the geometrical theory of diffraction. A simple analytic expression is proposed for the calculation of the excess attenuation due to diffraction around a barrier of sound rays emanating from a point source; this analysis takes into account oblique sound incidence at the barrier and also includes the transition region from the bright zone to the shadow zone behind the barrier. The excess attenuation by a barrier parallel to an incoherent line source is shown to be calculable from the excess attenuation of sound emanating from a few points on the line source. Engineering estimates for the required length of an efficient barrier parallel to a line source yield an aspect angle for the barrier equal to 95 percent of the aspect angle of the line source. The sound transmission through a barrier is found to be negligible for a typical automotive traffic noise spectrum if the mass per unit area of the barrier exceeds 4 lb/ft square.

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025574

**FIELD PERFORMANCE OF A NOISE BARRIER**

Scholes, WE Salvidge, AC Sargent, JW

Sound and Vibration, Journal of (Academic Press Incorporated,  
Berkeley Square House, Berkeley Square, London SW1, England)  
Vol. 16, No. 4, June 1971, pp 627-642

This paper is based on the results of a series of measurements of the performance of full-scale noise barriers of various heights that were carried out under a range of wind conditions. It relates to the effects of a long barrier in reducing the noise from localized sources, such as the peaks of traffic noise. Although the presence of an absorbing ground complicates the results, it is possible to make useful comparisons between theoretical predictions of barrier attenuation and the present experimental results, if these are expressed as the differences between the measured levels with the barrier and the calculated levels without the barrier. For this calculation, only the sound levels just above the barrier and the inverse square law, based on the distances of the source and reception point from the barrier, are taken into account. This procedure minimizes the influence of the effect of the ground on the data. The results, for zero wind conditions, show good agreement with theoretical attenuation values predicted by a method ascribable to Maekawa. For the situations covered in this experiment, these theoretical attenuation values ranged from 0 to 28 dB. In some situations the wind can have a significant influence on barrier performance. It has most effect on the attenuation of high frequencies at low reception points far from the barrier but little or no effect on the attenuation of the lower frequencies.

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025993

**A STUDY OF THE MAGNITUDE OF TRANSPORTATION NOISE GENERATION AND POTENTIAL ABATEMENT-TRAIN SYSTEM NOISE**

Saefer, HB Starley, SE Pomeroy, JD Knerr,  
BF Finz, SA Withrow, RL

Serendipity, Incorporated, 2001 Jefferson Davis Highway,  
Arlington, Virginia, 22202

Vol. 5, OST-ONA-71-1, Nov. 1970, 115pp

The noise from an individual vehicle is a function of the physical characteristics of the vehicle, the way in which the vehicle is operated and the construction characteristics of the vehicle's guideway, e.g., rail condition, roadbed supporting structure. Noise reduction at the source can be obtained by altering the vehicle and/or the guideway and by changing the way the vehicle is operated. Analysis of contemporary mass transit vehicle noise indicates that the rank order of conventional rail vehicle noise sources is: (1) wheel and rail system, (2) propulsion system and (3) auxiliary equipment. Noise levels alongside the right-of-way, are a function of the vehicle type, its operation and the configuration of the roadbed and surrounding areas. For a given vehicle and guideway, the right-of-way configuration has the greatest impact on the sound levels received at a specific wayside location. Rail vehicle wayside noise levels can be reduced by interrupting the sound transmission paths between the vehicle and the receiver. To the extent that this is achieved, rail vehicle wayside noise levels can be reduced in a manner which is similar to that used for highway noise reduction.

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028674

**NOISE REDUCTION BY VEGETATION AND GROUND**

Aylor, DE, Connecticut Agricultural Experiment Station

Acoustical Society of America, Journal of (Acoustical Society of America, 335 East 45th Street, New York, New York, 10017)

Vol. 51, No. 1, Jan. 1972

Transmission of random noise through dense corn, a dense hemlock plantation, an open pine stand, dense hardwood brush, and over cultivated soil was measured. The relation between attenuation and frequency in these diverse cases suggested models that permit the prediction of attenuation in any configuration of vegetation and soil. The corn crop had an excess attenuation of 6 dB/100 feet for each doubling of frequency between 500 and 4000-Hz. On the other hand, the stems of the hemlock, pine, and brush all reduced noise by only about 5 dB/100 feet at 4000 Hz. Bare ground attenuates frequencies of 200-1000 Hz, and the frequency of maximum attenuation depends on the soil permeability to air. Thus, tilling the soil reduced the frequency of peak attenuation from 700 to 350 Hz and increased maximum attenuation at 52 m from the source by nearly 80 percent. Furthermore, earlier conflicting reports of noise attenuation by vegetation appear reconciled if ground attenuation is taken into account. Scattering and ground attenuation are the principal factors in sound attenuation by vegetation. Both factors attenuate relatively less sound as distance from the sound source increases. Hence measurements far from the source can underestimate the effect of a narrow band of vegetation or soil.

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028733

**NOISE GENERATED BY SUBWAYS ABOVE GROUND AND IN STATIONS**

Bender, EK Heckl, M

Bolt, Beranek and Newman, Incorporated, 50 Moulton Street, Cambridge, Massachusetts, 02138

OST-ONA-70-1, Jan. 1970, 57 pp, 23 Fig, 4 Tab, 14 Ref

In this report we present and discuss subway noise data acquired near various outdoor subways in seven European cities as well as noise generated by trains entering and leaving nine subway stations. Outdoor noise is measured at distances between 3 and 300 feet. We find that there are substantial variations (of the order of 20-30 dB) in levels generated by trains at a given distance on elevated sections, depending on whether the supporting structure is steel, concrete, or earthen. Rail joints and poor quality wheels are shown to increase noise levels by 8-10 dB. Trains on rails which have been ground smooth generate 6dB (A) less noise than trains on underground rails. Effects of train speed, distance from a train, and track grade are analyzed. Finally, noise levels in small stations lacking significant sound-absorbing surfaces are found to be 22 dB(A) higher than larger acoustically well-treated stations.

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AD-701220

034550

**NOISE STUDIED IN RETARDER YARDS**

Kendall, HC, General Railway Signal Company

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

July 1971, 6 Fig

Interest in the abatement of retarder noise, principally wheel screech, is gaining momentum due to restrictive noise ordinances, which could prevent new yards from being built in urban areas unless retarder noise can be dramatically reduced. Wheel screech results from interaction between car wheels and retarder shoes. The sound level of wheel screech lies between 110 and 120 db at the retarder with principal frequency components in the 24,000 Hz band. Reduction in sound levels may be obtained through the use of softer retarder shoe material, use of special lubricants, increasing the mass of the shoe beams or construction of acoustic barriers.

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034831

**REDUCING THE NOISE FROM MOVING TRAINS, AND RHEOSTAT TESTS ON LOCOMOTIVES**

Bobin, YV, Leningrad Institute of Railroad Engineers

Gigiena Truda I Professionalnye Zabolevaniia (Mezhdunarodnaya Kniga, Smolenskaja Ploscad 32/34, Moscow G-200, USSR)

Vol. 34, Jan. 1969, 4pp, 3 Fig, 2 Tab

Measurements have shown that train noise is a function of speed, the type and engineering characteristics of the rolling stock, and upper-level track structure. A table is presented that displays decibel readings for passenger and freight trains at 40 and 60 mph and for seven types of loaded and unloaded locomotives. According to Soviet town planning regulations, residential structures must not be located closer to a railroad track than 100 meters in cities nor 50 meters in other settlements, while rheostat tests of locomotives must be made not less than 300 meters from residential areas. Investigation has shown that these regulations are insufficient to satisfy the sanitary norms for noise levels in living quarters. It is suggested that in existing communities a measure be generally adopted that has proved effective at the L'Vov West railway Station, where rheostat measurements have to be made 90 meters from a residential area. In that case a 15-meter-high screen made of sintered brick and placed 18 meters from the locomotives produced a 20 dB reduction in sound pressure level and a fourfold reduction in subjective evaluation of noise. Similarly, a school outside Vyborg was adequately protected against noise from passing trains. A series of formulas is presented that prescribe the distance from the noise source at which screens should be placed to have the greatest effectiveness. Planning for future communities should take into account the noise-absorbing characteristics of vegetation at various distances from noise sources.

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034961

**HOUSE VIBRATIONS SIGNIFICANT FOR INDOOR SUBJECTIVE RESPONSE**Mayes, WH, Langley Research Center  
Findley, DS, Langley Research Center  
Carden, HD, Langley Research Center

National Aeronautics and Space Administration

NASA SP-189, 1968, 12pp, 11 Fig, 3 Ref

"Progress of NASA Research Relating to Noise Alleviation of Large Subsonic Jet Aircraft", a Conference held at Langley Research Center, Hampton, Va., October 8-10, 1968.

An aircraft flyover is observed by a person inside a house in three ways: the acoustic transmission through the structure, the vibrations of the structure, and the noise radiated by decorative objects in contact with the structure. The average house structure provides from about 10 to 25 dB of noise reduction in the frequency range of

30 to 3000 Hz. The house vibration responses at the lower frequencies are associated with the framing members, whereas the vibration responses at the higher frequencies are associated with the window and wall panels. The indoor noise and vibration levels due to aircraft flyovers are of the same order of magnitude as those associated with rail and road traffic and normal household activities.

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034992

#### NOISE ABATEMENT ON BRIDGES

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

Vol. 2, No. 12, Dec. 1971, pp946-947

Noise measurements were made on a total of 20 railway bridges; the structural design and mode of track laying of these varying greatly. These measurements covered different supporting structures, various decks (steel, concrete) and track laid on wooden sleepers in a ballast bed or steel rail bearers, and also rails laid directly on steel and concrete decks or on steel girders. As shown by the measurements, steel bridges with direct ballast-free track laying produce sound levels in the vicinity of the source up to 19 dB(A) higher than those measured on a steel bridge with concrete deck and wooden sleepers track on ballast bed (mass effect).

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Louvain, 1000 Brussels, Belgium, Repr Req Price

035276

#### FIELD MEASUREMENT OF INFRASONIC NOISE

Hood, RA, Chelsea College  
Leventhall, HG, Chelsea College

Acustica (Postfach 347, 7 Stuttgart 1, West Germany)

Vol. 25, July 1971, pp10-13

Research supported by the Medical Research Council.

Portable equipment for the detection and recording of noise in the frequency range from 2 to 500 Hz is described, together with typical results obtained in an automobile, blast furnace, railroad car, engine room, and helicopters. Factors responsible for peaks appearing at various frequencies are identified, and research on the subjective effects of infrasonic noise is indicated.

#### ACKNOWLEDGEMENT

American Inst of Aero & Astro Tech Info Service, A72-10157

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035415

#### CONTROL OF RAILROAD WHEEL SCREECH NOISE

Kirschner, F, Soundcoat Company, Incorporated

The International Congress on Acoustics (6th), Tokyo, Japan

Aug. 1968

The screech noise generated by railroad wheels on sharp curves has been a source of discomfort since the introduction of railroads. The control of this noise source has been attempted with many auxiliary treatments, such as lubrication of the rails; vibration isolators between the shaft and the shoe of the wheel, but their safety and cost-effectiveness have not been fully acceptable. There is also an approach which applied a lead ring around the rim of the wheel, and

on investigator applied 10 mm thick rubber coatings to both sides of the web of the wheel in order to obtain noise reduction. Since 1963 efforts have been made in the U.S. to apply the newly developed, high efficiency, visco-elastic materials for the suppression of screech noise, first on model wheels, then in laboratory experiments, and finally in field trials. The noise reduction obtained in field trials is given for a five-layer damping treatment, which meets all our design goals in terms of weight, space limitations, temperature extremes and mechanical strengths. Noise levels with and without treatment on the sharpest curve available in the United States railroad industry (90 feet radius at Hudson Terminal in New York), are illustrated for two untreated and two treated cars (with 16 wheels each) rounding the 90 feet radius curve.

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035434

#### ACOUSTICS STUDIES

Parsons, Brinckerhoff-Tudor-Bechtel, 814 Mission Street, San Francisco, California, 94103

TR-8, Final Rpt, June 1968, 105pp

Report on San Francisco Bay Area Rapid Transit District, Demonstration Project. Sponsored by Department of Housing and Urban Development, Washington, D.C.

The report documents the noise and vibration studies for the Bay Area Rapid Transit District system. Several of the studies involved the investigation of new concepts of noise and vibrations control, such as the use of sound barrier walls (often called sound barriers or parapets) along the right-of-way, wheel damping, rail damping, and the use of rail fasteners incorporating vibration-reduction and noise-reduction features. Considerable effort was expended in determining the rank order of the various important sources of noise produced by steel-wheel vehicles passing over steel rails. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-179353

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035689

#### PROBLEMS ENCOUNTERED IN SOUND MEASUREMENTS IN THE SNCB

Dufaux, J Nordvik, N

Acta Oto-Rhino-Laryngologica Belgica (Societe Belge d'Oto-Rhino-Laryngologie, 43 rue des Champs Elysees, Brussels 5, Belgium)

Vol. 25, No. 1,2, pp84-91

The report is in two parts: the first concerns the sound measurements themselves and the second concerns the results of continuous automatic audiometric examinations. In general three locations of sound sources hold particular interest to the medical services of the railroads. They are 1) operator's cabs of diesel locomotives, 2) working areas for repair and mechanical drawing or their equivalent. We describe two types of apparatus for obtaining our results: a sound meter of the General Radio Company, type 1555A giving only total measurement in dB with the standard filter networks for A-, B-, and C-Scales, as well as an apparatus known as Kempex which analyses the frequency dependence by octave band.

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Societe Belge d'Oto-Rhino-Laryngologie, 43 rue des Champs Elysees, Brussels 5, Belgium, Repr PC Req Price

039122

**HIGH SPEED GROUND TRANSPORTATION: NOISE SOURCES**

Dietrich, CW Bender, EK Bruce, RD Heller, HH Nayak, PR

Bolt, Beranek and Newman, Incorporated, Cambridge, Massachusetts

BBN-1741, Oct. 1968, 52 pp

Analyzing the noise problem in high-speed ground transportation passenger spaces, this report identifies: (a) sources, (b) paths, and (c) receivers. It examines ways of establishing noise-level criteria for HSGT vehicles.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-182752

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039368

**ROADS AND THE ENVIRONMENT**

Burt, ME

Transport and Road Research Laboratory, Crowthorne, England

TRRL-LR-441, 1972, 39p

The report states briefly the benefits that roads and road vehicles render the community and then reviews their adverse effects on the environment in four main fields:—traffic noise, air pollution, vibrations and intrusion. In each of these areas the present state of knowledge is outlined and some indication given of the desirable research and development. Emphasis is placed on the need for some means of assessing environmental benefits in financial terms so that environment factors can be given their fair weight in relation to economic factors when decisions are made. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211137

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039865

**RECYCLAMATION: RAIL TRANSPORT ECONOMICS OF SUBSTITUTABILITY OF RECYCLED SCRAP OR WASTE FOR BASIC RAW MATERIALS**

Whitten (Herbert O) and Associates, Annandale, Virginia

Final Rpt, Dec. 1971, 111p\*

Contract DOT PS-20608

The report (1) determines the transportation and economic characteristics which should be considered in evaluating transportation of scrap and secondary materials vis a vis raw materials and finished products which might be used as a model for the study of all waste and scrap materials; (2) describes the prevailing transportation rate structure for waste and scrap materials vs. basic raw materials; (3) recommends and illustrates methodology for measuring the relative transportation rates and costs for movement of secondary materials as compared to other articles; and (4) recommends areas for more critical study. Metal scrap for use by the iron and steel industry is used as an example throughout the report.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212037

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039873

**DEVELOPMENT OF A PHOSPHATE-FREE ALKALINE CLEANER—PAINT STRIPPER**

Nichols, TR

Aberdeen Proving Grounds, Army Coating and Chemical Laboratory, Aberdeen, Maryland DA-1-T-062105-A-109

CCL-307, Final Rpt, July 1972, 21 pp

In recent years concern has been expressed about the contents of industrial water discharges. One of the major areas of concern has been with phosphates because of the eutrophication of streams and waterways. Phosphates are commonly used in alkaline cleaners and in alkaline paint strippers to increase efficiency. The report describes the development of a phosphate-free composition which can be used either as a cleaner or as a paint stripper depending on concentration. The composition is suitable for replacing the alkaline cleaner of Specification P-C-436C and both of the paint removers of Specification TT-R-230B.

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-748803

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041136

**NOISE STUDIED IN RETARDER YARDS**

Kendall, HC

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 7, July 1971, pp 9-13, 6 Fig

Recent adoption of noise ordinances has impacted retarder yards, long a source of noise. The predominate noise is the familiar wheel screech produced when the retarder shoes act on the car wheels. Sound recordings were taken at Perlman Yard. Overall peak sound levels range from 104 to 114 db at 2200 Hz. Car wheels are set into vibration by the action of the retarder shoes. The vibrations occur in a band of frequencies characteristic of the oscillating system composed of shoe beams and wheels. Solutions to be investigated include: changing the nature of the retarder shoe material, changing the mass and stiffness characteristics of the shoe beams, use of retarder pressure modulation to interrupt the input energy, the use of car wheel damping, the use of lubricants, and acoustic barriers.

**ACKNOWLEDGEMENT**

Railway System Controls

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041143

**RAILROADS AND THE ENVIRONMENT**

Welty, G

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 11, Dec. 1972, pp 19-23, 3 Phot

Environmental protection costs are hitting the railroads at a time when finances are in a bind. The railroads, which already converted from steam to diesel power, are a relatively minor source of pollution, and in fact are a positive environmental factor since they take less land, consume less fuel, and produce less pollution than do competitive modes for producing transportation. Since railroads are spread out geographically, they get the impact of varying environmental regulations. Many railroads have set up environmental committees or



appointed environmental officers to their staffs. The industry is working on such problems as locomotive noise, locomotive exhaust, wood crosstie disposal, passenger train human waste discharge, and water pollution. Wayside fires and brush and weed control are also problems. Railroads make a contribution to the environmental protection efforts of other areas of society by hauling low sulfur coal to power plants, by moving truck trailers on flat cars instead of over the highways, and by hauling scrap autos and other refuse.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041219****BN STUDIES RETARDER NOISE ABATEMENT**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 11, Nov. 1972, pp 14-20, 2 Phot

Burlington Northern has conducted tests at three retarder yards to determine sound levels and effective means to reduce those sound levels produced by cars moving through retarders. Screech produced by cars being pulled through inert retarders is a major source of noise. Noise levels indicated that the average retarder screech must be reduced by about 60 db to fall below the average background noise. Ductile iron strips into the retarder shoe eliminated the noise but proved expensive due to short shoe life. Screech appears to be produced by a slip-stick mechanism similar to that by which the violin bow works. BN conducted tests as follows: (1) a vertical sound barrier, (2) sand damping on the retarder, (3) wheel dampers, (4) water saturation, and (5) various types of lubricants. The vertical sound barrier provided between 20 and 23 db attenuation. The sand damping had little effect. The wheel damping tests were not conclusive. The water saturation test was negative, but was believed to be inconclusive, because of previous experience with moisture. Lubrication was found to be effective in eliminating screech. Another series of tests were also reported.

**ACKNOWLEDGEMENT**

Railway System Controls

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.75

**041224****TRANSPORTATION NOISE AND ITS CONTROL**

Department of Transportation, Office of the Secretary, Washington, D.C., 20590

5000-0057, June 1972, 30 pp; 24 Fig, 9 Phot, 7 Ref, 3 App

Specific aspects of the noise problem caused by the various modes of transportation are discussed. In particular, these discussions highlight approaches to noise reduction which have been studied and/or applied to data.

**ACKNOWLEDGEMENT**

Department of Transportation, DOT P5630

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Government Printing Office, Superintendent of Documents, Washington, D.C., 20402, Repr PC: \$0.7

**041309****INDUSTRIAL OILY WASTE CONTROL**

American Petroleum Institute, Suite 1000, 1101 17th Street, NW, Washington, D.C., 20036

This book was published by the American Petroleum Institute and announced in *Railway Locomotives and Cars*, V145, N9, September 1971.

To assist in developing effective, economical and ecologically sound waste oil disposal practices, API and the American Society of Lubrication Engineers have spent three years developing this handbook. Engineers and others concerned with waste disposal will find of great interest subjects such as industry's oily waste problem, standards for effective oily waste control, control of oily waste at the source, the disposal of oily waste, and a glossary of terms.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
American Petroleum Institute, Suite 1000, 1101 17th Street, NW, Washington, D.C., 20036, Repr P \$6.50

**041755****BRITISH AND AMERICAN TACV SYSTEM DEVELOPMENTS: TECHNICAL AND ENVIRONMENTAL FACTORS**

Swanson, CG Easton, GJ Lampros, AF

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

70-TRAN-50, Preprint, 1970, 23 pp, 12 Ref

Presented at the American Society of Mechanical Engineers Joint Transportation Engineering Conference in Chicago, Illinois on Oct. 11-14, 1970.

Research programs instituted by Track Hovercraft Ltd. and the Office of High Speed Ground Transportation for the development of a tracked air cushion vehicle (TACV) are reviewed with respect to economic, engineering, and environmental considerations. System design characteristics, research in propulsion and aerodynamics, coordination and cooperation with related projects, basic performance requirements, and system engineering and design studies are examined. Economic considerations are reviewed with attention to transportation systems planning, choice of areas for maximum use, alternatives, initial plant investment, annual operating costs, and other economic variables such as accident costs and control of noise and air pollution. Based on comparative data on emission of pollutants, the electrically powered high speed ground modes generally created less pollution per million passenger miles than the air modes and considerably less than the highway modes. Electric power collected from the track removed the problem of pollution caused by fuel burning engines. The possibility of locating the electric power generating plants in remote areas further improved the favorable pollution characteristics of the high speed ground modes.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 33216

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017, Repr Req Price

**041756****TOMORROW'S MEANS OF TRANSPORTATION 212 DIE VERKEHRSMITTEL VON MORGEN**

Leibbrand, K

Schweizerische Bauzeitung (Verlags. Ag der Akademischen Technischen Vereine, Staffelstrasse 12, Zurich 45, Switzerland)

Vol. 90, No. 4, Jan. 1972, pp 71-74

The future means of transportation shall produce no exhaust gases and no noise. Monorails and, magnetic or air-suspended trains driven by linear motors and maybe by atomic power are under consideration. Various new means of transportation operate without

personnel. Their operation will be monitored and controlled by electronic computers. A closer look of the new systems either in the planning or developmental stage let them seem way off and not as appealing and flexible as the transportation in the individual car. Therefore means of faster transportation of individual cars on inter-section free highways will be sought, and better bus transportation.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 37925

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

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**041758**

**ECONOMICALLY FEASIBLE ALTERNATIVES TO OPEN BURNING IN RAILROAD FREIGHT CAR DISMANTLING**

Hamburg, FC Bierman, GR Butler, DM Graham, WM Truett, JB

Booz-Allen Applied Research, Incorporated, 4733 Bethesda Avenue, Bethesda, Maryland, 20014

Paper 68-179, Preprint, Apr. 1968, 25 pp, 8 Ref

This paper was presented at the 61st Annual Meeting of the Air Pollution Control Association in St. Paul, Minnesota on June 23-27, 1968.

Open burning of retired railroad freight cars has been the accepted practice for removing the wood to prepare metal components for scrap and salvage operations. New legislation and enforcement zeal threaten the survival of the dismantling industry unless economical alternative methods involving acceptable emission levels are employed. A search for technologically feasible alternatives produced a listing of 39 methods, ranging from simple modifications of existing practice to complex automated, fully mechanized systems. All of the alternative methods satisfied the requirement that pollutant emission be at legally acceptable levels or entirely eliminated. A second requirement of short lead time for implementation led to the rejection of experimental processes and fully mechanized, automatic systems at this time. On the basis of eight other cost-effectiveness criteria, a qualitative screening resulted in the rejection of all but eleven methods. These final, candidate methods were evaluated by application of a forced decision model often used in value engineering. The eight criteria and eleven candidate methods were the arguments of a two-dimensional distribution matrix in which the scores were determined from the decision model exercise. The two highest scoring methods were emission-controlled wood incineration within the confines of each car by means of a special stack or hood configuration; and the use of high-pressure water jets to out away the wood. These methods have been demonstrated in principle by actual field tests performed on box cars in scrap yards. (Authors' Abstract)

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 10646

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Booz-Allen Applied Research, Incorporated, 4733 Bethesda Avenue, Bethesda, Maryland, 20014, Rep PC: Req Price

**041760**

**ENVIRONMENTAL AND CLINICAL INVESTIGATION OF WORKMAN EXPOSED TO DIESEL EXHAUST IN RAILROAD ENGINE HOUSES**

Battigelli, MC Mannella, RJ Hatch, TF

Industrial Medicine and Surgery (Industrial Medicine Publishing Company, Inc., Box 546, Kendall Station, Miami, Florida, 33156)

Vol. 33, Mar. 1964, pp 121-124

Within the limits of exposure to diesel exhaust products, of locomotive repairmen in three representative railroad engine houses over a period up to 15 years (average duration of 10 years), 210 workers (average age—50 years) did not show any significant difference in pulmonary function performance from a group of 154 railroad yard workers (average age—50 years) of comparable job status but without history of exposure to diesel exhaust products. Environmental studies in two engine houses revealed levels of exposure to several known constituents of diesel exhaust which were well within the tolerable limits of these substances considered as separate agents. These low values support the negative medical and physiological findings. In contrast, this investigation suggests higher frequency of respiratory complaints, physical examination of abnormalities of the chest, and decreased pulmonary function and performance of cigarette smokers compared to non-smokers regardless of occupation. (Author)

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 06640

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Industrial Medicine Publishing Company, Inc., Box 546, Kendall Station, Miami, Florida, 33156, PC: Req Price

**041761**

**A RESEARCH REPORT ON THE IMPROVEMENT OF AIR CIRCULATION INSIDE A RAILROAD CARRIAGE 212 SYANAI KANKI KAIZED NO KENYU NI TSUITE**

Fujii, S

Clean Air, Japan (Japan Air Cleaning Association, No. 4, 1-chome, Kanda-Jinbocho, Chiyodaku, Tokyo, Japan)

Vol. 7, No. 1, Res Rpt, Apr. 1969, pp 4-31, 10 Ref

The purpose of this research was to examine the air pollution inside a highly modernized railroad carriage using the new Tokaido line as an example. It was also aimed at finding a device to solve the problem. In the first test, the dust was measured using a dust meter, an air filter, a hygro-thermometer, and deodorant musk inside the controlled atmosphere carriage. In the second test, the air circulation in the carriage under operating conditions was studied. This carriage was equipped with a dust meter, an ionizer, an ion density meter, and an air filter unit with active carbon. The third test studied the influence of cigarette smoking in a carriage. Results show that the 35 cu m/min of fresh air provided by air circulation was sufficient in terms of 002 supply. Pollution increased while the train went through a tunnel. An ordinary ionizer could not cover a wide enough area in the carriage. Odor in the train was mainly caused by cigarette smoke, and a high-fidelity air filter was recommended to diminish the odor and dust density. Two problems left to further study are pressure in the high-fidelity air filter and economic feasibility of operation.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 14951

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Japan Air Cleaning Association, No. 4, 1-chome, Kanda-Jinbocho, Chiyodaku, Tokyo, Japan, Repr P Req Price

**041762**

**EFFECTS OF DIESEL EXHAUST**

Battigelli, MC

Archives of Environmental Health (American Medical Association, 535 North Dearborn Street, Chicago, Illinois, 60610)

Vol. 10, No. 2, Feb. 1965, pp 165-167

This paper was presented at the Seventh Annual Air Pollution Medical Research Conference at Los Angeles, California on Feb. 10-11, 1964.

Over the past three years the author's work at the school of public health in Pittsburgh has been directed to the possible detrimental effects brought about through exposure to diesel motor exhaust. Attention was directed to railroad workers employed in locomotive repair shops. Neither respiratory complaints nor impaired pulmonary function, could be related to this type of occupational exposure. As a second phase in this investigation, volunteers were exposed to diesel exhaust gas for short periods and pulmonary resistance was measured. The levels utilized for these controlled exposure are comparable to realistic values such as those found in railroad shops. No effect could be measured in these volunteers after they had been exposed at these varying levels of pollution from diesel exhaust for short periods up to one hour.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 00650

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American Medical Association, 535 North Dearborn Street,  
Chicago, Illinois, 60610, Repr PC: Req Price

**041767**

**POLYNUCLEAR AROMATIC HYDROCARBONS IN THE PARTICULATES OF DIESEL EXHAUSTS IN RAILWAY TUNNELS AND IN THE PARTICULATES OF AN URBAN ATMOSPHERE**

Moore, GE      Katz, M

International Journal of Air Pollution (Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 2, No. 3, Mar. 1960, pp 221-235, 14 Ref

This paper was presented at the American Chemical Society, Air Pollution Symposium, 136th National Meeting in Atlantic City, New Jersey in September 1959.

The identification of polynuclear aromatic hydrocarbons in the particulate matter arising from the operation of heavy diesel locomotives in railway tunnels is described. Results are compared with those derived from a similar analysis of particulates collected from an urban atmosphere. Although diesel operation in the tunnels increased the particulate loading to eight times normal, the detectable amounts of polynuclear aromatic hydrocarbons were such as might be found from the particulates carried into the tunnel by ventilating air. Chromatographic and spectrophotometric methods were used. Production of polynuclear aromatic hydrocarbons by efficiently operated diesel locomotives is negligible in comparison with the formation of this group by general combustion of fuels in urban activities. (Author Abstract Modified)

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 21635

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523, Repr PC: Req Price

**041768**

**EFFECTS OF DIESEL EXHAUST GAS ON THE HEALTH OF WORKERS. PART I: ENVIRONMENTAL SURVEY 212 DIIZERUKAIKI GASU GA SHINTAI NI OYOBOSU EIKYC. DAIPPO KANKYCCHOSA**

Mogi, T      Schimizu, M      Kondo, N      Yamazaki, K  
Jinguji, S

Science of Railroad Labor (Japan)

No. 22, 1968, pp 1-25, 11 Ref

Exhaust gases from diesel locomotives were investigated at location most likely for pulmonary effects on railroad workers to be prominent, namely, in tunnels and service depot structures. The compounds to be determined were carbon dioxide, carbon monoxide, nitrogen oxides, sulfur dioxide, methane, aldehydes, and other smoke constituents. Measurements were conducted with collection bottles, automatic continuous monitoring devices, and alkali filters, while the analyses performed were the saltzman, p-rosaniline, and barium chloranil methods. The pertinent data on nitrogen oxides, methane, and sulfur dioxide are tabulated for diesel as well as other types of locomotives. Results show that in general the gases are low in concentration, although high instantaneously, and are not immediately harmful. There were cases, however, when the concentrations were higher than the levels causing problems in Japan and other Countries. In Tsuchikura Tunnel, especially, the passage of diesel locomotives yielded substantially higher levels of nitrogen oxides.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 19824

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Science of Railroad Labor, Japan, Repr PC: Req Price

**041769**

**EFFECTS EXHAUST GAS ON HEALTH OF WORKERS. PART II: MULTIVARIATE ANALYSIS OF PULMONARY FUNCTION 212 DIIZERU HAIKIGSU GA SHINTAI NI OYOBOSU EIKYD. DAINIHO HAIKINOKENSASEISEKI NO KAISEKI**

Yamazaki, K      Mogi, T      Nishimoto, Y      Komazawa, T

Science of Railroad Labor, Japan

No. 23, 1969, pp 1-11, 13 Ref

Continued from Part I which included the determination of nitrogen oxides and sulfur dioxide in exhaust from diesel locomotives in tunnels and service sheds, the present study was conducted in order to investigate the effects of these emissions on the pulmonary function of railroad personnel. Employees fell into the categories of those who work in tunnels, in the service sheds, or elsewhere where the effects of gases were present. Data from the tests were subjected to multivariate analysis under various occupational and physiological categories in order to discover the significance of each item, elements which most influence the pulmonary function of railroad workers are their age, height, and weight. The next largest factors are the items relating to the type of work, the location of work, and the degree of pollution of the place of work, surpassing the effect of smoking. The place of work only reduces the pulmonary function by less than ten percent, and the effects of gases are much larger in the service sheds rather than in the tunnels, leading to the conclusion that a better ventilation system and exhaust treatment are necessary.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 19825

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Science of Railroad Labor, Japan, Repr PC: Req Price

**041773**

**AIR POLLUTION AND ASSOCIATED HEALTH HAZARDS FROM DIESEL LOCOMOTIVE TRAFFIC IN A RAILWAY TUNNEL**

Katz, M      Rennie, RP

Occupational Health Review (Department of National Health and Welfare, Canada, Occupational Health Division, Ottawa, Ontario, Canada)

Vol. 11, No. 3, 1960, pp 2-15, 26 Ref

This article was also published in the December 1959 issue of the American Medical Association's Archives of Environmental Health.

The results are presented of an intensive study of a railway tunnel environment under conditions of fully dieselized train traffic. Atmospheric sampling tests were conducted around the clock on an B-HR working shift basis for three days. More than 2000 observations were made to determine the fluctuations and range of occurrence of contaminant concentration under a variety of traffic conditions. There were no abnormal health effects on participants during exposure in the tunnel atmosphere, with the exception of minor cases of eye and throat irritation. However, nitrogen dioxide, aldehydes, smoke, and particulate matter attained high levels during periods of peak train activity. Therefore, installation of appropriate forced-draft ventilation is recommended for the tunnel before full dieselization is introduced to replace electrical operation of trains.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 26262

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Department of National Health and Welfare, Canada,  
Occupational Health Division, Ottawa, Ontario, Canada, Repr  
PC: Req Price

041774

#### NATIONWIDE INVENTORY OF AIR POLLUTANT EMISSIONS

National Air Pollution Control Administration, Division of Air Quality and Emission Data, Raleigh, North Carolina

Pub AP-73, Aug. 1970, 36 pp, 13 Ref

Nationwide emission estimates for the year 1968 are presented. Carbon monoxide, particulates, sulfur oxides, hydrocarbons, and nitrogen oxides are indicated from transportation sources, industrial processes, solid waste disposal, and fuel combustion in stationary sources. Projections of motor vehicle emissions to the year 1990 are included for HO, CO, and NOX. Presented also are the methodology and basic data used to make the emission estimates, such as fuel usage, vehicle miles of travel, and methods of solid waste disposal. Separate travel data were developed for urban and rural driving for automobiles and light- and heavy-duty trucks. Diesel fuel is indicated as well as gasoline. Aircraft, railroads, and ships are mentioned, including the non-highway consumption of motor fuels. Fuel consumption by stationary sources comprises coal, fuel oil, natural gas, and wood. Miscellaneous sources include forest fires, structural fires, coal refuse burning, organic solvent evaporation, gasoline marketing, and agricultural burning.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 26693

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PB-196304

041775

#### EFFECT OF DIESEL LOCOMOTIVE OPERATION ON ATMOSPHERIC CONDITIONS IN A RAILWAY TUNNEL

Rennie, RP

Canadian Journal of Chemical Engineering (Canadian Society for Chemical Engineers, 151 Slater Street, Ottawa 4, Ontario, Canada)

Aug. 1960, pp 123-128, 31 Ref

An extensive study was made over a seven day period to determine if it would be feasible, from an air pollution viewpoint, to operate diesel locomotive powered trains through the St. Clair Tunnel. The trials in the tunnel were conducted using 175 C class GR-17 road switchers of General Motors Manufacture. In these engines the air blower, providing air for combustion, is driven directly off the drive shaft and therefore air intake is proportional to engine speed.

The shape, dimensions, and absence of forced ventilation in the tunnel suggested the possibility of variations in exhaust gas concentrations at different points along the length of the tunnel. In addition, trains enter the tunnel on a down grade under their own momentum with engines idling and coast to about midpoint. To contend with this situation, it was necessary to collect air samples representing not only average conditions, but also fluctuating, peak, and residual conditions. Test methods are described. Concentrations of carbon monoxide found in the tunnel were well below the maximum allowable concentration of 100 ppm for an 8 hour exposure period, but post-exposure figures indicated a slight trend toward higher carboxyhemoglobin saturation percentages in approximately half of the subjects. Concentrations of aldehydes were generally below the maximum allowable concentration of 5.0 ppm. Although average values for all samples taken for nitrogen dioxide were well below the maximum allowable concentration of 5 ppm, total oxides of nitrogen showed concentrations considerably in excess of 25 ppm. This is discussed. Smoke and particulate matter occurred in relatively high concentrations and resulted in the subsequent decision to install forced ventilation in the tunnel. Measured air flow displacement by the trains is also discussed.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 27363

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Canadian Society for Chemical Engineers, 151 Slater Street,  
Ottawa 4, Ontario, Canada, Repr PC: Price

041777

#### PRIME STEEL SCRAP RECOVERED FROM WORN-OUT FREIGHT CARS—WITHOUT AIR POLLUTION

Industrial Heating (National Industrial Publishing Company, Union Trust Building, Pittsburgh, Pennsylvania, 15219)

Vol. 37, No. 8, Aug. 1970, 7 pp

A mechanized facility was built to produce prime steel scrap from wornout railroad box cars. The cars are first passed to an incinerator that contains five box cars in intermittent transit through the burning chamber. During this transit, the wood lining of the cars is reduced to charcoal. Incinerator smoke is treated in afterburner chambers, then water cooled from 1800-200 F to about 600 F. Particulate matter is effectively removed before the cooled gases are discharged to twin 90-ft stacks. The final effluent contains only a few percent carbon dioxide, and the opacity of the stack gases seldom exceeds 0.5 ringelmann. From the incinerator the box cars are transferred to an oxy-acetylene torch burning rack for final disassembly. Any Charcoal remaining in the car skeletons is recovered for barbecuing briquettes.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 30979

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

National Industrial Publishing Company, Union Trust Company,  
Pittsburgh, Pennsylvania, 15219, R PC: Req Price

041778

#### POLYNUCLEAR AROMATIC HYDROCARBONS ON LEAVES

Hancock, JL Applegate, HG Dodd, JD

Atmospheric Environment (Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 4, No. 4, 1970, pp 363-370, 15 Ref

An effort was made to determine the relationship of diesel locomotive exhaust to the concentrations of polynuclear aromatic hydrocarbons on vegetation adjacent to a railroad right-of-way. The leaves of little bluestem and post oak were analyzed by means of thin-layer and gas-liquid chromatography. Anthracene, fluoranthene, pyrene, benz(a)anthracene, and benzo(a)pyrene were identified and

quantified. A sixth compound, 3-methylpyrene, was not detected. Higher polynuclear aromatic hydrocarbon concentrations occurred in leaf extracts of plants collected from the control area than from the railroad right-of-way. A comparison of pyrene to benzo(a)pyrene ratios suggested that most of the PAH found on the leaves were products of plant biochemical synthesis and not products of locomotive exhaust. Definite patterns of individual PAH quantities with respect to season were noted.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 31802

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523, Repr PC: Repr Price

**041779****TERMINAL FORECAST REFERENCE FILE FOR MATHER AIR FORCE BASE, CALIFORNIA**

Mather Air Force Base, 24th Weather Squadron, Mather AFB, California

Detachment 7, Preprint, Oct. 1970, 42 pp

Factors affecting the weather at Mather Air Force Base, California, are discussed. Included are location, topography, air pollution; weather controls; climatic data; and local forecast studies. Ten miles east of Sacramento, Mather AFB is located in an urban area where air pollution is growing, but is not yet a serious problem. The Southern Pacific Railroad Shops, various lumber mills, home incinerators, refuse dumps, and automobiles are the prime constant sources of pollution. Seasonal sources are forest, range, or grass fires (summer and fall), and the burning of rice stubble and orchard trimmings in October through December. The lowest visibilities due to air pollution are caused by the burning of rice stubble in early winter and can lower visibility at the base to one-three miles. Smoke effects are illustrated by a geographic and smoke pollution rose.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 31243

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Mather Air Force Base, 24th Weather Squadron, Mather AFB, California, Repr PC: Repr Price

**041780****FUELS FOR TRANSPORTATION**

Amero, RC

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

ASME-NAFTC-3, Preprint, 1970, 28 pp, 38 Ref

This paper was presented at the North American Fuel Technology Conference in Ottawa, Canada on May 31-June 3, 1970.

Liquid hydrocarbon fuels supply energy for almost all of the world's transportation. The principal exception is natural gas used to power compressor stations on pipelines, if gas transmission is considered a sector of transportation. For 50 years, refinery development has meant increased yield and octane rating of gasoline. Demand for distillate (jet, diesel, and marine gas turbine fuel), though smaller, is now growing faster. Refiners have great technical versatility for converting widely different crudes into specification fuels. The technology has been extended to produce the same kinds of fuels from tar sands. Technology now being developed should be available when needed to convert shale oil and coal into conventional fuels. Air pollution controls and new engines may alter the distribution of products from the petroleum barrel, but electric automobiles, nuclear ships and other non-hydrocarbon systems are not expected to supply a large share of transportation in the foreseeable future. Fuel consumption is discussed for trucks, buses, automobiles, trains, aircraft, and ships.

(Author Abstract).

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 33931

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American Society of Mechanical Engineers, 345 East 47th Street, New York, New York, 10017, Repr Req Price

**041782****EMISSION INVENTORY FOR THE STATE OF NEW JERSEY**

International Business Machines Corporation, Federal Systems Division, Gaithersburg, Maryland

BOA 68-02-0043, Final Rpt, Aug. 1971, 85 pp

An emission inventory for New Jersey is presented with respect to area description, methodology, sources of information, and emission data for fuel combustion sources (coal, oil, and natural gas); evaporative sources, i.e., gasoline marketing and dry cleaning; mobile sources, including automobiles, diesel powered vehicles, railroads, vessels, and aircraft; and open burning. A total inventory of emission sources and pollutants determined that residential (heating), commercial, and industrial sources, incineration, transportation, power plants, and processing generated 28,005 tons of particulates, 78,068 tons of sulfur oxides, 224,838 tons of carbon monoxide, 49,261 tons of hydrocarbons, and 82,604 tons of nitrogen oxides annually.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 34969

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PB-203083

**041783****STATEWIDE INVENTORY OF AIR POLLUTION EMISSIONS, STATE OF KANSAS 1970**

Pedco-Environmental Specialists, Incorporated, Cincinnati, Ohio

Aug. 1971, 63 pp, 5 Ref

The emissions of air pollutants have been calculated from point and area sources in Kansas, and the emission data have been assembled in a suitable format for use in developing an implementation plan. Particulates, sulfur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons were included in the emissions inventory. Area grids are included. Sources included fuel combustion (coal, residual oil, natural gas, distillate oil), electric power generation, flour mills, chemical industries, grain mills, refining, steel and rubber manufacturers motor vehicles (gas and diesel), aircraft, trains, open burning, and solvents.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 35405

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PB-203350

**041784****EMISSIONS INVENTORY FOR THE STATE OF SOUTH CAROLINA**

TRW Systems Group, Washington Operations, McLean, Virginia

Aug. 1971, 102 pp, 30 Ref

Contract EPA-68-02-0048

A summary of the emissions inventory for the State of South Carolina is presented. Point source data required for the preparation of the inventory were obtained from questionnaires distributed by the State Agency and follow-up contacts with individual sources. The

data were transferred to prepared computer load sheets and processed. Area source data were obtained from various Governmental Agencies and by personal contact with knowledgeable individuals. This information was also computer processed. All emissions are summarized in tabular form for each region and gridded area. Charts have been prepared to illustrate major sources of each pollutant. These sources included coal, fuel oil, and natural gas boilers, used in residential, commercial, and industrial areas, open burning, incineration, solvent evaporation, vessels, railroads, diesels, residential heating, gasoline vehicles, air craft, dumps, electric power plants, mineral products, and wood fires. Particulates, sulfur dioxide, carbon monoxide, hydrocarbons, nitrogen oxides, sulfur, and ash were listed. (Author Abstract Modified)

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 35465

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PB-203501

#### 041786

##### A WORKING SYSTEM FOR THE MANAGEMENT OF EMISSION INVENTORY INFORMATION

Shanks, SG Cole, WA Boyer, A Copper, DG

Air Pollution Control Association Journal (Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania, 15213)

Vol. 22, No. 2, Jan. 1972, pp 85-89

This paper, #71-10, was presented at the Air Pollution Control Association's 64th Annual Meeting in Atlantic City, New Jersey.

Emission inventory data collected in the Metropolitan Toronto area (1969-1970) are managed by a computerized information system which abstracts specified information about individual sources for a diffusion model and also summarizes data in usable formats needed for the day-to-day operations of the air management branch, province of Ontario. Provisions are included for maintaining the data in a current state and modifying either specific sources or classes of sources for simulation purposes. The computer system utilizes Cobal programming routines but has the capacity to format data for the FORTRAN IV language used by the diffusion model. Emission inventory information includes seasonal, daily, and hourly emission rates for area and point sources plus exit gas velocity from stacks and control equipment efficiency. Three summary extracts are regularly prepared: emission quantity summary by size of contribution; emission quantity summary by source type; and sources by type of control equipment installed. The diffusion model predicts air quality on an hourly basis. Major sources include motor vehicles, domestic heating, industrial sources, shipping, railroads, and aircraft.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 38577

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh, Pennsylvania, 15213, Repr PC: Price

#### 041787

##### FINAL REPORT ON THE EMISSIONS INVENTORY FOR THE STATE OF ALABAMA

TRW Systems Group, Washington Operations, McLean, Virginia  
Aug. 1971, 93 pp, 33 Ref

Contract EPA-68-02-0048

Under the Clean Air Act of 1970, as amended, each state is required to submit a plan for the implementation and enforcement of national ambient air quality standards for each air quality control region in the state. An initial requirement for each of these plans is

an emission inventory for each designated region. The Alabama emission inventory is summarized in charts and tables that serve as a guide to control strategy development and selection. Point source data required for preparation of the report were obtained from questionnaires and follow-up contacts with individual sources: area source data were obtained from various Governmental Agencies and personal contact with knowledgeable individuals. All data were transferred to prepared computer load sheets and processed by the Environmental Protection Agency Inventory Computer Program. The Metropolitan Mobile and Birmingham areas were divided into grid networks for the purpose of apportioning the emissions in these areas. All other emission totals are reported by political jurisdiction and region. Sources included coal boilers and burners, fuel oil burners, natural gas boilers, open burning, incineration, solvent evaporation, diesel engines, railroads, ships, gasoline motor vehicles, surface coating, petroleum refining and distribution, wood burning, solid waste disposal, pulp mills, and power plants for residential, industrial and commercial areas. Sulfur dioxide, carbon monoxide, hydrocarbons, particulates, and nitrogen oxides were measured.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 35437

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PB-203467

#### 041788

##### PARTICULATE POLLUTANT SYSTEM STUDY. VOLUME II: FINE PARTICLE EMISSIONS

Shannon, JJ Gorman, PG

Midwest Research Institute, Environmental Sciences Section,  
Kansas City, Missouri

Vol. 2, MRI PROJ 3326-C, Aug. 1971, 335 pp, 139 Ref

Contract CPA-22-69-104

The emission of fine particulates (0.01-2 micron) from industrial emission sources was statistically investigated with respect to data acquisition, particle size distribution, fractional efficiency of control methods, defined sources, emission projections, particulate sampling, and effects on human health, animals, and atmospheric modifications. Industrial emission sources included stationary combustion of coal, fuel, oil, and natural gas (power plants), crushed stone processes, iron and steel plants, (furnaces), kraft pulp mills, cement plants and kilns, asphalt plants, ferroalloys processing, lime plants, carbon black, coal preparation plants, petroleum units, municipal incinerators, fertilizer and grain processes, dryers, iron foundries, cupolas, and acids. Mobile emission sources included motor vehicles, aircraft, railroads, and water transport. Efficiency curves for electrostatic precipitators, fabric filters, scrubbers, cyclones, and multiclones were derived. Sampling devices included impactors, thermal precipitators, electrostatic precipitators, particle-size distribution analyzers, microparticle classifiers, counters, differential sedimentation techniques, and microscopic measurements. Atmosphere modifications due to particulates emissions were determined as weather pattern modifications, light scattering, decreased visibility, association with smoke plumes, and change in air compositions. Projections of particulate emissions to the year 2000 are given.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 35443

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#### 041789

##### PITTSBURGH METROPOLITAN AREA AIR POLLUTION EMISSION INVENTORY

McGraw, MJ Holt, CS

National Air Pollution Control Administration, Air Quality and Emission Data Division, Durham, North Carolina

PUB-APTC-0895, Nov. 1968, 54 pp, 15 Ref

An emission inventory for the Pittsburgh Metropolitan area is presented. Total emissions of sulfur oxides, particulates, carbon monoxide, nitrogen oxides, and hydrocarbons were estimated as a function of source type, season, and geographical distribution. The major sources included motor vehicles, industrial processes, steam-electric power plants, domestic heating, commercial and institutional fuel combustion, refuse disposal, incineration, open burning, aircraft, railroads, and vessels. Data on combustion of coal, residual and distillate fuel oils, and natural gas are tabulated.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 39431

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PB-207648

041790

#### NEW YORK STATE SOUTHERN TIER WEST EMISSION INVENTORY

Beaty, JR

Environmental Protection Agency, Air Pollution Control Office, Durham, North Carolina

PUB-APTD-0824, Feb. 1971, 73 pp, 5 Ref

Sulfur oxides, particulates, carbon monoxide, hydrocarbons, and nitrogen oxides are delineated with respect to source type, season of the year and geographical distribution within the area. The general procedure for the surveys of seven counties in Southwest New York was based upon the rapid survey technique for estimating air pollutant emissions, with a grid coordinate system employed to show the geographical distribution of emissions within counties. Stationary combustion sources, especially four steam-electric plants located in the area which had coal fired units, accounted for 99 percent of all sulfur oxide emissions and 71 percent of nitrogen oxides. While the four power plants also contributed the majority of particulate emissions (52 percent), other industrial processes contributed 12 percent of the emissions, the largest source of which was the mineral products industry. Motor vehicles contributed 88 percent of the carbon monoxide emitted annually and were the major source of hydrocarbon emissions. Railroads, aircraft, incineration, open burning, gasoline storage and handling, automobiles, and solvents also caused large amounts of pollution.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 40274

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PB-207749

041791

#### FINAL REPORT FOR STATEWIDE EMISSIONS INVENTORY FOR THE STATE OF LOUISIANA

Lagrone, F Burklin, CE

Radian Corporation, Austin, Texas

PUB-APTD-0794, Final Rpt, Sept. 1971, 77 pp, 14 Ref

Area and point source emissions of sulfur compounds (sulfur dioxide and sulfur trioxide), particulates, carbon monoxide, nitric oxide, nitrogen dioxide, and hydrocarbons and their derivatives were calculated within an emission inventory for Louisiana. Procedures involved in gathering data on emissions and fuel consumption, determination of the grid systems, survey methodology, data analysis, and actual calculations of emissions are reviewed. The point sources

included chemical processing, coal cleaning, detergent and soap manufacturing, ink manufacturing, paint and varnish production, fertilizer plants, synthetic fiber and rubber production, food and feed operations, rendering, primary and secondary metallurgical processes, mineral processing, petroleum refining, pulp and paper manufacture, dry cleaning, surface coating operations, gasoline marketing, steam-electric power plants, incinerators, and open burning dumps. Area source emissions were calculated from combustion and consumption data on coal, fuel oil, natural gas, residual oil, and distillate oil with vessels, railroads, diesel motor vehicles, gasoline motor vehicles, airport operations, solid waste disposal, and process losses as major area sources. Sample inventory forms, data tabulations, and area maps are included.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 40345

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PB-204949

041792

#### A METHOD FOR ESTIMATING AND GRAPHICALLY COMPARING THE AMOUNTS OF AIR POLLUTION EMISSIONS ATTRIBUTABLE TO AUTOMOBILES, BUSES, COMMUTER TRAINS, AND RAIL TRANSIT

Scheel, JW

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10001

720166, Preprint, 1972, 12 pp, 22 Ref

This paper was presented at the Automotive Engineering Congress in Detroit Michigan on January 10-14, 1972.

An analytical method is described for estimating and graphically comparing the amounts of mass emissions from automobiles, buses, commuter trains, and rail transit given the emission characteristics of each type of vehicle. Emissions considered include carbon monoxide, hydrocarbons, nitrogen dioxide, and sulfur dioxide. These mass emissions are expressed in grams per person mile as well as grams per vehicle mile in order to consider their quantity based on the movement of people as well as on the movement of vehicles. The relative effects of these pollutants are also presented. Information from this method can be used to estimate the quantity of emissions produced in a specific area given the travel characteristics of that area. Changes in the amount of emissions resulting from persons who change their mode of travel can also be estimated. Application of this method for a given region can help local officials estimate the effects of various transportation policies on the regional transportation-related pollution. (Author abstract modified)

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 41076

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Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10001, Repr PC: Req Price

041793

#### OKLAHOMA CITY METROPOLITAN AREA POLLUTANT EMISSION INVENTORY

McGraw, MJ

National Air Pollution Control Administration, Air Quality and Emissions Data Division, Durham, North Carolina

PUB-APTD-0825, Feb. 1970, 65 pp, 10 Ref

Five categories of emissions were examined—transportation, stationary fuel combustion, solid waste disposal, industrial processes and, evaporative losses. Each of these sources was evaluated in two subgroups—point sources and area sources. Natural gas is virtually

the only fuel used in the Oklahoma City Metropolitan area. Forty-eight sources having emissions greater than 0.5 tons/day of any pollutant were classified as point sources. Remaining contributors were considered collectively as area sources. Estimated annual emissions in the Oklahoma City metropolitan area for September 1969 are listed. Sulfur oxides totaled 2200 tons. Motor vehicles contributed 84 percent of the sulfur oxides. Aircraft and railroads account for 8 percent. Particulates totaled 14,200 tons. Light industrial processes contribute 50 percent of the particulate emissions. Transportation contributes 29 percent, refuse disposal 15 percent and stationary fuel combustion 8 percent. Carbon monoxide totaled 150,700 tons. One-third of the total hydrocarbons can be attributed to the production of crude oil. Liquid propane gas plants contribute 17 percent and evaporative loss from motor vehicles 12 percent. Exhaust gas from motor vehicles adds 20 percent and solvent handling 10 percent of total hydrocarbons. Nitrogen oxides totaled 43,600 tons, of which motor vehicles contributed over 55 percent. Natural gas combustion accounted for 41 percent, with 33 percent attributed to two steam-electric plants.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 42758

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PB-207694

#### 041794

#### AIR POLLUTION INVENTORY, STATE OF MINNESOTA

TRC, The Research Corporation of New England, Hartford, Connecticut

4280, Oct. 1971, 60 pp, 33 Ref

Contract EPA-68-02-0047/1

Emission inventory data were collected to provide specific information appropriate to the calendar year 1970 on area and point sources for five air pollutants: particulates, sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides. The overall methodology employed centered on correctly apportioning various types of fuels, process emissions, and combustible solid waste. Totals for all types of emissions sources were determined from the tabulated sources. The fuels and solid waste were apportioned according to population and applicable land use variables in each region. Once subtotals had been established for fuels and solid waste for the seven air quality control regions in the area, the quantities reported by point source questionnaires were subtracted resulting in the quantities of fuel that would be available for area source apportioning. Specific source types whose emissions contribution to each of the seven regions was estimated were coal, residual and distillate oil, natural and bottled gas, domestic and other wood burning, open burning and incineration, solvent evaluation, diesel vessels, railroads, diesel motor vehicles, gasoline motor vehicles, and gasoline evaporation. For each source type, specific methods of estimation are described.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 43399

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PB-203902

#### 043329

#### ACOUSTICS OF MASS TRANSPORTATION SYSTEMS

Goodrich (BF) Company, 500 South Main Street, Akron, Ohio, 44318

15 pp

This report discusses noise and vibration problems in the use of rail rapid transit systems. In a rail operation wheels and rails are the prime offenders. The truck is a secondary offender. Sound can be reduced by just treating the wheels and rails. Some noise will remain from the truck, but unless a major sound reduction is required, the

truck need not be treated. The research and development facilities of B.F. Goodrich Company are continually working on acoustical materials and design methods for transit noise control.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Goodrich (BF) Company, 500 South Main Street, Akron, Ohio,

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#### 043332

#### ANALYSIS OF POTENTIAL NOISE SOURCES OF TRACKED AIR CUSHION VEHICLES (TACV)

Bender, EK Hayden, RE Heller, HH

Bolt, Beranek and Newman, Incorporated, 50 Moulton Street, Cambridge, Massachusetts, 02138

DOT-TSC-194-1, Contr Rpt, July 1971, 104 pp, 42 Fig, 4 Ref, 6 App

Contract DOT-TSC-194

Prepared for Urban Mass Transportation Administration.

This report presents an evaluation of the principal sources of noise from tracked air cushion vehicles (TACVs). The study is based on analyses of and laboratory experiments on existing TACVs and rapid transit systems. Measurements of two French TACV systems were conducted, one a 44-passenger prototype suburban vehicle propelled by a linear induction motor (LIM), and the second an 80-passenger intercity vehicle powered by a gas turbine and shrouded pusher propeller. Noise levels from a slider current-collection system were also obtained through measurements of the noise and vibration of a third-rail contact shoe on a rail rapid transit car. (Author)

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#### 043355

#### NOISE LEVEL MEASUREMENTS ON THE UMTA MARK I DIAGNOSTIC CAR (R42 MODEL)

Rickley, EJ Quinn, R Byron, G

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-UMTA-72-3, Tech Rpt, 7105-7108, Oct. 1971, 100 pp, 44 Fig, 1 Tab, 11 App

ID DOT-UM-204

The R42 Model mass transit car currently operating on the "N" line of the new York City Transit System was selected for experimentation and tests. For this purpose, the car was instrumented and designated as the UMTA Mark I Diagnostic Car. Noise levels generated by "stop and go" operations of the Diagnostic Car were measured and tabulated in this report. Measurements were made inside of and outside the car during operation on the "N" line of the New York Transit System and during operation at the DOT High Speed Ground Test Center at Pueblo, Colorado. The report contains tabulations of the noise levels measured, time history charts, 1/3-octave frequency analyses and pertinent comments on the information obtained. (Author)

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#### 043525

#### EFFECT OF CETANE IMPROVERS IN THE FUEL ON NITROGEN OXIDES CONCENTRATION IN DIESEL EXHAUST GAS

Freedman, RW Long, HW Sippel, AJ, III



Bureau of Mines, C Street Between 18th and 19th, NW,  
Washington, D.C.

BM-RI-7310, Oct. 1969

The effect of cetane improvers on the nitrogen oxide concentration in diesel exhaust gas is analyzed.

**ACKNOWLEDGEMENT**

National Aeronautics and Space Administration, N70-25619

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**043526**

**DIESEL EMISSIONS REINVENTORIED**

Fleming, RD Marshall, WF

Bureau of Mines, Petroleum Research Center, Bartlesville,  
Oklahoma

BM-RI-7530, July 1971

This research was sponsored in part by Department of Health,  
Education and Welfare.

The exhaust emission characteristics of diesel engines are analyzed, noting emissions of smoke, odor, hydrocarbons, nitrogen oxides, carbon monoxide, and aldehydes.

**ACKNOWLEDGEMENT**

National Aeronautics and Space Administration, N71-32492

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N71-32492

**043615**

**TIE REPLACEMENT PROGRAM**

Keener, Chesapeake and Ohio Railway

Railway Systems and Management Association, 163 East Walton  
Street, Chicago, Illinois, 60611

Feb. 1969, pp 63-74

The demand for track materials varies directly with the financial state of the railroads. The demand for wood ties has recently slackened off so that tie producers have no incentive for R&D, lessening production efficiency and putting a squeeze on profits. The market for other lumber products and the availability of a concrete tie substitute have also considerably weakened the wood tie market. Concrete ties are more stable and lower in price due to steadier cost trends of sand, gravel, and cement, and also a lower labor to material cost ratio. Performance studies comparing concrete and wood ties have favored the former. In an economic evaluation of discounted cash flow equations and cost drains, concrete ties are favored again.

**ACKNOWLEDGEMENT**

Railway Systems Management Association

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Railway Systems Management Association, 163 East Walton  
Street, Chicago, Illinois, 60611, Repr \$5.00

**043805**

**STATEMENT OF KENNETH KNIGHT BEFORE THE  
PUBLIC HEARINGS ON NOISE ABATEMENT AND  
CONTROL**

Knight, KG, Institute for Rapid Transit Noise Control

Environmental Protection Agency, 400 M Street, SW,  
Washington, D.C., 20024

Oct. 1971, pp 113-121

Presented at the Public Hearings on Noise Abatement and Control conducted by the Office of Noise Abatement and Control, U.S. Environmental Protection Agency in New York City, Oct. 21-22, 1971. Included in Vol. VI--Transportation Noise, Urban Noise Problems and Social Behavior.

Noise ranks as the most important problem facing the steel wheel-steel rail transit system industry. Acoustic problems of vehicles in stations, in tunnels, or from aerial structures are intensified by dense urban environmental operation. At the present time the public can control or alter route locations, demand aerial structures, demand at-grade facilities be put underground or other major changes, although such design changes are often prohibitively expensive. The industry itself has been aware of the noise problems and made significant technological improvements since the first subways were introduced in Boston, New York and Philadelphia. Basic research is required to clearly establish the effects of noise upon people and to establish appropriate criteria for the noises of the type generated by transit system operations.

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Washington, D.C., 20024, Repr PC: Req Price

**043808**

**STATEMENT OF WILLIAM HARRIS BEFORE THE  
PUBLIC HEARINGS ON NOISE ABATEMENT AND  
CONTROL**

Harris, WH, Association of American Railroads

Environmental Protection Agency, 400 M Street, SW,  
Washington, D.C., 20024

Oct. 1971, pp 74-81

Presented at the Public Hearings on Noise Abatement and Control conducted by the Office of Noise Abatement and Control, U.S. Environmental Protection Agency in New York City, Oct. 21-22, 1971. Included in Vol. VI--Transportation Noise, Urban Noise Problems and Social Behavior.

Noise sources associated with the rail transportation industry are identified as the steel wheel-steel rail interaction; retarders in classification yards consisting of metal brake shoes acting on car wheels; diesel locomotives and component systems; and locomotive horns. In the case of horns there is a straight tradeoff problem because a large percent of fatalities associated with railroad operations occur at grade crossings. In the other noise areas Federal standards should be designed because of the interstate nature of railway commerce. The cost of responding to noise standards should be met by society because of the benefits accruing to society. In the context of total environment the railroad mode of freight transportation is a low-pollution mode.

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Washington, D.C., 20024, Repr PC: Req Price

**043997**

**CURRENT SURVEY OF FEDERAL AIR QUALITY  
CONTROL LEGISLATION AND REGULATIONS**

Keener, KC

Natural Resources Lawyer (American Bar Association, Div of  
Legal Practice and Regulation, 1155 East 60th Street, Chicago,  
Illinois, 60637)

Vol. 5, No. 1, Jan. 1972, pp 42-81

After a brief discussion of the historical development of federal legislation in the field of air quality, this article analyzes in detail the law as a result of the Clean Air Amendments of 1970. Both stationary and mobile sources as well as fuels are covered. The analysis demonstrates a sufficiently comprehensive scheme insofar as the legal

framework is concerned. Assuming that the relevant government entities provide the requisite funding and personnel, it appears that the present governmental commitment should be more than enough to cope with the problem.

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1155 East 60th Street, Chicago, Illinois, 60637, Repr PC:  
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044063

**THE RAILWAY AND ENVIRONMENTAL PROTECTION**

Bottger, W

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

Vol. 3, No. 7-8, July 1972, pp 425-429

Most of the private German railways are in poor financial shape. Since in accordance with the existing Railway Act the Governments of the "Lander" exercise supervisory powers over the private railways, the "Ministerium fur Wirtschaft, Mittelstand und Verkehr" of North Rhine-Westphalia has obtained expert opinion on the reasons why support and financial assistance should be given in the individual cases despite proven unprofitability. It was repeatedly found that the required protection of the environment can justify the continuation of the railway services. So as to put more emphasis on this increasing awareness an attempt was made to obtain proof in figures of damage to the environment. At the same time the intention was to make these individual results more conclusive than before in order to gradually prepare the ground for the establishment of reliable evaluation data. The following article is basically an extract from an (unpublished) expert's report prepared for the "Ministerium fur Wirtschaft, Mittelstand und Verkehr" of North Rhine-Westphalia. The

supporting figures were provided by the Transport Sciences Institute at the University of Cologne.

**ACKNOWLEDGEMENT**

British Railways Board

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International Railway Congress Association, 17-21 rue de  
Louvain, 1000 Brussels, Belgium, Repr Req Price

044190

**AN INVESTIGATION OF STEEL WHEEL-RAIL NOISE AND TECHNIQUES FOR ITS SUPPRESSION— MONOGRAPH NO. 15**

Enright, JJ

Battelle Memorial Institute, 505 King Avenue, Columbus, Ohio,  
43201 3-nss-3

Oct. 1967

The report assesses studies performed on noise reduction at the steel wheel-rail interface and recommends an r&d program for further testing and suppression. The report also enumerates 15 techniques for noise suppression.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-178256

**007336  
MAGNETIC SUSPENSION**

Polgreen, CR

Institution of Mechanical Engineers, Proceedings (Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1, England)  
No. 4C, Oct. 1966, 6 pp, 2 Fig, 2 Tab, 4 Ref

Tracked transport by magnetic suspension using new ceramic permanent magnets is now practicable for slow as well as highest speeds. Vehicles float with clearance up to an inch on a magnetic field requiring no power expenditure and, therefore, without noise and the need for maintenance. development that is now at the man-carrying model stage is described, including propulsion-braking by a simple D.C. linear motor that uses the track permanent field for excitation. The paper opens with an outline of latest progress in magnet material and design, on which this whole subject is based. /RRL/A/

**ACKNOWLEDGEMENT**  
Road Research Laboratory

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**037159  
AERODYNAMICS OF HIGH SPEED GROUND VEHICLES  
IN TUBES**

Magnus, DE Panunzio, S

Canadian Aeronautics and Space Journal (Canadian Aeronautics and Space Institute, 77 Metcalfe Street, Ottawa 4, Ontario, Canada)

Vol. 16, No. 6, June 1970, pp 225-31, 12 Ref

The drag coefficients and measurements of static wall pressure for tube-vehicle transportation systems are presented. The experimental results are from a test facility that launches models at 200 to 400 mph into a precisely aligned tube (one inch diam and 100 feet long test section). The models simulate a full-scale vehicle operating with a Reynolds number of 10 to the fifth power in a tube seven miles long. With a blockage ratio of 0.56, a choke flow in the gap between the vehicle and wall requires velocities above 300 mph. The wake region is shown to be an important factor on the vehicle drag. By opening or closing a set of vents behind the vehicle, the drag is modified substantially. The static pressure measurements provide information about the compression and expansion waves in the tube. Details of the pressure in the immediate vicinity of the vehicle are shown.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 71 03728

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**037177  
PROSPECTS FOR NEW INTERCITY GROUND MODES**

Vadeboncoeur, JR

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10001

SAE-Paper 700184, 6 pp, 4 Ref

Further development of new and innovative transportation technologies for intercity passenger service is dependent upon the resolution of certain remaining technological problems but, most importantly, upon the assessment of their economic viability. This paper outlines the critical elements of this assessment, with emphasis on the role of transportation system planning. Some of the initial results of the service design of baseline configurations of high-speed rail and tracked air cushion systems in the Northeast Corridor of the United

States are presented as example outputs of the planning process.  
**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 20543

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**037186  
ANALYSIS OF THE EFFECTS OF WALL PERFORATIONS  
ON THE PERFORMANCE OF A VEHICLE IN A TUBE**

Cromack, DE

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 3, No. 3, Sept. 1969, pp 335-51

The flow induced by a vehicle traveling through a porous-wall tube is analyzed as a one-dimensional incompressible flow steady in the vehicle-fixed frame of reference. The pressure and velocity fields are determined for both non-viscous and viscous flows, for varying vehicle blockage ratios, for externally and internally propelled vehicles, and for various tube-wall porosities. Drag decreases with increasing wall porosity, up to a critical value, which is 10% for a vehicle blockage of 40% and a vehicle length of five times the tube radius.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 35455

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**037190  
ROLE OF TECHNOLOGICAL FORECASTING IN  
TRANSPORTATION R&D PLANNING**

Sims, R, TRW Systems Group

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

Proceeding, 1968, pp 145-52

Problem of technological forecasting is discussed in relation to its use in transportation system planning activity; example is drawn from study of technology of superconductivity, essential ingredient for electromagnetically suspended high speed train.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 17137

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**037193  
PRELIMINARY INVESTIGATION OF THE LIFT AND  
DRAG OF AN AIRFOIL OPERATED BETWEEN PARALLEL  
LANES**

Williams, JC

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 3, No. 3, Sept. 1969, pp352-60

Study of configuration proposed by PBS Lissaman for high speed ground transportation system, in which an airfoil operated in a tunnel is used to support a load-carrying body mounted exterior to the tunnel. A substantial increase in airfoil lift is obtained when the airfoil is operated in this configuration. Drag is also increased, but over a wide range of angle of attack the increase in lift is sufficiently large so that there is an increase in lift to drag ratio.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 35400

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037194

**TUBE-VEHICLE DRAG**

Skinner, JH, Jr., General Electric Company

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 3, No. 2, May 1969, pp 243-54

Aerodynamic drag calculations are made for both internally and externally propelled vehicles travelling at constant subsonic speeds through long tubes of different diameters. The results indicate that the aerodynamic drag in a nonevacuated tube is always greater for an externally propelled tube-vehicle than for the same vehicle internally propelled, while in both cases the drag is greater than for the vehicle traveling in the open air. The propulsive power saving that can be attained for vehicles in evacuated tubes is indicated.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 35401

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037195

**SECONDARY SUSPENSION REQUIREMENTS FOR TRACKED VEHICLES**

Cooperrider, NK, General Electric Company

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 3, No. 2, May 1969, pp255-67

Results of a study of the behavior of tracked air cushion vehicles (TACV's) with both passive and active secondary suspension systems (between air cushion and vehicle body) in response to disturbances from the guideway and from aerodynamic loads. These show that a secondary suspension is needed for adequate ride comfort at high speeds even on a relatively smooth guideway. A passive secondary suspension incorporating spring and viscous dampers must be quite soft to meet ride comfort objectives. An active suspension is needed to provide excellent ride.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 35386

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037201

**TERRAFOIL. A NEW CONCEPT IN HIGH SPEED GROUND TRANSPORTATION**

Harris, GL, Seamann, GR

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 4, No. 2, May 1970, pp 197-209

A new concept in HSGT called the Terrafoil is presented and discussed. The potential performance of this vehicle concept is discussed only from a semiquantitative point of view and conclusions are drawn on the basis of preliminary experiments and elementary analysis.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 04852

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037313

**TRACKED AIR CUSHION RESEARCH VEHICLE. SUBSYSTEMS ANALYSIS**

Schlosser, A

Grumman Aerospace Corporation, Bethpage, New York

Design Rpt, Mar. 1971, 205 pp

Contract DOT-FR-00005

The TACRV is composed of a body containing the cabin, equipment compartment and air supply engines, and a chassis which has ducts to distribute the air to the cushions. The vehicle has secondary suspensions between the body and chassis, and between the chassis and air cushions. Two propulsion modes are available, the Linear Induction Motor (LIM) Propulsion System and the Aeropropulsion System. The report describes the selection, sizing and installation of the air supply system air cushions, secondary suspension, braking system, environmental control system and electric, hydraulic, and pneumatic power systems. The LIM, and TACRV electric propulsion thruster currently being developed under a separate DOT contract, is described along with its performance and salient features. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210826

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037530

**ACOUSTIC ENGINEERING CONSIDERATIONS IN THE DESIGN OF A TRACKED AIR CUSHION VEHICLE (TACV)**

Spice, BJ, Vought Aeronautics Company

Institute of Noise Control Engineering

Proceeding, Oct. 1972, pp 231-235, 8 Fig, 1 Tab, 8 Ref

Published in Inter-Noise '72 Conference Proceedings, Washington, D.C., October 4-6, 1972.

The TACV seems to be leading the field of potential high-speed ground transportation systems in the United States. This paper briefly discusses the acoustic design of a proposed 150 mph, 60 passenger prototype vehicle by LTV Aerospace Corporation. It was some 120 feet long and intended to travel in a channel-section guideway. The vehicle was levitated by a continuous series of air-cushion arrays, underneath, with a similar arrangement along the sides to provide guidance. Two fans at the front supplied air to the cushions via a duct down each side of the vehicle. The cushion concept comprised a shallow, inverted pan suspended from a flexible air-bag. The gap between the pan lip and the guideway was 0.14". Stringent environmental requirements were imposed by DOT to allow operation in urban areas, and to provide unexcelled passenger comfort.

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Editor, Noise/News, P.O. Box 1758, Poughkeepsie, New York, 12601, Repr PC: Req Price

039004

**THE AERODYNAMIC CHARACTERISTICS OF A SLENDER BODY TRAVELING IN A TUBE 212 Technical rept.**

Goodman, TR

Oceanics, Incorporated, Plainview, New York

TR-66-31, Tech Rpt, Jan. 1967, 50 pp

Contract C-265-66

Slender-body theory is applied to determine the flow about a slender body of revolution traveling in a tube. A formula for the pressure distribution on an ellipsoid centered in the tube is derived and it is shown that for a body whose diameter is a large percent of the tube diameter the pressures are an order of magnitude greater than they would be for the same body traveling in free air. It follows that a body which passes from a wide to a narrow passage will experience a large impact loading. Formulas for all the static and dynamic stability derivatives are then derived for an arbitrary body of revolution in terms of its cross-sectional area distribution. These formulas are specialized to an ellipsoid of revolution as an illustrative example, and plots of the results are presented as a function of the ratio of the maximum cross-sectional area of the body to the area of the tube. For the body whose diameter is a large percent of the tube diameter the stability derivatives also become an order of magnitude greater than they would be for the same body in free air. Furthermore, a statically unstable force of attraction to the wall due to proximity to the wall is present which does not exist at all for the body in free air. The inherent aerodynamic instability of a body in free air without controls is thus exaggerated by the presence of the tube walls, and the walls may be said to exert a large effect on the aerodynamic characteristics of the body. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173997

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**039005****PROJECT TUBEFLIGHT. PHASE I. FEASIBILITY STUDY  
212 Final rept., 10 Dec 65-9 Sep 66**

Rensselaer Polytechnic Institute, Troy, New York

Final Rpt, 6512-6609, Sept. 1966, 194 pp

Contract C-117-66

High speed ground transportation project.

Project Tubeflight is a study of a transportation mode in which aerodynamically supported and propelled vehicles travel at high speed in non-evacuated tubes. The feasibility of a mode of propulsion is studied in which thrust is generated by a continuous transfer of air in the tube from immediately in front of the vehicle to its rear. The use of bladeless fans as thrust generators for propulsion is examined. A study is made of the feasibility of powering the vehicle by high frequency electrical energy. The problems of radiating, propagating through the tube, receiving and rectifying this energy are covered. The inherent stability of a vehicle supported by a ram wing or a jet-flapped wing operating in close proximity to the tube wall is studied. A theoretical analysis of augmented stability and control is made, particularly in relation to the vehicle's roll. A small scale test facility was constructed consisting of an instrumented 12 inch diameter tube 2000 feet long. (Author)

**ACKNOWLEDGEMENT**

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**039006****UNSTEADY FLOW IN TUNNELS**

Brown, FT    Shah, RP

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

Sept. 1967, 108 pp

Contract C-85-65t

Theoretical predictions are made for attenuation, dispersion, and characteristic impedance of long-wavelength small-amplitude waves in turbulent flow in cylindrical lines or tunnels. A lower limit for attenuation and dispersion results from assuming a turbulent viscosity profile across the tube which remains constant throughout the cycle. An upper limit results from assuming a turbulent viscosity profile which fluctuates during the cycle, maintaining the steady-flow values. An experimental apparatus was nearly completed to check the theory and resolve the transition from upper limit to lower limit. The theory indicates that a relatively simple constant-inertance-resistance model is useful at much higher frequencies than in laminar flow, including most problems of normal vehicle acceleration and deceleration in tunnels, but is totally unacceptable at very high frequencies such as those which result when a vehicle passes rapidly through a sharp or gradual change in the tunnel area. (Author)

**ACKNOWLEDGEMENT**

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**039007****TECHNOLOGY FOR HIGH-SPEED GROUND TRANSPORT**

Seifert, WW    Hansen, RJ

Massachusetts Institute of Technology, Cambridge, Massachusetts  
6509-6609, Dec. 1966, 53 pp

Contract C-85-65t

Summary on research at MIT for 16 September 65-15 September 66.

The report summarizes the research accomplished at the Massachusetts Institute of Technology during the period September 16, 1965 through September 15, 1966. The efforts were on networks and terminals, scheduling, vehicle flow control and switching problems, vehicle-suspension problems, propulsion problems, vehicle and tube aerodynamics, and guideway problems.

**ACKNOWLEDGEMENT**

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**039008****HYDRAULIC ANALOGY STUDY OF WAVES IN TUNNELS**

Suo, M    Jacobs, P

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

DSR-76111, Final Rpt, Nov. 1966, 55 pp

Contract C-85-65t

As a train enters a tunnel at high velocities, a pressure wave is built up ahead of it. The pressures involved may be so high as to cause the train to slow down and to cause damage to the train and the tunnel. In order that trains be used at high velocities, it is necessary to find a way to relieve these pressure waves. A study was made of a technique for measuring these pressure waves and of some data for a typical train configuration. The technique consists of making measurements on a free-surface water table of a model geometrically similar to actual trains. This gives information about the pressure waves around trains travelling on the ground through air. The results indicate that valid information can be obtained from the water table and that the water table can be ultimately used towards reducing the magnitude of the pressure waves. (Author)

**ACKNOWLEDGEMENT**

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**039009**

**ORGANIZATION OF SYSTEM CONTROL**

Brockett, RW Canales, RJ

Massachusetts Institute of Technology, Electronic Systems  
Laboratory, Cambridge, Massachusetts

Nov. 1966, 25 pp

Contract C-85-65t

In the report a general method of designing control laws for very complex systems is described. A particular multipoint scheduling problem which has potential application in the operation of a high-speed ground transportation system is given to illustrate the approach. The basic assumption made is that the system to be controlled is so complex that mathematical optimization, even with the aid of a high-speed computer, is either impossible or too expensive—an assumption that holds even for relatively simple scheduling problems. Of course this assumption implies that the optimization problem must be divided into smaller parts and a sub-optimal solution sought. By the development of precise lower bounds on the performance of the system it is possible, however, to obtain an estimate of how close to optimal the system is. This leads to the definition of a performance ratio which characterizes the efficiency of the control system and provides what should be a very useful design parameter. (Author)

**ACKNOWLEDGEMENT**

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**039010**

**ON THE OPTIMAL AND SUBOPTIMAL POSITION AND VELOCITY CONTROL OF A STRING OF HIGH-SPEED MOVING TRAINS**

Athans, M Levine, WS Levis, AH

Massachusetts Institute of Technology, Electronic Systems  
Laboratory, Cambridge, Massachusetts

Nov. 1966, 73 pp

Contract C-85-65t

Rept. on Project Transport.

The study was motivated by the interest in developing a high-speed ground-transport (HSGT) system for the Northeast Corridor. The report contains general methods for controlling the spacing, velocity, and acceleration of individual vehicles in a tightly-packed string of high-speed trains. The control of vehicles moving in a string can be divided into four functions: The control of the starting and stopping operations; The injection and ejection of vehicles from the main guideway; The normal operation of a string of vehicles (far from stations) at essentially constant velocity and separation; and the control in emergency situations. (Author)

**ACKNOWLEDGEMENT**

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**039012**

**RESEARCH AND DEVELOPMENT FOR HIGH SPEED GROUND TRANSPORTATION**

Department of Commerce, High Speed Ground Transportation,  
Washington, D.C.

Mar. 1967, 40 pp

Panel on High Speed Ground Transportation

Contents: Research recommendations for pre-prototype studies; Roster of Panel and Subpanels; Presentations to the Panel and Subpanels; Report of the Subpanel on Guideways, Suspensions and Aerodynamics; Report of the Subpanel on Propulsion, Energy and Braking; Report of the Subpanel on Communication and Control; Report of the Subpanel on Terminals and Interfaces; Report of the Subpanel on Passenger and Freight Factors; Current HSGT R and D Contract, Office of High Speed Ground Transportation.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173911

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**039014**

**PRESSURE-FLOW-DISPLACEMENT CHARACTERISTICS OF A PERIPHERAL JET FLUID SUSPENSION**

Richardson, HH Ribich, WA Ercan, Y

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts DSR-76110-7

June 1968, 68 pp

Contract C-85-65t

An experimental investigation of the pressure-flow-displacement characteristics of a peripheral jet fluid suspension is summarized. The effects of nozzle pressure ratio, Reynolds number, base recess and jet nozzle size on equilibrium and non-equilibrium characteristics are presented for a 30 deg. nozzle angle. It is shown experimentally that the effects of geometric scaling can be studied adequately by varying ambient pressure level. Inviscid performance theories were found to overestimate equilibrium cushion pressures from 40% at low jet thicknesses, low Reynolds numbers and high hover heights to less than 5% at opposite conditions. Mass flow rates and power requirements were found to be within 15% of the inviscid Barratt theory for the larger jet widths tested. Theories for non-equilibrium jet behavior were found to be inadequate for predicting pressure-flow and displacement-flow sensitivities needed in dynamic models of peripheral jet devices. Predicted discontinuities in these parameters were not observed experimentally. Experimental values of pressure-flow-displacement sensitivities derived from non-equilibrium performance data are presented. These results suggest that for comparable conditions the peripheral jet suspensions will experience higher maximum heave accelerations than corresponding plenum configurations. (Author)

**ACKNOWLEDGEMENT**

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**039017**

**TRANSIM—GENERAL PURPOSE TRANSPORTATION SYSTEM SIMULATOR—USER'S MANUAL**

California University, Los Angeles, Department of Engineering,  
Los Angeles, California

66-6, May 1966, 231 pp

Contract Cc-62201

See PB-173 017 for the IBM-1401 and 7090/7094 punched cards.

The TRANSIM transportation simulator was developed at the University of California, Los Angeles, to fill the need for a general-purpose computer simulation method which is simple and economical to use for a wide variety of problems in transportation; these may concern different modes, traffic types, firm sizes, or system situations. The User's Manual describes the simulator and delineates the procedures for its use. The User's Manual also discusses topics of more general interest, such as the concept of the systems approach, and the difference between mathematical models and computer simulators such as TRANSIM.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-173016

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#### 039021

##### HIGH PRIORITY RESEARCH TASKS FOR HIGH SPEED GROUND TRANSPORT 212 Part 2

Massachusetts Institute of Technology, Cambridge, Massachusetts

Pt 2, June 1965, 73 pp

Contract C-85-65t

Part 2

This volume represents Part II of a four part report prepared in partial fulfillment of a Contract initiated in September 1964 between the Massachusetts Institute of Technology and the United States Department of Commerce. The following proposals for additional research of high priority are divided into two groups: technological studies and design studies. The technological studies constitute applied research in various technical areas essential to the realization of a HSGT system. Their purpose is to establish the current state of the art, to determine which lines of attack are technically promising, to ascertain the practical and theoretical feasibility of various design alternatives, and to extend the state of present knowledge to the point where the design of an HSGT system will be a practical possibility. The purpose of the design studies is to generate alternative ideas and proposals for network configuration, access methods, guideway structures, vehicle designs, propulsion, suspension, control, communication, and all other components of the system.

#### ACKNOWLEDGEMENT

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#### 039022

##### OPTIMAL VEHICLE CONTROL FOR THE MERGING PROBLEM

Athans, M Levine, WS

Massachusetts Institute of Technology, Electronic Systems Laboratory, Cambridge, Massachusetts

ESL-R-327, Nov. 1967, 30 pp

Contract C-85-65t

The report deals with the problem of the control of high-speed vehicles so that safe merging from two guideways into a single one takes place. The theory of optimal control is used to analyze the problem. Two main results are obtained: first, the optimal control of the vehicles is obtained for any given merging sequence and second,

the best possible merging sequence is obtained. (Author)

#### ACKNOWLEDGEMENT

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#### 039023

##### STUDY BY HYDRAULIC ANALOGY OF THE PASSAGE OF HIGH-SPEED TRAINS THROUGH TUNNELS

Mills, JM Wilson, DG

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

Dec. 1967, 52 pp

Contract C-85-65t

When a train enters a tunnel, an unsteady flow of air occurs in the tunnel near the front end of the train, and this disturbance is propagated down the tunnel as a pressure wave. Accompanying this is a change of air pressure on the exterior of the train. In view of the proposal for a high-speed ground-transportation system in this country to operate in the speed range of 250 miles per hour, and faster, it is important to know what pressure fluctuations to expect when fast trains enter tunnels. In order to surmount experimental difficulties associated with high-speed models and transient phenomena, a series of experiments using a water table and two-dimensional train and tunnel models were begun. The work has now been extended to several tunnel-entry shapes, and to square and elliptical train section-models. Experiments included trains entering along the tunnel centerline, as well as trains entering near one wall of the tunnel, and traveling along that wall through the tunnel. (Author)

#### ACKNOWLEDGEMENT

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#### 039024

##### A FEASIBILITY STUDY OF THE CRYOPUMPED TUBE TRAIN CONCEPT

Chuan, RL Rogers, KW Wilbur, PC Choudhury, PR Peterson, NV

Celestial Research Corporation, South Pasadena, California

Celesco-388-101, Oct. 1966, 136 pp

Contract C279-66t

The thermodynamic and gasdynamic characteristics of a saturated vapor in a tube enclosing a high speed train have been analyzed to assess the aerodynamic resistance to motion and possible means of propulsion using the same vapor. It is found that the piston action of the train causes condensation of the vapor ahead of and re-evaporation behind the train, these mechanisms thus providing the equivalent of by-passing the atmosphere in the tube around the train without any significant gap between the train and the tube. The term Cryopumped Tube Train is applied to the concept, since it is the heat sink capacity of the earth which effects the pumping of the vapor in the tube by condensation. The results of the analysis indicate that the total aerodynamic resistance to motion of a train at speeds around 400 mph in a close-fitting subterranean tube, evacuated free of air but filled with saturated water vapor at 13 mm pressure, is about two orders of magnitude below the resistance of a conventional flanged wheel-rail suspension system. Use of the same vapor for cruise mode jet propulsion is found to be feasible, though with very low efficiency. An effective and economical acceleration system to bring a train rapidly to cruising speed by means of low pressure steam catapult is

found to be feasible and compatible with the cryopumped tube concept. These theoretical results have yet to be verified experimentally. (Author)

**ACKNOWLEDGEMENT**

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**039025**

**PLANE-FLAME SIMULATION OF THE WAKE BEHIND AN INTERNALLY PROPELLED VEHICLE—PART I—SIMULATION OF A SUPERSONIC VEHICLE BY A DETONATION**

Skinner, JHJ

Rensselaer Polytechnic Institute, Department of Aeronautical Engineering and Astronautics, Troy, New York

TR-AE-6701-Pt-1, PhD Thesis, Mar. 1967, 44 pp

Contract C-117-66

Rept. on Proj. Tubeflight.

The development of the flow field behind an internally-propelled vehicle in steady motion at supersonic speed is analyzed by the method of characteristics. The vehicle is simulated by a Chapman-Jouguet detonation propagating in an infinite duct. Friction and heat transfer are accounted for, and the friction factor is related to the heat transfer coefficient through the Reynolds analogy. The characteristic equations are integrated numerically employing a high-speed computer. In the inviscid adiabatic case the flow is nonsteady in all frames of reference. On the other hand, when the effects of friction and heat transfer are included, a region of flow is found to develop which is steady in a frame of reference moving with the detonation front. The steady-flow region starts directly behind the detonation and gradually grows to fill the entire flow field. The flow conditions far downstream from the detonation return asymptotically to their ambient values. (Author)

**ACKNOWLEDGEMENT**

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**039027**

**AERODYNAMIC PROPERTIES OF PERFORATED WALLS FOR USE IN A TUBE TRANSPORTATION SYSTEM**

Goodman, TR

Oceanics, Incorporated, Plainview, New York

TR-67-39, Apr. 1968, 26 pp

Contract C-265-66

For flow in a closed wall tube the boundary condition at the tube wall is the kinematic one of no normal flow. When the tube is perforated it is shown that the average effect of many small perforations may be calculated. From a theoretically derived formula it is shown that many small holes are more effective than a few large ones. It is then shown that there exists an analogy between a body traveling in a perforated tube and a geometrically similar body tested in a tunnel test facility having longitudinal slots. Furthermore, a relationship between the geometry of the holes of the perforated tube and the geometry of the slots of the tunnel test facility is established. (Author)

**ACKNOWLEDGEMENT**

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**039028**

**TRANSPORTATION SYSTEM OPTIMIZATION PROGRAM DEMONSTRATION PROBLEM**

TRW Systems Group, Washington Operations, Washington, D.C.

06818-W917-R000, June 1968, 98 pp

Contract C-353-66

Report on High Speed Ground Transportation System Engineering Studies Program.

The report describes the application of a computerized methodology to the analysis of a representative ground transportation system. The preferred design and performance characteristics of a tracked air cushioned vehicle system were determined in order to minimize the cost per passenger mile. The vehicle-guideway system was mathematically represented by a set of simultaneous, non-linear, algebraic equations. This description was combined with a cost accounting model and structured for solution on a digital computer. Results were obtained for parametrically varied system performance levels. (Author)

**ACKNOWLEDGEMENT**

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**039029**

**AERODYNAMIC DRAG ON VEHICLES IN ENCLOSED GUIDEWAYS**

Gouse, SWJ Nwude, J

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76108-1, 6409-6609, Dec. 1966, 59 pp

Contract C85-65ct

Rept. on Proj. Transport. See also PB-173 647.

The purpose of this study was to investigate the aerodynamic drag on vehicles moving in enclosed guideways. The reason for the study was, and is, that several potential high-speed ground-transport system concepts involve high-speed motion of vehicles in enclosed guideways for significant portions of their travel time. Both analytical and experimental studies have been carried out. The analytical studies commenced by developing a solution for the aerodynamic drag on a vehicle in an enclosed guideway in laminar flow. This analysis was based on an analogy, first suggested by Rayleigh, that exists between the governing equations for unsteady flow resulting when an infinite body is started impulsively from rest and for the steady flow that results from steady motion of a semi-infinite body. The results of this analysis for laminar flow provided a base from which to begin, and were then used in an attempt to predict the drag that would result in turbulent flow. The turbulent flow analytical estimate was based on another approximation or analogy which assumes that for any turbulent flow there exists a laminar flow in which corresponding streamlines in the laminar flow can be found to enclose the turbulent wake in the turbulent flow, and that by making use of an effective eddy viscosity in the laminar flow solution, one can predict the drag coefficient in the corresponding turbulent flow. Experimental studies were carried out using 8 spherical models and 16 cylindrical models in tubes of various diameters. (Author)

**ACKNOWLEDGEMENT**

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039031

**SOME PROBLEMS RELATED TO ELECTRIC PROPULSION**

White, DC Thornton, RD Kingsley, CJ Navon,  
DH Nonaka, S

Massachusetts Institute of Technology, Department of Electrical Engineering, Cambridge, Massachusetts

Nov. 1966, 133 pp

Contract C-85-65t

Content: Short-stator effects in linear-induction motor; Discussion of the Laithwaite goodness factor; Summary of double-sided linear induction motor design; Summary of the effect on induction motor performance non-sinusoidal excitation; Laithwaite semiconductor-switched motors; A linear induction power-transfer system for vehicles; Design of a double-sided linear induction motor for electric propulsion; Induction motor supplied by simple frequency inverter, producing rectangular voltage waveform.

**ACKNOWLEDGEMENT**

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039032

**DYNAMIC ANALYSIS OF HEAVE MOTION FOR A TRANSPORT VEHICLE FLUID SUSPENSION**

Ribich, WA Richardson, HH

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76110-3, Jan. 1957, 90 pp

Contract C-85-65t

A general lumped-parameter technique for the dynamic analysis of vehicle fluid suspensions operating in the heave mode (translational motion along an axis normal to the mean surface of the vehicle guideway) is presented. The analysis includes the effects of sealing region characteristics, of the fluid source, of the internal geometry, and of base flexibility. A linearization of the general system equations is given which is useful in the study of vehicle-suspension stability and dynamic behavior when the variations in support force are small compared with the average force. The analytical technique described is applied to formulate simple dynamic models for plenum, peripheral-jet, and flexible-base fluid suspensions. The parameters appearing in the dynamic equations can all be determined from computations or measurements of only the static characteristics of the suspensions. Analytical and graphical methods of finding these static parameters are discussed. (Author)

**ACKNOWLEDGEMENT**

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039033

**A TWO-DIMENSIONAL FLUID-SUSPENSION TEST APPARATUS FOR INVESTIGATION OF PRESSURE RATIO, MACH NUMBER AND REYNOLDS NUMBER EFFECTS**

Richardson, HH Ribich, WA

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76110-2, Nov. 1966, 53 pp

Contract C-85-65t

The design, instrumentation and evaluation of a small scale two-dimensional test apparatus for investigating the equilibrium and nonequilibrium pressure-displacement-flow characteristics of fluid suspension sealing regions are described. The apparatus is versatile and adaptable to a wide variety of suspension configurations. Dynamic similarity to large scale devices is maintained by varying the ambient pressure level. Ambient pressures from 0.1 psia to 150 psia can be employed in the present apparatus. The system is transparent and permits flow visualization through injection of smoke into the supply flow. Data reduction is automated via direct input of raw data into an IBM 7094 digital computer. Test results are presented for equilibrium and nonequilibrium conditions for tests run at one atmosphere ambient pressure for a peripheral jet suspension. Nonequilibrium cushion flow versus cushion pressure ratio did not show the discontinuity of slope near equilibrium predicted by all inviscid theories. The slopes of the pressure-flow curves were found to be predicted reasonably well by the inviscid underfed jet theory but predictions of actual magnitudes were in error by large factors. (Author)

**ACKNOWLEDGEMENT**

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039036

**STATIC AND DYNAMIC BEHAVIOR OF A FLEXIBLE BASE FLUID SUSPENSION**

Casey, BL

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76110-5, MA Thesis, Nov. 1966, 111 pp

Contract C-85-65t

The object of the thesis is to uncover a set of analytical expressions which will adequately permit the design of a flexible base air bearing and to verify these expressions experimentally. Simplifying assumptions include adiabatic flow through the inlet orifices and in the plenum beneath the diaphragm. Bending and shear stresses in the diaphragm are assumed to be negligible compared to tensile stresses. In the steady-state analysis, an equation is developed which predicts the platform height as a function of plenum pressure and also yields the bearing float limit condition. By averaging and linearizing, a limited amount of dynamic theory is developed which yields the bearing stability limit and completes the analysis. Experimental correlation of the theory is presented as well as a Fortran computer program which performs the necessary computations. (Author)

**ACKNOWLEDGEMENT**

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039043

**AERODYNAMIC DRAG ON A BODY TRAVELING IN A TUBE**

Gouse, SWJ    Noyes, BS    Swarden, MC

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

Oct. 1967, 94 pp

Contract C-85-65t

The purpose of the study is to continue the investigation of the aerodynamic drag on vehicles moving in guideways of varying degrees of enclosure. The reason for the study is that several potential high-speed ground transport system concepts involve high-speed motion of vehicles in enclosed guideways for significant portions of their travel time. Both analytical and experimental investigations were carried out. The analytical studies continued the development of the solution for the aerodynamic drag on a vehicle in an enclosed guideway in laminar flow. Experimental studies were carried out using cylindrical models in circular tunnels of various length and various degrees of wall porosity. A drop testing apparatus was employed in which water was the only test fluid and results were obtained for Reynolds numbers of the order of 100,000. Results to date indicate that for vehicle length-diameter ratios of the order of 15 and above, with tunnel to vehicle diameter ratios of 1.5 and greater, a drag coefficient based on the wetted surface area of the vehicle is independent of the vehicle length-diameter ratio for incompressible flow. Results also indicate that, for incompressible flow, employing a tunnel model with a closed end simulates a tunnel length-diameter ratio of infinity. Tunnel wall porosity, assuming relatively unobstructed motion of fluid outside the porous wall, has a marked effect on decreasing the aerodynamic drag on vehicles moving in enclosed guideways and for the range of variable investigated (clearance ratio as low as 1.4) tunnel wall porosity of 20 per cent is adequate for all the significant drag reduction that is possible. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-177211

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039044

**STUDIES ON THE ACTIVE CONTROL OF HIGH SPEED TUBE VEHICLE**

Lee, I    Frederick, D    Josephy, N    Treiber, F

Rensselaer Polytechnic Institute, School of Engineering, Troy,  
New York

Jan. 1968, 126 pp

Contract C-117-66

This document consists of two reports: (A) Stability analysis of a tube vehicle with flexible suspension; (B) A digital computer program for simulation of nonlinear tube vehicle dynamics with six degrees of freedom.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-177519

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039045

**SIMPLIFIED STATIC PERFORMANCE CHARACTERISTICS OF LOW-PRESSURE PLENUM AND PERIPHERAL JET FLUID SUSPENSIONS**

Richardson, HH    Captain, KM

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

Jan. 1968, 55 pp

Contract C-85-65t

Simplified relationships and approximate design curves and nomograms are presented which permit the power, mass flow and stiffness of simple plenum and peripheral jet fluid suspensions to be estimated. Both gravity-loaded and transverse suspensions are considered. The incremental load capacity divided by the design load (force increment) is shown to be a major design parameter for fluid suspensions. Compared with simple orifice-restricted plenums, peripheral jet suspensions are shown to require less power and mass flow and to possess lower stiffness for comparable operating conditions. The advantage in power and flow increases as the force increment increases. A comparison is made between the inviscid peripheral jet performance theory used and experimental data which indicates that the theory gives useful estimates of performance which become more accurate as flow Reynolds number increases. (Author)

**ACKNOWLEDGEMENT**

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039046

**APPLICATION OF HIGH POWER SOLID-STATE ELECTRONICS TO ELECTRIC PROPULSION**Thornton, RD    Navon, DH    Lichtenberger, J    Erdelyi,  
C    Miller, EMassachusetts Institute of Technology, Department of Electrical  
Engineering, Cambridge, Massachusetts

Oct. 1967, 67 pp

Contract C-85-65t

The work reported here is concerned with the application of high power electronics to electric propulsion. During the last year the effort has been in two main areas: (1) development of improved high power semi-conductor switches and (2) the development of light-weight, low inductance machines which are well matched to semi-conductor device capabilities.

**ACKNOWLEDGEMENT**

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039047

**SUMMARY OF RESEARCH AT RPI ON TUBEFLIGHT, SEPTEMBER 1966-9 NOVEMBER 1967**

Rensselaer Polytechnic Institute, Troy, New York

TR-PT-6801, 6609-6711, Jan. 1968, 34 pp

Contract C-117-66

This report is a summary of the researches performed during the period 9 September 1966-9 November 1967 under contract with the Office of High-Speed Ground Transportation of the United States Department of Transportation. Studies under this program focussed on the areas of Propulsion (Chapter I), inherent stability (Chapter II), stability augmentation (Chapter III), electrical power supply (Chapter IV), and small-scale experimentation (Chapter V). Specific problems within each of these areas are discussed in detail in the technical reports which are listed in the Appendix.

**ACKNOWLEDGEMENT**

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**039048**  
**STATIC AERODYNAMIC FORCE MEASUREMENTS OF BODIES IN TUBES**

Goodman, TR Lehman, AF  
 Oceanics, Incorporated, Plainview, New York  
 TR-68-45, Apr. 1968, 46 pp  
 Contract C-265-66

Experiments were performed in a water tunnel to measure the lift, drag, and pitching moment on models intended to simulate a vehicle traveling in a tube. Bodies of three different thickness ratios were tested, and the heave displacement and angle of incidence was varied. In one series of tests the body alone was tested in a tube. In another series a propeller was placed near the rear of the body in the tube and the thrust of the propeller was made equal to the drag of the body, thereby simulating the condition of self-propulsion. The slopes of the measured lift-displacement and moment-displacement curves at zero displacement, for both heave and incidence displacements, were found to give good agreement with a theory previously derived by one of the authors. These curves remained virtually unaltered when self-propulsion was simulated. (Author)

ACKNOWLEDGEMENT  
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**039049**  
**TRENDS IN SUPERCONDUCTIVITY RELATED TO ELECTROMAGNETIC SUSPENSION OF HSGT VEHICLES**

TRW Systems Group, Washington Operations, Washington, D.C.  
 06818-6009-R000, Oct. 1967, 46 pp  
 Contract C-353-66

Report on High Speed Ground Transportation System Engineering Studies Program.

The technology of superconductive magnets was studied because of their potential application to electromagnetic suspension of high speed ground transportation vehicles. The technology was observed to be in the classical period of rapid growth which follows a technological breakthrough. The liquid helium technology was also investigated because it is presently the most feasible technique to maintain the low temperatures required for superconductivity. The electromagnetic suspension system which was proposed for HSGT usage was found to be within the present state of the art except possibly for the proposed current density. (Author)

ACKNOWLEDGEMENT  
 National Technical Information Service, PB-178795

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**039051**  
**THE AERODYNAMICS OF TUBE TRAVEL: EFFECTS OF COMPRESSIBILITY AND THE RESISTANCE OF SLENDER CYLINDERS TRAVELING IN A TUBE**

Goodman, TR  
 Oceanics, Incorporated, Plainview, New York  
 TR-67-36, Tech Rpt, Nov. 1967  
 48 pp  
 Contract C-265-66

Slender-body theory is used to determine the flow about a slender body of revolution traveling inside a tube at subcritical speed in a compressible fluid. It is shown that if the tube diameter is a small percent of the body length and the body is centered in the tube then the axial component of the flow in the annular region between the body and the tube can be approximated by one-dimensional compressible channel flow. Formulas for all the static and dynamic stability derivatives are derived for an arbitrary body of revolution in terms of its cross-sectional area distribution. The dynamic derivatives are shown to be identical with their incompressible counterparts. The static derivatives, on the other hand, are Mach number dependent and, as an illustrative example, these are calculated for an ellipsoid, and the results are normalized with respect to their incompressible counterparts. The resulting compressibility rise is presented graphically as a function of the ratio of the maximum cross-sectional area of the body to the area of the tube for various free-stream Mach numbers. The augmentation factor due to the presence of the tube walls, which had previously been calculated for incompressible flow, is shown to be augmented still further by the effect of compressibility. (Author)

ACKNOWLEDGEMENT  
 National Technical Information Service, PB-176204

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**039053**  
**PLANE-FLAME SIMULATION OF THE WAKE BEHIND AN INTERNALLY PROPELLED VEHICLE. PART III. EXPERIMENTAL SIMULATION OF A SUPERSONIC VEHICLE BY A DETONATION**

Skinner, JHJ  
 Rensselaer Polytechnic Institute, Department of Aeronautical Engineering and Astronautics, Troy, New York  
 Pt 3, TR-AE-6708-Pt-3, PhD Thesis, Nov. 1967, 41 pp  
 Contract C-117-66

Rept. on Proj. TUBEFLIGHT. See also Part 2, PB-177 141.

The flow field induced by an internally-propelled vehicle traveling through a tube at a supersonic speed is simulated experimentally by the flow field induced by a detonation. The results indicate that as the vehicle continues to travel at a constant velocity, the effects of friction and heat transfer cause a region of flow to develop which is steady in the frame of reference of the vehicle. This steady-flow region starts directly behind the vehicle and gradually grows to fill the entire flow field as time progresses. (Author)

ACKNOWLEDGEMENT  
 National Technical Information Service, PB-176924

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039055

**PLANE-FLAME SIMULATION OF THE WAKE BEHIND AN INTERNALLY PROPELLED VEHICLE. PART 2. SIMULATION OF A SUBSONIC VEHICLE BY A HEAT SOURCE**

Skinner, JHJ

Rensselaer Polytechnic Institute, Department of Aeronautical Engineering and Astronautics, Troy, New York

Pt 2, TR-AE-6705, PhD Thesis, July 1967, 34 pp

Contract C-117-66(Neg.)

Rept. on Proj. Tubeflight. See also Part 1, PB-174 730.

The development of the flow field about an internally-propelled vehicle in steady motion at subsonic speed in a tube is analyzed by the method of characteristics. The vehicle is simulated by a heat source releasing heat at a constant rate and moving through an infinite duct at a constant subsonic velocity. Friction and heat transfer are accounted for, and the characteristic equations are integrated numerically employing a high-speed computer. In a vehicle-fixed frame of reference the induced flow field is initially steady, but friction and heat transfer soon cause it to become nonsteady. As time progresses, the nonsteady effects slowly decay and the flow field asymptotically approaches a steady state. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-177141

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039057

**AN ANALYSIS OF THE EFFECTS OF FINITE FLUID-SUSPENSION PAD LENGTH ON THE DYNAMICS OF A VEHICLE ON AN IRREGULAR GUIDEWAY**

Ribich, WA Captain, KM Richardson, HH

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

Sept. 1967, 46 pp

Contract C-85-65t

An analysis is presented which describes the heave motion of a fluid-suspended vehicle moving over a guideway in which the irregularity wavelengths may be shorter than the suspension pad length. The analytical model is applied and exact solutions obtained for the cases of plenum and peripheral jet suspensions traversing sinusoidal and pure step irregularities. The technique is shown to be applicable to general irregularity profiles and numerical procedures for the general case are briefly discussed. It is found that compared to predictions based on zero suspension pad length (uniform guideway-suspension clearance) peak acceleration and relative displacements are generally reduced by the effects of finite pad length. Thus a conservative estimate of performance will usually be obtained if pad length effects are ignored. For most vehicle configurations and speeds, however, the attenuation due to finite pad length will be insignificant near the point of maximum vehicle response (near the natural frequency). Vehicle step responses are smoothed and a slight time delay appears compared with behavior predicted from the zero pad length theory. This work suggests that design criteria based on deterministic irregularities and peak dynamic response of the vehicle system can reasonably neglect the effects of finite suspension pad length. Further work is needed to evaluate these effects for statistically described irregularities. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176135

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PB-176135

039064

**FLOW PROPERTIES OF A SLENDER BODY TRAVELING CENTERED IN A PERFORATED TUBE**

Goodman, TR

Oceanics, Incorporated, Plainview, New York

TR-68-43, Apr. 1968, 29 pp

Contract C-265-66

The previously derived boundary condition which states the law governing the flow through a perforated wall (see PB-177 766) is applied to solve the title problem for a body of revolution. It is shown that even a moderate amount of perforations can cause the axial perturbation velocity in the annular region to be reduced by an order of magnitude in comparison with the closed wall case. It may be inferred from this that all aerodynamic forces, including drag, can be reduced considerably by perforating the walls. Thus, from the point of view of the body aerodynamics, tube wall perforations will have a beneficial effect on a tube transportation system. (Author)

**ACKNOWLEDGEMENT**

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039066

**SUPPLEMENT TO SURVEY OF TECHNOLOGY IN FLUID SUSPENSIONS: PATENT SEARCH AND EFFECTS OF FORWARD SPEED**

Richardson, HH Ribich, WA

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76110-1, Nov. 1966, 68 pp

Contract C-85-65t

See also PB-168 648.

Supplementary information to that given in Part I, Survey of Technology for High Speed Ground Transport, Ref. 1, is presented for fluid suspensions and fluid-supported vehicle systems. Representative patent literature is described which shows that the existing basic concepts and configurations for fluid suspensions and associated vehicles are very old; however, many recent patents have been issued covering variations, improvements and applications to transport vehicles. Published information and experimental facilities and techniques relative to the influence of forward speeds on fluid suspension data are reviewed. Available data are limited to forward speeds less than 150 mph, to ambient pressures of one atmosphere and to low cushion-pressure levels. An adequate theoretical approach to forward speed effects is lacking. No experimental facilities entirely satisfactory for the investigation of the behavior of dynamically similar scale models of HSGT vehicles and guideways were found to exist in the world. (Author)

**ACKNOWLEDGEMENT**

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039067

**DYNAMICS OF FLEXIBLY SUPPORTED TUNNELS AND OTHER ROADBEDS**

Brown, FT

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76107-1, Nov. 1966, 31 pp

Contract C-85-65t

Vehicles supported by flexible roadbeds can exhibit violent vibrations near a particular critical velocity. This situation is idealized to a concentrated load traveling on a Bernoulli-Euler beam which rests on an elastic foundation. A floating tunnel design of the type proposed by Edwards is so modeled, and found to have a critical velocity of about 262 miles per hour and nearly negligible damping. Avoidance of excessive vibration by rapidly accelerating or deceleration through the critical frequency is studied with preliminary results. The tentative indication on the particular example is that an impractically high acceleration would be necessary unless changes are made. (Author)

**ACKNOWLEDGEMENT**

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039069

**HEADWAY AND SWITCHING STRATEGIES FOR AUTOMATED VEHICULAR GROUND TRANSPORTATION SYSTEMS**

Godfrey, MB

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

Nov. 1966, 170 pp

Contract C-85-65t

The report considers the distribution of headways throughout the vehicle flow on a one-lane guideway, the splitting of such a flow at a diverging switch, and the merging of two such flows at a converging switch. The focus of the investigation was on several vehicles near a single switch, rather than on the entire system as an integrated entity. The minimum headway separating two isolated vehicles or trains is shown to be a function of time delays in information transmission and processing, uncertainties in the measurement of, and errors in, kinematic variables, emergency stopping distance, and a cost criterion pertaining to reliability and expected damage. Several alternative headway distributions among vehicles in single-lane flow are presented, and maximum flow rates are computed as functions of these strategies and system performance parameters. The propagation of velocity transients is discussed in terms of responses to the probable inputs to a single-line of traffic. It is shown that controlling headways to a single-valued function of velocity leads to undesirable responses, and that headways must include some space in excess of the minimum safe headway. In addition to the minimum headway strategies, there is a presentation of several possible merging strategies for a converging switch and of queue disciplines to yield either maximum or minimum queue lengths. (Author)

**ACKNOWLEDGEMENT**

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PB-173644

039070

**STUDY OF LINEAR INDUCTION MOTOR AND ITS FEASIBILITY FOR HIGH-SPEED GROUND TRANSPORTATION**

Garrett Corporation, AIRsearch Manufacturing, Los Angeles, California

67-1948, Final Rpt, June 1967, 322 pp

Contract C-145-66(Neg)

The report presents the results of a study program performed by AIRsearch for the Office of High Speed Ground Transportation, U. S. Department of Transportation. This program is concerned with determining the feasibility and practicality of utilizing linear induction motors for high-speed ground transportation (HSGT) propulsion at speeds up to 500 mph. Detailed consideration is given to the electrical, thermal, and mechanical aspects of linear induction motor design. The electrical design analysis considers motor end effects, reaction rail design, and other motor design parameters influencing performance. The analytical models derived in the study for electrical design are verified in laboratory tests using small rotary motors designed to provide the desired data. Data on five reaction rail designs are reported. A composite reaction rail design is recommended for optimum motor performance, although other types are considered for special characteristics. The thermal studies indicate that the minimum motor size consistent with appropriate operating temperature levels for long motor life corresponds to specific continuous thrusts on the order of 1.2 to 2.4 lb per sq in. per side of motor area. The problems of air gap control, speed control, and power supply are analyzed to determine suitable provisions in the design of HSGT propulsion systems incorporating linear induction motors. Recommendations for future work include fabrication and testing of a full-scale (2500 hp) prototype linear induction motor. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-174866

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039071

**NONFRICTIONAL POWER COLLECTION FOR GUIDED HIGH-SPEED GROUND VEHICLES**

General Electric Company, Research and Development Center, Schenectady, New York

S-68-1056, Final Rpt, Apr. 1968, 147 pp

Contract C-7-35121

The report is a preliminary evaluation of four basic noncontacting methods of transferring motive electrical power to high-speed trains (up to 300 miles per hour). The four methods considered are: Gaseous Conduction by a Controlled Electric Arc; Magnetic Induction Using Lenz's Law of Flux Linkage; Capacitive Coupling by Displacement Currents Between Parallel Plates; Electromagnetic Directional Wave-guide Coupling. Examination and calculation of several configurations of the four methods considered established data for comparison. The evaluations include the system functions of power conditioning, power transmission, noncontacting coupling, and onboard power conversion; however, emphasis is on the equipment directly associated with the coupling. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178228

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**039075**  
**TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT**

Hansen, RJ

Massachusetts Institute of Technology, Cambridge, Massachusetts  
 Sun Rpt, 6609-6711, Dec. 1967, 67 pp

Contract C-85-65t

This report contains highlights of research findings developed during the second year of research at M. I. T. on the technology of high speed ground transport(HSGT). The research topics are diverse but can be grouped roughly into areas relating to system operational performance, vehicles, including suspension, propulsion, and control; and the problems of the infrastructure of an HSGT system. The research is aimed at establishing a basis for design of HSGT and often treats problems not previously studied for conventional transportation systems. (Author)

**ACKNOWLEDGEMENT**

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**039076**  
**THREE NOTES ON PROPULSION AND BRAKING OF TUBEFLIGHT VEHICLES**

Foa, JV

Rensselaer Polytechnic Institute, Troy, New York

TR-AE-6707, Mar. 1968

110 pp

Contract C-177-66

Rept. on Proj. TUBEFLIGHT.

This report consists of the following articles: Tubeflight propulsion by bladeless fans; Power demands of tubeflight vehicles; Preliminary evaluation of the braking capabilities of tubeflight vehicles.

**ACKNOWLEDGEMENT**

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**039077**  
**AERODYNAMIC CHARACTERISTICS OF GROUND SUPPORT SYSTEMS**

Duffy, RE Cooke, GC, IV

Rensselaer Polytechnic Institute, Troy, New York

TR-AE-6801, Jan. 1968

119 pp

Grant

Report on Proj. TUBEFLIGHT.

Two reports dealing with the aerodynamic characteristics of ground support systems are presented. The first report 'Aerodynamic Characteristics of a Tubeflight Vehicle Support System' by Robert E. Duffy presents experimental data on an aerodynamic ground-support-system obtained in a moving-wall wind tunnel. The second report 'Jet-Flapped Airfoils in Ground Proximity' by George C. Cooke concerns a study of the subsonic lift characteristics of airfoils in ground proximity with and without trailing-edge jet flaps. This study

was restricted to supercritical flow analysis. (Author)

**ACKNOWLEDGEMENT**

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**039078**  
**SAMPLED-DATA CONTROL OF HIGH-SPEED TRAINS**

Levis, AH Athans, M

Massachusetts Institute of Technology, Electronics Systems  
 Laboratory, Cambridge, Massachusetts

ESL-R-339, Jan. 1968, 56 pp

Contract C-85-65t

The report deals with the control of the positions and velocities of high-speed vehicles in a single guideway. It is assumed that each and every train measures its position and velocity every T seconds. The appropriate accelerations or decelerations to be applied to each vehicle are constrained to be constant during the sampling interval. Through the use of a control costs functional, which penalizes the system for any deviations from the desired headway and velocity, the required control accelerations and decelerations are obtained by deriving the system equations in discrete-time and, through the use of available results in the theory of discrete optimal control, the optimal linear time-invariant sampled-data feedback control system is determined. The general results, as well as the general purpose digital computer programs, are presented and are used to study the effect of changing the sampling time T upon the control-system performance. Since, in general, the cost of the communication system (in terms of required channel capacity, bandwidth, etc.) decreases with increasing values of the sampling time, the system designer has the capability of conducting trade-off studies involving the deterioration of the control system performance vs. the decrease in the cost of communication as the sampling time is increased. (Author)

**ACKNOWLEDGEMENT**

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**039080**  
**STUDY OF THE POTENTIAL OF HOVAIR FOR HIGH-SPEED GROUND TRANSPORTATION**

Jindra, F

General Motors Research Laboratories, Warren, Michigan

Final Rpt, Mar. 1968, 131 pp

Contract C-197-66

The object of the program was to study the potential of the air bearing as a support system for high-speed ground vehicles. The tasks required included analytical investigations of performance characteristics of air bearings, analytical investigations of ride characteristics of vehicles with such support, development of dimensional analysis for experiments, and outlining future research and development requirements. (Author)

**ACKNOWLEDGEMENT**

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039081

**USE OF SURFACE WAVES IN COMMUNICATING WITH HIGH SPEED VEHICLES**Gallawa, RL Beery, WM Chu, TM Cook,  
KR FitzGerrell, RGInstitute for Telecommunication Sciences, Boulder,  
Colorado C51369414  
Colo.

Tech Rpt, June 1968, 155 pp

Prepared in cooperation with Department of Transportation,  
Washington, DC. Office of High Speed Ground Transportation.

The potential use of surface waves in communicating with and controlling high speed ground vehicles has been under study. Consideration was given to the Goubau line or G-line in particular, and it was found that it has many attractive features. The various facets considered include launching, line characteristics, coupling to the moving vehicle, and communication capacity. It appears that the use of surface waves shows great promise in providing the bandwidth and economy required to meet the communication demands of the high speed ground transportation problem. (Author)

**ACKNOWLEDGEMENT**

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039083

**LITERATURE SURVEY ON THE COMMAND AND CONTROL OF HIGH-SPEED GROUND ORIENTED TRANSPORTATION SYSTEMS**Hughes Aircraft Company, Transportation Research Project Office,  
Fullerton, California

FR-66-11-65, Mar. 1966, 56 pp

Revision of FR65-11-281.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-170561

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039084

**ROLL CONTROL OF A FLUID-SUPPORTED VEHICLE MOVING IN A NON-EVACUATED TUBE**

Frederick, DK Lee, I

Rensselaer Polytechnic Institute, School of Engineering, Troy,  
New York

TR-CISD-101, Sept. 1967, 35 pp

Contract C-117-66

Presented at the Sequicentennial Forum on Transportation  
Engineering, New York, N.Y., August 29, 1967, ASME paper  
67-Tran-8.

The problem of controlling the roll angle of a high-speed vehicle moving through a tube was investigated, both for straight portions of the tube and around curves. The dynamics of the vehicle with 6 degrees of freedom were studied by postulating reasonable force characteristics for the support pads and the aerodynamic forces on the fuselage. It was shown that de-stabilizing coupling exists between the roll and lateral modes, whereas the heave, pitch, and yaw modes are essentially uncoupled and are well-damped. However, the vehicle model studied can be stabilized by the use of a feedback torque

about the roll axis proportional to the derivative of the roll-angle error. During a curve, the roll-angle error can be sensed by using a pendulum mounted in the vehicle in conjunction with a rate gyro. For straight portions of the tube only the rate gyro measurement is required. In addition to the feedback torque, the vehicle's roll angle is varied by an appropriately chosen open-loop torque as it passes through a curve. The results of digital and analog simulations are presented. (Author)

**ACKNOWLEDGEMENT**

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039085

**STEADY-STATE SIMULATION STUDY OF THE FLOW INDUCED BY AN INTERNALLY PROPELLED VEHICLE IN AN INFINITE TUBE: SUPERSONIC VEHICLE**

Cromack, DE

Rensselaer Polytechnic Institute, Department of Aeronautical  
Engineering and Astronautics, Troy, New York

TR-AE-6704, June 1967, 30 pp

Contract C-117-66

The flow induced in the wake of an internally-propelled supersonic vehicle or of a disturbance moving supersonically through an infinite tube is analyzed as a steady one-dimensional flow in the frame of reference of the vehicle or disturbance, with full amount of heat transfer and dissipative effects. The governing equations are solved numerically. The results confirm that the flow can be steady if it is everywhere supersonic relative to the vehicle or disturbance. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176410

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039088

**DYNAMICS OF SIMPLE AIR-SUPPORTED VEHICLES OPERATING OVER IRREGULAR GUIDEWAYS**

Richardson, HH Captain, KM Ribich, WA

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

DSR-76110-4, June 1967, 55 pp

Contract C-85-65t

The simplest appropriate dynamic model for fluid suspensions, a dynamic spring with lead and lag, is used to study the vertical displacement and acceleration of a vehicle moving over a guideway containing deterministic and random irregularities. The analysis is limited to heave motion and to irregularity wavelengths long relative to the suspension length. For any value of lead time constant an optimum lag time constant is shown to exist which minimizes vehicle acceleration and which may be achieved by adjusting the dead volumes in the fluid suspension. The general results are applied to a simple rigid-walled plenum. Relations for acceleration, relative displacement, mass flow and pumping power are presented as functions of cushion geometry, loading, and hover height. The dynamic lead is shown to depend primarily on the vehicle weight and area and to be a primary factor determining maximum acceleration. For typical vehicle weights and sizes it is shown that optimum dynamic lead cannot be physically realized in a simple plenum suspension. Further the results obtained in this simple analysis suggest that it will be very difficult to achieve adequate passenger comfort at HSGT speeds over

realistic guideways through use of only primary rigid simple plenum suspensions. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173655

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**039089**

**OPTIMAL DISPATCHING POLICIES BY DYNAMIC PROGRAMMING**

Ward, DE

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R66-55, Res Rpt, Nov. 1966, 102 pp

Contract C-85-651

The paper describes methods of determining optimal vehicle dispatching schedules by the use of dynamic programming techniques. Using cost criteria based on minimizing a combination of passenger delay and system capacity, these techniques were applied to vehicle scheduling for three variations of linear networks of dispatching stations: point-to-point (one way), line of stations (one way), and two-station line (round trip). FORTRAN programs were written to aid in both the generation and analysis of the optimal schedules. Various dispatching policies are examined with respect to system parameters such as vehicle capacity, load factor, and fleet size. An analysis and comparison of the optimal schedules in terms of passenger delay and vehicle fleet size are made with some non-optimal schedules similar to those used in many present-day operations. Optimal schedules yielding minimum passenger delay are shown to be superior with respect to most other system variables. The value of dynamic programming in these and future scheduling studies is discussed. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173636

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PB-173636

**039091**

**UNIVERSAL DRAG LAW**

Gouse, SWJ Swarden, MC

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76108-2, 6409-6609, Dec. 1966, 79 pp

Contract C85-65ct

Rept. on Proj. Transport. See also PB-173 646.

The purpose of this report is to present the results of a general examination of the propulsion power requirements of a variety of transport system vehicles in an effort to determine patterns of behavior that might be useful in the preliminary design of high-speed ground-transport systems. The propulsion system will be one of the major sub-systems of any high-speed ground-transport system, and there are several ways in which one can begin making estimates on the magnitude of the power requirements. One way is to extrapolate the performance of existing vehicles into higher speed regions. Another might be to make detailed designs of various HSGT systems. Still a third approach to the estimation of potential power requirements is to base it on the best performance attained by all classes of vehicles with existing technology. The last approach was based on the estimation of potential power requirements on the updating of the Gabrielli-von Karman technology limit line which first

appeared in 1947. In addition to adding the performance of supersonic aircraft, supertankers, and missiles on a gross weight basis, we have examined the performance of a variety of transport systems on a payload basis and found a payload performance technology limit line similar to the gross weight performance technology limit line established by Gabrielli and von Karman in 1947. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173647

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**039092**

**AERODYNAMIC ANALYSIS OF VEHICLES IN TUBES**

TRW Systems Group, Washington Operations, Washington, D.C.

06818-6026-R000, Apr. 1968, 35 pp

Contract C-353-66

Report on High Speed Ground Transportation System Engineering Studies Program.

The aerodynamic characteristics of a vehicle traveling in a tube are an important consideration in the analysis of high speed ground transportation systems. This report presents a list of the important aerodynamic parameters; an analysis of the various flow assumptions available to the researcher; a breakdown of the problem into two regimes, near field and far field; and a detailed description of the numerical analysis of the one-dimensional unsteady flow problem. (Author)

**ACKNOWLEDGEMENT**

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**039095**

**THE CALCULATION OF PROPAGATION CONSTANTS OF A PERIODICALLY LOADED MULTIMODE CIRCULAR WAVEGUIDE**

Arden, D Riganati, J

Rensselaer Polytechnic Institute, Division of Systems Engineering, Troy, New York

TR-DSF-6801, July 1968, 93 pp

Contract C-117-66

Report on Project Tubeflight.

Operation of a circular waveguide at frequencies considerably above cutoff in order to obtain a low attenuation for the circularly symmetric transverse electric modes results in a system capable of propagating many modes. The stability of the launched TE sub 01 energy is a function of both the deviations of the guide from a true right circular cylinder and the mode structure. Guide modifications based on the natural dichotomy between the desired and spurious mode forms may be designed to increase this stability by modifying the mode structure. One way to determine the effect of any periodic modifications is to compute the scattering matrix for each junction and to apply Floquet's theorem. For a modification consisting of a narrow circumferential gap, coupled to either free space or an off resonance coaxial cavity, the scattering matrix may be found if the field in the gap is known. A field equivalence theorem is presented and used to formulate equations for the solution of the electromagnetic boundary value problem for this field. (Author)

**ACKNOWLEDGEMENT**

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**039096**  
**A PRELIMINARY STUDY OF THE COANDA NOZZLE PRINCIPLE FOR PROPULSION OF TUBE VEHICLES**

Reba, I  
 IIT Research Institute, Chicago, Illinois IITRI-J6128  
 Final Rpt, 6710-6805, Oct. 1968, 92 pp  
 Contract DT-7-35512

The report describes experimental studies to determine the feasibility of a new type of mass transportation, called the IITRI Passive-Vehicle Tube Transport System. This system (1) uses propulsive guideway concepts based on solely fluid dynamical propulsion principles (the Coanda effect). (2) has the utmost mechanical simplicity, with no moving parts other than vehicles. (3) uses small, inexpensive vehicles providing a personalized mode of mass transportation. (4) is suitable for transportation of goods and passengers. The qualitative and quantitative results of the study provide an insight into various problem areas. The following features were demonstrated: (1) High subsonic speed potential (in the experimental mode, speeds up to 320 fps were reached). (2) Capability of high vehicular frequency. (3) High load-to-power ratios at speeds above 120 mph and at high vehicular frequencies. (4) System efficiency increases with increasing tube diameter. (Author)

**ACKNOWLEDGEMENT**  
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**039098**  
**FEASIBILITY STUDY OF COUPLED LEAKY WAVEGUIDE SYSTEM FOR COMMUNICATION IN HIGH SPEED GROUND TRANSPORTATION**

Nakahara, T Nagao, T Kurauchi, N Yoshida, K  
 Kitani, H  
 Sumitomo Electric Industries Limited, Osaka, Japan  
 Tech Rpt, Oct. 1968, 77 pp  
 Contract DT-3-0212

The use of a coupled leaky waveguide system for high speed ground transportation communication was studied and found to be feasible. The coupled leaky waveguide system has leaky circular waveguides along the track and a coupling antenna on the trains. Basic properties of the leaky circular waveguides were determined theoretically. The coupling was estimated based on earlier experiments. The FDM-FM system was shown to be applicable to the modulation and multiplex requirement of the system. Basic structure and signal level diagrams were presented for the proposed coupled leaky waveguide system. The unwanted radiation levels were estimated in comparison with the FCC restrictions. The interference on this system was also estimated. (Author)

**ACKNOWLEDGEMENT**  
 National Technical Information Service, PB-180750

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**039099**  
**AERODYNAMIC STABILITY DERIVATIVES OF A SLENDER BODY TRAVELING IN A PERFORATED TUBE**

Goodman, TR  
 Oceanics, Incorporated, Plainview, New York  
 TR-68-48, Tech Rpt, Oct. 1968, 33 pp  
 Contract C-265-66

The incompressible potential flow is determined for a slender body traveling off center in a perforated tube. From this, formulas are derived for the stability derivatives of a body having an arbitrary cross-sectional area distribution. These results may be compared with results previously derived for the stability derivatives of a slender body traveling in a tube with a closed wall. In the latter case the stability derivatives could become a large multiple of their free air values, and the more the body filled the tube the greater the multiple. When the wall is perforated, on the other hand, it is found to be always possible to design the perforations in such a way that the stability derivatives take on their free air values regardless of the size or shape of the body. Thus, it becomes possible to make the ratio of the body cross-sectional area to the tube cross-sectional area very close to unity without paying any aerodynamic penalty. (Author)

**ACKNOWLEDGEMENT**  
 National Technical Information Service, PB-180091

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**039102**  
**ANALYSIS OF A FREE PISTON HYDRAULIC PUMP**

Baumann, DM Oaklund, RE Powell, BT  
 Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts  
 DSR-6106-2, Nov. 1966, 83 pp

Contract C-85-65t

Among the sets of attributes investigated in the Concepts-keeping, Evaluation, and Development report, were propulsion system reliability, compactness, efficiency and controllability for the family of on-board propulsion component concepts. The consideration of efficiency and compactness pointed to use of chemical fuel with as high a compression ratio as possible. The resulting free-piston-hydraulic pump, (FPHP) described here is a uniflow scavenged, supercharged diesel engine with potential compression ranges up to or exceeding 50:1. (Author)

**ACKNOWLEDGEMENT**  
 National Technical Information Service, PB-173643

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**039103**  
**SCATTERING OF TE (0)SUB01 MODE ENERGY FROM A CENTERED METAL RING (WITH APPLICATION TO ANTENNA ARRAYS)**

Bradshaw, JA  
 Rensselaer Polytechnic Institute, Division of Electrophysics, Troy, New York  
 TR-EP-6801, Jan. 1968, 19 pp  
 Contract C-117-66

Report on Project Tubeflight. See also PB-179 465 and PB-174 085.

A variational expression for the fields scattered by a metal ring, centered in round waveguide, is obtained for excitation by circularly symmetric TE modes. An example is worked out and the method supported by application to a rectangular iris for which data are available. An antenna array for launching TE01 or TE02 fields in round waveguide is described, based on current rings, and measurements of its performance given. It is capable of launching rather pure fields in highly over-moded guide, but its efficiency is not high. (Author)

**ACKNOWLEDGEMENT**

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**039105  
HIGH FREQUENCY SOLID-STATE POWER  
RECTIFICATION**

Mortenson, KE Bakeman, PEJ Taft, WC

Rensselaer Polytechnic Institute, Division of Electrophysics, Troy, New York

TR-EP-6803, Dec. 1967, 42 pp

Contract C-117-66

Report on Project Tubeflight. See also PB-179 464.

This report covers the progress made on high frequency power rectification from September 1966 to September 1967. The requirements for a high frequency rectifying diode are reviewed. The germanium-gallium arsenide p-n heterojunction diode is presented and its material requirements, fabrication technology, and packaging are discussed. The circuit requirements for high frequency rectification are considered, and a new lumped-circuit test jig was designed and built. The development of a 220 MHz one kilowatt rectification test facility is reported. Finally, a continuous rectified DC output power of 28 watts was obtained from a 220 MHz source using a single germanium-gallium arsenide heterojunction diode. The overall rectification efficiency of a similar heterojunction diode including circuit losses was 72%. (Author)

**ACKNOWLEDGEMENT**

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**039109  
THE AEROTRAIN SYSTEM: AIR CUSHION GUIDED  
GROUND TRANSPORTATION: DESCRIPTION AND  
PERFORMANCE OF THE EXPERIMENTAL VEHICLE**

Giraud, FL

Aeroglide Systems, Incorporated, New York, New York

Final Rpt. 1968, 204 pp

Contract DT-7-35337

The report presents selected results of testing the experimental Aerotrain vehicle on the Gometz-laVille to Limours test track, including technical data on the vehicle and guideway, generalized performance and economic models, and technical specifications for a specific site for application of a full-scale Aerotrain system as an airport link. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-178961

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PB-178961

**039110  
PRELIMINARY DESIGN AND TEST OF LINEAR  
INDUCTION TRACTION MOTORS AND SUSPENSION  
SYSTEMS**

Baumann, DM Meacham, GBK

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

DSR-6106-3, Nov. 1966, 47 pp

Contract C-85-65t

The report presents some very preliminary calculations and experiments investigating linear induction motors for high speed ground transportation. An iron field slotted rotor configuration is proposed for improved performance. The possibility of combined magnetic suspension and propulsion are discussed and found to require pole pieces that are on the order of weight of the vehicle. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173686

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**039111  
HIGH SPEED GROUND TRANSPORTATION. A  
PRELIMINARY STUDY OF THE LINEAR INDUCTION  
MOTOR FOR HIGH SPEED GROUND TRANSPORTATION**

TRW Systems Group, Washington Operations, Washington, D.C.

06818-W454-R0-12, Jan. 1968, 120 pp

Contract C-353-66

A theoretical study was undertaken to describe the characteristics of a linear induction motor for High Speed Ground Transportation. A quasi-one-dimensional analysis is made of a linear induction motor without recourse to the usual idealization of the polyphase stator windings into current sheets. The analysis assumes that the stator windings and the induced currents inside the reaction rail (rotor) produce a resultant traveling wave magnetic field at the stator surfaces, and under the assumption of negligible end effect, the electromagnetic boundary conditions are applied to determine the attenuation of the magnetic field, both inside the reaction rail and at the air gap between the reaction rail and stator surfaces. Taking into account real machine effects, expressions based on classical AC machine theory are given for the required exciting current, the generated voltage, the net power output, and the electrical efficiency. Results are reduced into equivalent circuit form so comparisons can be made with conventional rotary induction motors. (Author)

**ACKNOWLEDGEMENT**

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**039115  
MOVING GROUND-PLANE WIND-TUNNEL TESTS ON  
SEVERAL TRACKED AIR CUSHION VEHICLE (TACV)  
MODELS**

TRW Systems Group, Washington Operations, Washington, D.C.

06818-6029-R0-00, Intrm Rpt, Sept. 1968, 101 pp

Contract C-353-66

An experimental wind-tunnel test program conducted jointly by TRW and NASA-Langley has provided supporting air cushion and body aerodynamic data for ongoing analytical and design studies at TRW and elsewhere. Selected results for two of the TACV models tested are presented in this report. Tests were conducted on a 30-inch-diameter circular air-cushion model and on an elongated model approximately 11 inches wide and 67 inches long. Each model's air-cushion base area was 5 square feet. The models' air-cushions were capable of operating in a peripheral-jet or hybrid-plenum mode. Circular model test results for both the forward-speed and hover state and the peripheral-jet and hybrid-plenum modes are reported. Results for the hover state and peripheral-jet mode are reported only for the elongated mode.

#### ACKNOWLEDGEMENT

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#### 039119

#### TRACKED AIR CUSHION VEHICLE DEVELOPMENT

McCabe, WL Swanson, CG Tang, KK

Mitre Corporation, McLean, Virginia

Status Rpt, Oct. 1968, 16 pp

Prepared in cooperation with TRW Systems Group, Washington, D.C. Presented at Transport Engineering Conference, Washington, D.C. 28-30 Oct 68.

Program results to date, current activities and plans for future work are discussed. System engineering studies performed so far have identified and examined the major alternatives available for a TACV system, and significant R and D requirements. Factors which will strongly affect the design and cost of an operational TACV system include the vehicle-guideway configuration, the effects of cross winds, the relationship between cushion pressure and the free stream dynamic pressure, and the type of propulsion subsystem used. Research activities to advance the state of the art of TACV systems are briefly described. These include the NASA/TRW wind tunnel tests, the suspension and dynamics studies at MIT and NASA, and the experimental French Aerotrain tests. The objective, approach and requirements of the recently contracted design studies for a Tracked Air Cushion Research Vehicle are presented. (Author)

#### ACKNOWLEDGEMENT

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#### 039123

#### OBSTRUCTION DETECTION PROGRAM

Radio Corporation of America, Princeton, New Jersey

Final Rpt, Mar. 1969, 162 pp

Contract DT-7-35509

An obstacle detection system comprised of transmitters and collocated receivers spaced alongside railroad tracks and scanning across the tracks to a continuous retroreflective fence was studied, tested, and demonstrated. The transmitters emit a very narrow beam of collimated coherent light from a gallium arsenide laser. The retroreflector establishes a narrow region with reflectivity substantially higher than

the normal surroundings. An object located between the laser transmitter and the retroreflector will prevent the laser beam from impinging upon the retroreflector and will, therefore, cause a variation in the return energy normally observed by the receiver. This variation is then reported to a central control station for further action. An engineering model of a laser scanner was designed and built. In combination with an engineering model of a retroreflective fence, the scanner engineering model was used to successfully demonstrate the feasibility of the system concepts. (Author)

#### ACKNOWLEDGEMENT

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#### 039126

#### TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME I. RESEARCH VEHICLE PRELIMINARY DESIGN

Grumman Aircraft Engineering Corporation, Bethpage, New York  
Vol. 1, FSR-ST-4, Final Rpt, Mar. 1969, 230 pp

Contract DOT-FR-9-0003

See also Volume 2, Pt 1, PB-183 173.

The report contains a preliminary design and development plan for a research tool to validate tracked air cushion vehicle technology.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183172

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PB-183172

#### 039127

#### TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME II. RESEARCH VEHICLE DEVELOPMENT PLAN. PART I-TECHNICAL PLANS

Grumman Aircraft Engineering Corporation, Bethpage, New York  
Vol. 2, Pt 1, FSR-ST-5A, Final Rpt, Mar. 1969, 31 pp

Contract DOT-FR-9-0003

See also Volume 3, PB-183 174.

Three major subsystem development tasks are required: (a) Design, build, and test a cushion air control valve; (b) Develop friction and wear data for friction brake facing and skid materials at high speeds; (c) Develop a suitable flexible peripheral jet material. Manufacturing facilities required are 8000 sq ft of shop area with access to detail parts manufacturing, processing, and inspection areas. The GFE required includes a JT8D-9 turbofan, a PLFIA-2 turbofan, the LIM, its turbo-alternator package and power pickups and/or power conditioning equipment. A minimum qualification program has been generated which uses qualified hardware and/or conservative design, reducing the need for testing. Qualification testing is therefore categorized as functional, performance verification, and/or calibration.

#### ACKNOWLEDGEMENT

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#### 039128

#### TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME III. RESEARCH VEHICLE RESEARCH PLAN

Grumman Aircraft Engineering Corporation, Bethpage, New York  
Vol. 3, FSR-ST-6, Final Rpt, Mar. 1969, 106 pp

Contract DOT-FR-9-0003

See also Volume 1, PB-183 172.

The TACRV program will provide test data on ride comfort, performance, efficiency, and level of noise in operation, for use in the final design of a public demonstration system. The TACRV will be used to obtain test operation data, under actual forward speed conditions, in the areas of air cushion performance, suspension system dynamics, vehicle stability and control dynamics, vehicle/guideway dynamic interactions, linear induction motor (LIM)/vehicle performance and internal cabin and far field acoustics. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183174

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039129

#### TRACKED AIR CUSHION RESEARCH VEHICLE DEVELOPMENT PLAN STUDY REPORT

General Electric Company, Transportation Systems Division,  
Philadelphia, Pennsylvania

69AT-1003, Mar. 1969, 72 pp

Contract DOT-FR-9-0004

See also PB-183 178, PB-183 179 and PB-183 180.

The objectives of this R/V Development Plan are to indicate the schedules for, and to describe the efforts necessary to accomplish the refinement of the vehicle design details, development of subsystems, fabrication and assembly of the research vehicle, and the performance of suitable component and vehicle qualification and performance tests. Its further objective is to include schedule estimates for the production of all ground support equipment, checkout systems, and spares necessary to implement the proposed research use of the vehicle. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183177

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039130

#### TRACKED AIR CUSHION RESEARCH VEHICLE RESEARCH PROGRAM STUDY REPORT

General Electric Company, Transportation Systems Division,  
Philadelphia, Pennsylvania

69AT-1004, Mar. 1969, 83 pp

Contract DOT-FR-9-0004

See also PB-183 177, PB-183 179 and PB-183 180.

The system test program discussed in this report is to provide engineering data, verified analytical tools, and design guidelines for an attractive, high-performance public demonstration TACV and guideway system. The report examines the general qualities required of a commercial TACV system; the translation of these qualities into technology requirements; and the assessment of the state-of-the-art in regard to these requirements. In each deficient area, several alternative ways of advancing the state-of-the-art are examined. This basic work culminates in a clearer definition of the specific role of the

TACRV. This role is then translated into specific experiment areas and instrumentation requirements.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183178

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039131

#### TRACKED AIR CUSHION RESEARCH VEHICLE PRELIMINARY DESIGN STUDY REPORT

General Electric Company, Transportation Systems Division,  
Philadelphia, Pennsylvania

69AT-1002, Mar. 1969, 204 pp

Contract DOT-FR-9-0004

See also PB-183 177, PB-183 178 and PB-183 180.

This report presents a preliminary design for a Tracked Air Cushion Research Vehicle (TACRV). The proposed design meets performance, design, and test requirements prescribed by the OHSGT. The research program test requirements emphasize air cushion and suspension research. Additional research program investigations include subsystem interactions, aerodynamics, propulsion, noise, and vehicle/guideway interactions, especially as they affect ride quality and operational guideway design requirements. The experimental program is to provide engineering data and verification of analyses that will be applicable to the design of public demonstration TACV systems. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183179

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039132

#### TRACKED AIR CUSHION RESEARCH VEHICLE PRELIMINARY DESIGN STUDY REPORT: APPENDICES

General Electric Company, Transportation Systems Division,  
Philadelphia, Pennsylvania

69AT-1007, Mar. 1969, 473 pp

Contract DOT-FR-9-0004

See also PB-183 177, PB-183 178 and PB-183 179.

These appendices deal with (a) requirements, (b) aerodynamics, (c) braking, (d) loads and structural design criteria, (e) structural analysis, (f) weight analysis, (g) personnel accommodations, (h) linear induction motor, (j) ground support equipment, (k) electrical system, (m) guideway requirements, (n) suspension dynamics, (p) special sensors and measurement techniques, (q) drawings and specifications, (r) noise, and (s) instrumentation and data handling system.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-183180

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039133

**A PRELIMINARY DESIGN STUDY OF A TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME I: GENERAL REPORT**

Giraud, FL

Aeroglide Systems, Incorporated, New York, New York

Vol. 1, Final Rpt, Feb. 1969, 262 pp

Contract DT-7-35337

See also Volume 2, PB-183 320.

The first part of this study compares different configurations of high speed air cushion vehicles and guideways. Economical and functional comparisons of the guideway functional cross section favor the double 'L' and inverted 'T'. A comparison of 3 types of suspensions points to the suspended lip as the most suitable design to achieve the comfort requirement, since it allows a simple means of activation. A comparison of different means of propulsion focuses on aerodynamic propulsion with a by-pass ratio of 5 combined with a propulsive exhaust into the track gap. The second part of this study aims at describing a vehicle and track to perform a test program. A common vehicle frame equipped with a fan jet can accommodate the existing linear induction motor. Tests of the most interesting track form and structure, tests of all suspensions and trials of alternate means of aerodynamic propulsion with their noise attenuation systems can be performed.

**ACKNOWLEDGEMENT**

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039134

**A PRELIMINARY DESIGN STUDY OF A TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME II. GUIDEWAY STUDY REPORT**

Aeroglide Systems, Incorporated, New York, New York

Vol. 2, Dec. 1968, 112 pp

Contract DT-7-35337

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc., New York. See also Volume 1, PB-183 319.

This report describes the development of preliminary design tradeoff studies for a single vehicle aerial guideway to accommodate a vehicle traveling on air cushions at speeds up to 300 miles per hour. Three guideway structure types were studied: (1) the Inverted Tee, (2) the Double L (or Channel), and (3) the Box (or Inverted Channel). Each of these structural types was analyzed for the purpose of determining the most economical construction material, the optimum span length, the tolerance requirements, construction methods and maintenance procedures. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183320

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039135

**SPECIFICATIONS FOR LINEAR INDUCTION MOTOR P/N 546230, TURBOALTERNATOR PACKAGE P/N 546798, AUXILIARY POWER UNIT P/N 928288, MANUAL CONTROL P/N 44290**

Kalman, GP Chapa, J

Garrett Corporation, AIRResearch Manufacturing Division, Los Angeles, California

68-3400-1, Mar. 1969, 44 pp

Sponsored by Office of High Speed Ground Transportation, Washington, D.C.

The document describes the basic power systems supplied for the linear induction motor test vehicle. The alternator is matched to the turbine, and is capable of providing 3000KVA at 0.6 pf. at 173 Hz, which can be exceeded only by using military overload of the gas turbine. The linear induction motor was designed to be compatible with the turboalternator and produce 3750 lb thrust, 0 to 250 mph, 2500hp. The linear induction motor, however, is also capable of much higher performance if suitable electrical power is supplied.

(Author)

**ACKNOWLEDGEMENT**

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039141

**MOVING GROUND PLANE WIND TUNNEL TESTS ON SEVERAL TRACKED AIR CUSHION VEHICLE (TACV) MODELS**

TRW Systems Group, Washington Operations, Washington, D.C.

06818-6032-RO-00, Mar. 1969, 220 pp

Contract C-353-66

Report on High Speed Ground Transportation Systems Engineering Study.

Test results are presented for four models. Briefly, the objectives of the program were: (a) Determination of whether a moving ground plane simulation is necessary for valid TACV wind tunnel test results. (b) Determination of the aerodynamic characteristics of air cushions. (c) Determination of the aerodynamic characteristics of TACV bodies. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183857

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039142

**FAR-FIELD AERODYNAMICS OF TUBEFLIGHT PROPULSION**

Foa, JV

Rensselaer Polytechnic Institute, Project Tubeflight, Troy, New York

TR-PT-6903, Jan. 1969, 36 pp

Contract C-117-66

Tubeflight is a high-speed tube transport scheme in which the vehicle derives its propulsion from the fore-to-aft transfer of air within the tube. The power required for tubeflight propulsion depends not only on the gas dynamics of the transfer flow but also on the amplitude of the disturbances that are generated by the vehicle in the far field, and these in turn depend on the energy conversion efficiency of the propulsion mechanism. A method is developed for the coupling and solution of the equations governing the flow field for the case of a tubeflight vehicle in steady motion in a very long tube. The method produces useful information on the interrelationships between the speed of travel, the drag of the vehicle, the amplitude of

the flow disturbances in the far field, the energy conversion efficiency of the thrust generator, and the power demands. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183866

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**039143**

**HEAVE DYNAMICS OF FLEXIBLE-BASE FLUID SUSPENSIONS**

Captain, KM Richardson, HH

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts MIT-DSR-76110-9

Jan. 1969, 111 pp

Contract DOT-C-85-65

The report presents the results of an analytical and experimental study of the heave dynamics of externally pressurized flexible base fluid suspensions operating over guideways containing either deterministic or random irregularities whose wave lengths are large compared to the suspension pad length. The effects of base flexibility and damping, but not of base mass, on the dynamic behavior of suspended vehicles are investigated and relationships are derived between the critical fluid and mechanical parameters which will maximize ride quality for a given vehicle and guideway characteristic. The suspension is modeled as a dynamic lead-lag spring and it is shown that for any value of lead time constant—as determined by the vehicle weight and size—there exists an optimum value for the lag time constant (or cushion volume) which minimizes the peak vertical vehicle acceleration. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183987

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**039145**

**FEASIBILITY STUDY OF LINEAR INDUCTION MOTOR THRUST BOOSTERS FOR DIESEL-ELECTRIC LOCOMOTIVES**

Kalman, GP Hafale, BW

Garrett Corporation, AiResearch Manufacturing Division, Los Angeles, California

69-4862, 6811-6812, Mar. 1969, 51 pp

Contract DOT-FR-9-0014

Both the technical and economic feasibility of utilizing surplus power available from the diesel engine, by adhesion-independent thrust boosters were reviewed. First the power available for thrust boosting was determined. Then several linear motor reaction rail configurations were considered. A preferred thrust booster configuration (Figure 1-1) which utilized the running rails as the secondary member, was described. It was found that 6000-lb force per locomotive, at 12 to 13 mph train speed can be delivered by such a thrust booster. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184252

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**039146**

**SUMMARY OF RESEARCH AT RPI ON TUBEFLIGHT, 15 FEBRUARY 1968 15 JANUARY 1969.**

Rensselaer Polytechnic Institute, Troy, New York

TR-PT-6904, Summary, 6802-6901, Jan. 1969, 24 pp

Contract DOT-C-117-66

See also PB-177 518.

Project Tubeflight deals with an intercity high-speed ground-transportation scheme in which air-cushion-supported vehicles propel themselves in a novel way in nonevacuated tubes. The report covers effort aimed primarily at the objective of obtaining realistic predictions of the power demands and attainable speeds of full-scale tube-flight vehicles. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184317

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**039147**

**STABILITY OF A SLENDER ELASTIC BODY TRAVELING IN A TUBE**

Wang, DP

Oceanics, Incorporated, Plainview, New York

TR-68-54, Feb. 1969, 54 pp

Contract DOT-FR-9-0020

The stability of a slender, axisymmetric, elastic body, supported by two simple spring systems, travelling in a cylindrical tube filled with air is studied. Slender-body theory is used to evaluate the aerodynamic force acting on the body. Under this aerodynamic loading the elastic body is assumed to obey the equation of motion of a simple beam. A method of solution of the equation of motion is presented for a slender ogive cylinder. It is found that at a given travelling speed instability occurs when the length of the body exceeds a critical value. This critical length is found to be approximately proportional to the inverse of the travelling speed, and to the square-root of the difference of the characteristic cross-sectional areas of the tube and of the body to the third power. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184319

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**039148**

**TUBEFLIGHT POWER-DEMAND TESTS AND INITIAL VALIDATION OF THEORY: 1. ESTIMATED PERFORMANCE OF WHEEL-SUPPORTED VEHICLES TO BE TESTED IN FACILITY T-2. 2. INTERPRETATION OF INITIAL TUBEFLIGHT PROPULSION TEST RESULTS, AND COMPARISON WITH THEORY. 3. TESTS OF WHEEL-SUPPORTED VEHICLES IN THE T-2 FACILITY.**

Foa, JV Messina, NA Graham, PA Brower, WBJ

Rensselaer Polytechnic Institute, Troy, New York

TN-PT-6802, Feb. 1969

116 pp

Contract C-117-66

Also includes Report TN-PT-6901.

To permit correlation between the predictions of PB-177 520 and the results of the small-scale model tests that are to be conducted in facility T-2, the power demands of these models are calculated by a procedure that is essentially the same as that of PB-177 520, except for such changes in the analytical model as are suggested or called for by the conditions of the tests. Experimental power demand data are presented for tests of the RPI MK IIc scale-model tubeflight vehicle in test facility T-2. This is done by use of propeller efficiency data generated through testing in the tubeflight wind tunnel, facility T-3. A description of the Mark IIc (wheel-supported) tubeflight vehicle is given. A series of test runs in the T-2 Facility is reported in which the top speed was about 76 feet per second. This result checks very closely with theoretical predictions for this vehicle. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184435

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PB-184435

**039151**

**EXPERIMENTAL EVALUATION OF VEHICLE DRAG IN LONG TUBES**

Magnus, DE Panunzio, S Medeck, H

General Applied Science Laboratories, Incorporated, Westbury, New York

Final Rpt, May 1969, 128 pp

Contract FR-9-0011

The report describes experimental results for aerodynamic phenomena in high speed tube-vehicle transportation systems. The data is obtained from a scaled facility which is suitable for a broad range of operating conditions and vehicle configurations. Seven vehicle configurations were used to measure vehicle drag force and the histories of static and dynamic pressure. The results correspond to full-scale vehicles approximately 8 to 13 feet in diameter operating in an evacuated tube ( $p = .0056$  atm) 7 miles long. The history of static wall pressure in the far field is analyzed and related to the propagation of disturbances along the tube. Also, the pressure was measured in the region of the near field, and the results compared for various geometries of the vehicle. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-185707

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PB-185707

**039154**

**POWER COLLECTION BY SLIDING CONTACT METHODS FOR HIGH SPEED GUIDED VEHICLES. PHASE I. ANALYZE TECHNIQUES AND DESIGN CONCEPTS**

General Electric Company, Transportation Systems Division, Erie, Pennsylvania

Final Rpt, Aug. 1969, 166 pp

Contract DOD-FR-9-0023

Systems Design and Materials Studies.

As a result of the high speed (300 mph) power collection research, specific recommendations are developed for power collection system design, candidate materials and further analysis and testing. Each of these areas is covered in detail. A power collection system

based on the use of multiple contacts mounted on a servo driven support is recommended. Techniques for material selection are developed and used for the selection of preferred candidate materials for both the distributor and collector. Recommendations are presented for evaluation and verification of both collector system design and materials selection with laboratory-type equipment. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-185449

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PB-185449

**039156**

**PRELIMINARY DESIGN STUDY OF A LINEAR INDUCTION MOTOR WITH AN ALUMINUM BONDED TO STEEL REACTION RAIL**

Westinghouse Electric Corporation, Transportation Division, Pittsburgh, Pennsylvania

Final Rpt, Aug. 1969, 137 pp

Contract DOT-9-0025

High speed ground transportation vehicles that are propelled by linear induction motors (LIM) may prove to be attractive alternatives for high speed inter-city transit. One concept for such a vehicle system employs a steel I-beam to guide the vehicle. The steel I-beam, onto which has been bonded some material of high conductivity, serves as the reaction rail for the LIM. The purpose of the study was to determine if a steel I-beam acting as the LIM reaction rail could be used to guide and support the LIM as well as guide the vehicle. If such an arrangement would prove practical, a large cost saving might be realized in guideway construction for the Tracked Air Cushion Vehicle (TACV). (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-186231

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PB-186231

**039157**

**ELECTRIC POWER SYSTEMS FOR HIGH SPEED GROUND TRANSPORTATION**

Westinghouse Electric Corporation, Transportation Division, Pittsburgh, Pennsylvania

Final Rpt, Aug. 1969, 352 pp

Contract DOT-9-0025

This study investigates the power needs of four classes of systems: (1) 300 mph Tracked Air Cushion Vehicle (TACV); (2) 250 mph Linear Induction Motor (LIM)-driven rail vehicle; (3) 250 mph wheel-driven vehicle; (4) 200 mph wheel-driven rail vehicle. Task areas for the study are: (1) Power systems; (2) Power distribution; (3) Power collection; (4) Power conditioning.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-186232

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PB-186232

**039158**

**INVESTIGATION OF SEAL MATERIALS AND CONFIGURATIONS FOR HIGH SPEED AIR CUSHION VEHICLES**

Reynolds, HJJ

Johns-Manville Research and Engineering Center, Manville, New Jersey

Oct. 1969, 84 pp

Contract DOT-3-0268

Air flow characteristics through openings provided by single and multiple metal or rubber skirts (labyrinths) situated above a bed surface were established for low pressure systems up to one psig. Single skirting of both types exhibits the standard theoretical discharge coefficient of 0.61 for sharp-edged skirting. Reduced coefficient values are obtained with multiple skirting with rapidly declining benefit over five skirts. For metal skirts, coefficients are asymptotically low at skirt spacing/opening ratios in excess of 60 for two skirts, 45 for three skirts, and 30 for five skirts. The test results indicate that rubber skirting in multiple configurations is more efficient than metal with respect to coefficient values and pressure retention between skirt spacings. This is contrary to what might be expected, and the reason for this difference is not understood at this time. Pressure retention between skirts in all multiple skirt configurations is at an asymptotically high value when skirt spacing/opening ratios are at least 60. The relative efficiency of air cushions using multiple skirt configurations is very dependent upon specific plenum shape factor, skirt spacing, and operational skirt opening. When properly designed, multiple skirt air cushions can be appreciably more efficient than single skirt cushions. (Author)

#### ACKNOWLEDGEMENT

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039160

#### A VISCOUS-FLOW ANALYSIS FOR THE QUASI-STATIC PRESSURE-FLOW-DISPLACEMENT CHARACTERISTICS OF PERIPHERAL JET FLUID SUSPENSIONS

Ercan, Y Richardson, HH

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts MIT-DSR-76110

DSR-76110-10, Feb. 1969, 111 pp

Contract DOT-C-85-65

A viscous-flow analysis is presented which is capable of predicting the static and quasi-static behavior of peripheral jet fluid suspensions operating in the incompressible flow regime. The theory accounts for the observed discrepancies between experiment and inviscid flow analyses by including entrainment and turbulent mixing in the jet and wall boundary layer effects. Equilibrium cushion pressure is predicted within 3 to 4 percent compared with errors up to 40% which occur in even the most conservative inviscid theories. The analysis is used to develop solutions for the non-equilibrium pressure-flow-displacement characteristics required in dynamic analysis of heave motion. Comparison of theory and experiment indicates the slopes of these characteristics (the sensitivities) can be predicted within about 10 percent over the range of jet Reynolds numbers of interest for vehicle suspensions. Curves and digital computer programs are included which permit peripheral jet performance to be determined as a function of geometry, supply pressure and Reynolds number. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-188358

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039161

#### FLUID DYNAMIC DRAG ON VEHICLES TRAVELLING THROUGH TUBES

Hoppe, RG Gouse, SWJ

Carnegie-Mellon University, Department of Mechanical Engineering, Pittsburgh, Pennsylvania

CMU-1-59076-1, Aug. 1969, 187 pp

Contract DOT-3-1058

The document presents the results of an investigation of the fluid dynamic drag force exerted on externally propelled vehicles moving axially through guideways of varying lengths, degrees of enclosure, and percentage of wall perforation area. The conditions differ from most wind or water tunnel studies because the models are moving relative to the tunnel walls and occupy a large percentage of the tunnel cross section. Experimental studies were conducted by measuring the terminal velocity of small scale models falling through transparent, vertical and inclined guide tubes filled with water. The models were cylindrical with an ogive nose and a blunt conical tail. They varied in length from 3 to 36 diameters and occupied between 7 and 93 per cent of the tunnel cross section. Reynolds number based on model terminal velocity and diameter ranged from 3000 to 2,500,000. The experimental results indicated a smooth transition from free environment flow, with little or no wall interference, to fully developed confined flow, with no unusual phenomena or discontinuities occurring.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-188451

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039163

#### STUDY OF SYNCHRONOUS LONGITUDINAL GUIDANCE AS APPLIED TO INTERCITY AUTOMATED HIGHWAY NETWORKS

TRW Systems Group, Washington Operations, Washington, D.C.

06818-W666-RO-00, Final Rpt, Sept. 1969, 103 pp

Contract C-353-66 (Neg)

The report documents the results of the Synchronous Longitudinal Guidance (SLG) Study as applied to automated highway networks. Section 1 of the report contains a background of the SLG projects, an introduction to the basic concepts used in SLG, objectives and methods of the study, and conclusions reached as a result of the study. Sections 2 and 3 discuss results of analytical work done to verify various properties of the algorithms used for local vehicle control and for interfacing highway elements within the network. Work done in simulating the allocation algorithm for three networks is summarized in Section 4. A brief comparison between SLG and manual highway design is drawn in Section 5. Finally, Section 6 contains recommendations for further study of the SLG concept. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-188582

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039164

#### ANALYSIS OF THE NEAR FLOW FIELD FOR TUBE-VEHICLE SYSTEMS

Panunzio, S Magnus, DE

General Applied Science Laboratories, Incorporated, Westbury,



New York

GASL-TR-732, Final Rpt, Sept. 1969, 58 pp

Contract DOT-FR-9-0011,

Results are presented from the investigation of vehicle drag in tube transportation systems. The report emphasizes the analysis of the aerodynamic phenomena in tube vehicle systems. A simplified one-dimensional analysis is formulated for the near flow field. The analysis is applied to several model vehicles, and the results compared with existing data from 19 different experiments. The correlation between the experimental and analytical drag coefficients is good. Also, the dependence of the drag coefficient on various flow parameters is examined and tentative conclusions presented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-188847

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**039165**

**AN EXPERIMENTAL STUDY OF THE AERODYNAMIC RESISTANCE OF VEHICLES MOVING THROUGH TUBES**

Gregorek, GM

Ohio State University, Columbus, Aeronautical and Astronautical Research Laboratory, Columbus, Ohio

Apr. 1969, 43p

Contract DOT-3-0298

The aerodynamic resistance of solid rocket propelled, tube-vehicle models was examined at speeds up to 400 ft/sec. During the traverse of a 250-foot-long, 2.89 in. I.D. stainless steel tube, model trajectory, tube air static pressure and tube air velocity data were recorded. At low speeds, a pipe friction theory was found to correlate both the drag coefficients inferred from model deceleration, and the air pressure drop across the models. At high speed, the models induced significant air motions in the tube which, when coupled with tube end reflections, precluded data reduction to coefficient form. Application of the one-dimensional, unsteady method of characteristics, modified to account for mass flow past the models, is shown to produce reasonable agreement between the measured and predicted values of the induced air velocity. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-188848

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**039168**

**DIELECTRIC WAVEGUIDE FOR COMMUNICATION WITH HIGH SPEED VEHICLES**

Abele, M

General Applied Science Laboratories, Incorporated, Westbury, New York

GASL-TR-729, Final Rpt, Aug. 1969, 154 pp

Contract DOT-FR-9-0016

This report assesses the feasibility of a wireless, non-radiating communication system based on the use of a dielectric waveguide. The dielectric waveguide is composed of a dielectric rod attached to a metallic shield. The transfer of an electromagnetic signal to and from a vehicle moving parallel to the waveguide is accomplished by means of a coupler mounted on the vehicle itself without a physical contact

with the dielectric waveguide. Both the waveguide and the moving coupler theoretically are non-radiating units. Consequently, no radiation is emitted by the system and conversely it does not couple with external electromagnetic signals which propagate in the surrounding environment. The feasibility study, conducted in the X-band or 8.8 to 9.0 GHz, has shown that the concept provides a reasonably simple and efficient communication system with a moving vehicle. In terms of radiation losses and rejection of external electromagnetic signals, the performance of the waveguide is good and consequently it can be used in regions of crowded electromagnetic environment. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-189476

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PB-189476

**039169**

**VERIFICATION OF FEASIBILITY STUDY OF COUPLED LEAKY WAVEGUIDE SYSTEM FOR COMMUNICATION IN HIGH SPEED GROUND TRANSPORTATION**

Nakahara, T Yoshida, K Kuroda, M Kurauchi, N Takemura, K

Sumitomo Electric Industries Limited, Osaka, Japan

Final Rpt, Jan. 1970, 141 pp

Contract DOT-FR-9-0042

See also PB-180 750.

Laboratory-scale tests and extensive studies were carried out to verify the feasibility of a coupled leaky waveguide system. Aluminum waveguides with radiation holes and some components were fabricated for the test. The attenuation constants and coupling properties were measured, and these measurements agreed well with the theory. Installation of waveguides in a duct with plastic cover proved effective to eliminate foreign substances depositing thereon affecting transmission loss. Suppression of radiation was measured by use of various combinations of wall materials. Expected suppression radiation effects were obtained even with combinations of metal and concrete. The effect of rain on the attenuation and coupling were measured. Though phase distortion due to waveguide irregularity could not be measured, the theoretical limitation of phase distortion was obtained, which provided the data required to evaluate the waveguide properties employing the various modulation and multiplex systems and also the channel band width capacities. Signal-to-noise ratios were calculated for voice channels in typical cases of the coupled leaky waveguide system with a 400 mile waveguide length with estimates for FDM-FM and PCM-PM systems including the thermal, intermodulation, and distortion noises.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-189481

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**039170**

**REQUIREMENTS AND METHODOLOGY FOR EVALUATION OF THE WAYSIDE COMMUNICATION LINK**

New Mexico State University, Las Cruces, Physical Science Laboratory, Las Cruces, New Mexico

PSL-PR00651, Final Rpt, 6812-6906, Sept. 1969, 72 pp

Contract DOT-FR-9-0026

The study was devoted to formulating technical requirements for the HSGT wayside communications medium and to developing a methodology for determining the most suitable of the proposed media. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-189778

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**039171**

**HIGH SPEED GROUND TRANSPORTATION COMMUNICATIONS SYSTEM**

Lundgren, RE Nudd, GR

Hughes Research Laboratories, Electron Device Physics Department, Malibu, California

Final Rpt, Nov. 1969, 268 pp

Contract DOT-FR-09-0007

The report contains the results of an investigation concerning the communication aspects of a high speed ground transportation (HSGT) system. The study was restricted to the portion of the frequency spectrum between 30 and 65 GHz. In contrast to communication systems which operate at lower frequencies, this millimeter-wave portion of the spectrum makes available to the system designer very large bandwidths, of the order of several gigahertz, and techniques for insuring system isolation and freedom from interference. The characteristics and feasibility of two types of communication system were considered. It is concluded that, on a performance basis, a system employing a leaky waveguide transmission medium is the better of the two; however, if cost is the overriding determinant, a communication system which employs atmospheric propagation should be considered. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-189416

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**039172**

**PRELIMINARY STUDY OF AN AUGMENTED RAM-WING VEHICLE CONCEPT**

Reba, I

IIT Research Institute, Chicago, Illinois IITRI-J6128

IITRI-J6128-FR, Final Rpt, 6708-6805, Jan. 1970, 126 pp

Contract DOT-7-33512

The report describes a wind-tunnel study of a ram-wing-type vehicle with various blowing arrangements. Two models were studied. One model represented a thick vehicle configuration with a blunted rear end. The second had a streamlined chord section. Blowing arrangements consisted of two two-dimensional Coanda nozzles, one placed near the leading edge and one near the midchord. Upward, downward, and mixed blowing arrangements were investigated. The results indicate that the downward blowing near the leading edge and upward blowing at midspan constitute the most promising of those arrangements investigated. With this arrangement the vehicle has high lift capability at zero forward speed and low drag characteristics at all forward speeds. A range of blowing and pressure coefficients at which a considerable increase in lift-to-horsepower ratio takes place (as compared with a case without blowing) also exists. Similarly, blowing arrangements and blowing coefficients that detrimentally affect power economy also exist. In most cases, blowing permits increasing the wing loading efficiency (weight carried per unit area), independently of forward speed or ground clearance.

(Author)

**ACKNOWLEDGEMENT**

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**039173**

**TRAVEL TIME REDUCTIONS AND ENERGY SAVINGS FOR GRAVITY-AUGMENTED, EVACUATED TUBE VEHICLE SYSTEMS**

King, M Simms, R Smylie, JW

TRW Systems Group, Washington Operations, Washington, D.C.

06818-6035-RO-00, Jan. 1970, 41 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems Engineering Study.

The use of gravity augmentation to accelerate an evacuated TVS affects the travel time, speed, and energy requirements for the system. For stage lengths of 3 to 10 miles characteristic of urban links, savings in travel time can be achieved by gravity augmentation over that for conventional systems operating on the surface. Savings in travel time are achieved however at the expense of higher vehicle speeds which lead to a more complex technological system. For stage lengths up to 100 miles characteristic of a regional transportation system, gravity augmentation results in a savings in travel time at the expense of greater tunnel depth and train speed. A reduction in energy per train trip can also be attained. However, the technological requirements depend largely on the maximum train speed which is sensitive to the propulsion mode of operation selected.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190396

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**039174**

**THE AERODYNAMIC CHARACTERISTICS OF A SLENDER BODY TRAVELING CHOKED IN A TUBE**

Goodman, TR

Oceanics, Incorporated, Plainview, New York

TR-69-67, Tech Rpt, Jan. 1970, 112 pp

Contract DOT-FR-9-0020

See also PB-173 997.

In order that a tube vehicle system (TVS) be economically feasible it is necessary that the vehicle fill the tube as much as possible because tunneling costs are very high. Under these circumstances the body-tube ratio may be so large that the flow in the annular passageway between the body and the tube will choke. The paper is concerned with analyzing the flow and determining the aerodynamic forces acting on a vehicle under these circumstances. When the flow is choked a shock wave appears downstream of the throat and the flow never expands to upstream ambient conditions. This unsymmetrical flow situation creates a wave drag and increases the lift and moment substantially above the values they have in subcritical flow. All the stability derivatives are calculated for choked as well as subcritical flow conditions for a vehicle shaped in the form of an ellipsoid and also for a family of vehicles shaped in the form of ogive-cylinders. Using the results for one of the ogive-cylinders it is shown that when the flow is choked the aerodynamic forces can become

comparable with the weight of a TVS vehicle. (Author)  
ACKNOWLEDGEMENT

National Technical Information Service, PB-190395

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**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)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190635

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**039178**

**VEHICLE-TUNNEL ENTRY AT SUBSONIC SPEEDS**

Swarden, MC Wilson, DG

Massachusetts Institute of Technology, Engineering Projects  
Laboratory, Cambridge, Massachusetts

Pt 1, DSR-76111-3, Final Rpt, Mar. 1970, 54 pp

Contract DOT-C-85-65

This is the first part of a two-part report on the problem of vehicle-tunnel interaction during the entering period. This part covers most of the analytical work done for the project and contains a description of the experimental apparatus to be used to investigate the phenomena.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190912

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**039196**

**EVALUATION OF FDM-FM MODULATION FOR USE ON  
WAYSIDE COMMUNICATION SYSTEMS 212 Final rept. 17  
Jun 69-12 Jan 70**

New Mexico State University, Las Cruces, Physical Science  
Laboratory, Las Cruces, New Mexico, 88801

PSL-PE00651, Final Rpt, 6906-7001, Mar. 1970, 128 pp

Contract DOT-FR-9-0026

The frequency response of Long Transmission Line with multiplex reflection discontinuity is obtained by computer simulation. A criterion is derived for evaluating frequency division multiplex on a frequency modulation carrier for transmission over the simulated lines. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-191788

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**039222**

**STATE-OF-THE-ART TUBE VEHICLE SYSTEM**

King, M Smylie, JW

TRW Systems Group, Redondo Beach, California

06818-6042-R000, Final Rpt, June 1970, 56 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems  
Engineering Study.

A train utilizing state-of-the art equipment operating in a low pressure (3.5 psia) underground tunnel is analyzed. The tunnel is smaller (13.75 feet in diameter) than conventional subway tunnels (16 to 18 feet in diameter). The tunnel is deeper (200 to 500 feet) than most subways. The additional depth provides assistance to the propulsion system during acceleration and to the braking system during deceleration. The reduction in tunnel size and cost offsets the additional cost of vacuum pumps of conventional urban systems, while at the same time energy costs are reduced. The system speed is great enough to provide high capacity as a shuttle service utilizing a single tube, which may have application in an airport access link.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-193273

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PB-193273

**039229**

**DYNAMIC ANALYSIS OF MULTIPLE CAR VEHICLES  
USING COMPONENT MODES. VOLUME I. ANALYSIS**

Hasselmann, TK Riead, HD Kaplan, A

TRW Systems Group, Redondo Beach, California

Vol. 1, 06818-6048-RO-00, Final Rpt, July 1970, 271 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems  
Engineering Study.

The report documents the development of a computer program to predict the dynamic characteristics of multiple car trains. The approach, of analysis by subsystems forms the basis of this program. The method of component mode synthesis is then used to obtain an accurate approximate solution with a reduced number of coordinates

and thus reduced computing time. Previously the method of component mode synthesis has been applied to undamped elastic structures. In this report the method is extended to general linear systems, that is, systems which include significant damping and asymmetric matrix coefficients. The modal coordinates to which the original equations of motion are thus transformed are no longer real but complex, and include velocity as well as displacement information. Included is a complete description of the program, a user's guide and a sample program. A limited amount of numerical results have been obtained and these are discussed. These preliminary results show that modal frequency and damping obtained by component mode synthesis after truncating half of the component modes agrees to within a couple of percent of exact solutions which include all of the modes. As expected, the mode shapes did not agree quite as well.

(Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-193545

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#### 039230

#### TRAIN/ELEVATED GUIDEWAY PARAMETRIC INVESTIGATION

Soux, AL

TRW Systems Group, Washington Operations, Washington, D.C.

06818-WO18-RO-00, Final Rpt, July 1970, 133 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems Engineering Study. See also report dated Feb 70, PB-190. 635.

The report contains the results of a parametric investigation of train/elevated guideway interaction to establish the dynamic criticality in the design of simply-supported elevated guideways for multi-vehicle trains traveling at high speeds. The study is based on a digital simulation model developed for this purpose. Results of the study are presented in graphical form. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-194039

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PB-194039

#### 039231

#### DYNAMIC RESPONSE OF CONTINUOUS BEAM ELEVATED GUIDEWAYS. VOLUME I—ANALYSIS

Lipner, N Evensen, DA Kaplan, A

TRW Systems Group, Redondo Beach, California

Vol. 1, 06818-6046-RO-00, Final Rpt, July 1970, 104 pp

Contract DOT-C-353-66

See also Volume 2, PB-194 138.

The report describes a Train-Elevated Guideway Interaction (TEGI-2) program. TEGI-2 considers a two-vehicle train traveling at constant velocity over a series of uniform, simply-supported, continuous span bridges. A technique for considering nonuniform guideway beams is developed and discussed. The equations governing the train and guideway responses are numerically integrated from arbitrary initial conditions. The bridges can have initial camber or roadway roughness conditions. As part of the program formulations, the dynamic response of a semi-infinite uniform and periodically supported beam load by end moments is derived. The program calculates motion parameter, wheel loads, and bending moments in the spans as a

function of time. Maximum values of these quantities are also determined. As options, the program can consider a one-car train or a single spring mass damper system moving across the bridges. A sample case is run with the program developed using the same vehicle parameters as those for the sample case presented in TRW Systems Group Report, 'Train Elevated Guideway Interactions' (PB-190 635) for the simply-supported spans. It is shown that even with a reduced beam cross section, the response is improved. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-194137

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#### 039232

#### DYNAMIC RESPONSE OF CONTINUOUS BEAM ELEVATED GUIDEWAYS. VOLUME II—COMPUTER PROGRAM

Roberts, FB Lipner, N Evensen, DA Kaplan, A

TRW Systems Group, Redondo Beach, California

Vol. 2, 06818-6047-RO-00, Final Rpt, July 1970, 172 pp

Contract DOT-C-353-66

See also Volume 1, PB-194 137.

The report describes a Train-Elevated Guideway Interaction (TEGI-2) program. TEGI-2 considers a two vehicle train traveling at constant velocity over a series of uniform simply supported continuous span bridges. A technique for considering non-uniform guideway beams is developed and discussed. The equations governing the train and guideway responses are numerically integrated from arbitrary initial conditions. The bridges can have initial camber or roadway roughness conditions. As part of the program formulations the dynamic response of a semi-infinite uniform and periodically supported beam load by end moments is derived. The program calculates motion parameters, wheel loads, and bending moments in the spans as a function of time. Maximum values of these quantities are also determined. As options, the program can consider a one car train or a single spring mass damper system moving across the bridges. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-194138

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#### 039234

#### A SURFACE-WAVE TRANSMISSION LINE FOR VEHICULAR COMMUNICATIONS

FitzGerrell, RG Haidle, LL Partch, JE

Institute for Telecommunication Sciences, Boulder, Colorado

Final Rpt, Feb. 1970, 147 pp

A year's study carried out by the ESSA/ITS Guided Wave Technology Group under contract from the OHSGT/DOT indicates that low cost, excellent coupling characteristics, and ability to serve vehicles on two closely spaced guideways make the Goubau surface-wave transmission line an attractive solution to the high-speed ground transportation communications problem. Further testing in a real environment should be undertaken to prove or disprove the encouraging results obtained experimentally with the 918-ft prototype line used in this study. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-194146

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**039236**  
**ELEVATED STRUCTURES—CONTINUOUS BEAMS**

Wang, CH

TRW Systems Group, Washington Operations, Washington, D.C.  
06818-W017-RO-00, Final Rpt, July 1970, 80 pp

Contract C-353-66

Report on High-Speed Ground Transportation Systems  
Engineering Study.

The report addresses the problem of elevated guideway structures employing continuous span beams and spread footing. Various structural materials and components are considered. On the basis of static analysis, practical information about the design requirements was generated. Results are displayed in convenient graphical form for span length up to 160 feet and maximum deflection up to .16 foot. (Author)

**ACKNOWLEDGEMENT**

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**039237**  
**REPEATER STATION FOR A DIELECTRIC WAVEGUIDE COMMUNICATIONS SYSTEM**

Abele, M

General Applied Science Laboratories, Incorporated, Westbury, New York

GENAPPSL-70-743, Final Rpt, May 1970, 41 pp

Contract DOT-FR-9-0016-1

The research program was developed to study a new repeater station concept for a dielectric waveguide communication system. The recommendations and summary of the results are presented. For completeness the principles of operation of the dielectric waveguide communication system are summarized. The concept of the new repeater station and the experimental results are presented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-194373

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**039238**  
**OBSTACLE DETECTION FOR HIGH SPEED GROUND TRANSPORTATION**

Magnus, DE Medeck, H Panunzio, S Sallustio, P

General Applied Science Laboratories, Incorporated, Westbury, New York

GENAPPSL-TR-745, Final Rpt, 6906-7006, June 1970, 121 pp

Contract DOT-FR-0057

Results are presented from the investigation of optical sensors as a means for detecting obstacles on the guideway of a high speed transportation system. Operating characteristics for such sensors were investigated experimentally and analytically. Both approaches are

described in the report. In addition, the kinematics of the optical sensor for scanning the guideway is reviewed. A scanner was designed and demonstrated in the laboratory. The performance of the optical sensor is dependent upon the extent of the ray bending which is caused by the solar heating of the air immediately above the guideway. The effect of ray bending is presented in terms of a relationship between obstacle size and length of the optical path. The sensor is investigated for deployment along a TACV guideway and estimates of cost per mile are included. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-194374

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**039241**  
**HIGH-SPEED GROUND TRANSPORTATION SYSTEMS ENGINEERING STUDY. TRACKED AIR CUSHION VEHICLE SYSTEMS**

TRW Systems Group, Redondo Beach, California

06818-6039-RO-00, Final Rpt, May 1970, 623 pp

Contract DOT-C-353-66

The tracked air cushion vehicle is one of several advanced ground transportation systems being studied by TRW Systems Group for the Department of Transportation as a possible means of providing safe, high-speed, high-capacity transportation along densely populated areas such as the Northeast Corridor. Based on requirements and constraints chosen for an operational system, subsystem alternatives are evaluated and the selected subsystems are synthesized into a TACV system. Cost and performance are estimated over a range of parameters, such as design cruise speed (150 to 350 mph) and vehicle capacity (50 to 150 passengers per vehicle). The configuration defined consists of trainable, electrically powered TACV's which collect power from trackside power rails mounted on the side of a channel guideway. Propulsion is by linear induction motors with variable frequency speed control. Control of the vehicles, singly or in trains, is automated and centralized. The vehicles are supported on and guided by peripheral jet air cushions with high pressure air provided by electrically driven axial flow compressors. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-195030

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**039243**  
**TUBE VEHICLE SYSTEMS**

TRW Systems Group, Redondo Beach, California

06818-6038-RO-00, Final Rpt, May 1970, 759 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems  
Engineering Study.

The tube vehicle class is one of several advanced transportation concepts studied by TRW Systems Group for the Department of Transportation as a possible means of providing safe high speed inter-city transportation along densely populated areas such as the Northeast Corridor. The tube vehicle class consists of those systems requiring a complete enclosure such as a tube or tunnel surrounding the train during operation. The enclosure requirement may come from the need for a reduced pressure or a need for a continuous support for the vehicle suspension. Tunneling to avoid unfavorable terrain or unfavorable community reaction, or to provide all-weather

capability does not classify a transportation concept as a tube vehicle system (TVS) although these attributes are characteristic of the class. The TVS class is able to achieve ultra-high speeds (300 to 450 mph) without enormous power plants or large expenditure of energy. Preliminary subsystem elements are considered in the light of the high speed requirements and the TVS class characteristics. A baseline representative TVS is defined evaluating the design characteristics and relative investment and operating costs for alternate combinations of subsystems. The baseline system consists of electrically propelled, mechanically suspended steel wheels on steel rails and travels through an underground guideway which is at reduced pressure. Design solutions for propulsion, braking and suspension are suggested, and R and D requirements are identified. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-195875

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**039247**

**EXPERIMENTAL INVESTIGATION OF THE NEAR FLOW FIELD FOR TUBE VEHICLES**

Panunzio, S Magnus, DE

General Applied Science Laboratories, Incorporated, Westbury, New York

GASL-TR-70-749, Final Rpt, Nov. 1970, 96 pp

Contract DOT-FR-0039

The experimental results from an investigation of the near flow field for tube-vehicle systems are reported. The data were obtained from a tube-vehicle test facility which is 200 feet long and instrumented to measure vehicle drag, history of static wall pressure and dynamic pressure. Emphasis is on the accurate measurement of the dynamic pressure to determine the flow velocity in front of the vehicle. With this data and drag force, a drag coefficient is defined and related to the relative Mach number and the ratio of relative flow velocity to vehicle velocity. The experimental results are correlated with an analysis of the near flow field and results from other studies. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-198205

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**039257**

**SUSPENDED VEHICLE SYSTEMS (SVS). VOLUME I. SYSTEM DEFINITION**

Pei, RY

TRW Systems Group, Washington Operations, McLean, Virginia

Vol. 1, 06818-W031-RO-00, Final Rpt, June 1971, 168 pp

Contract C-353-66(Neg)

See also Volume 2, PB-202 608.

A first-generation Suspended Vehicle System (SVS), to be synthesized from state-of-the-art components, is described. The configuration is based on a comprehensive selection logic supported by quantitative analyses. A 125-mph state-of-the-art SVS appears to be entirely feasible, and higher speeds seem readily attainable with slightly more advanced subsystems whose development requirements do not appear excessive. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202607

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**039258**

**SUSPENDED VEHICLE SYSTEMS (SVS). VOLUME II. SUPPORTING ANALYSES**

Pei, RY

TRW Systems Group, Washington Operations, McLean, Virginia

Vol. 2, 06818-W031-RO-00, Final Rpt, June 1971, 182 pp

Contract C-353-66(Neg)

See also Volume 1, PB-202 607.

The volume contains the following appendices: An evaluation of the pneumatic tire for application to suspended vehicle systems (SVS); Acousta-flex wheel; Roll dynamics; Vehicle-guideway interaction dynamics; Structural design tradeoffs; Electromagnetic suspension for suspended vehicle system; Air suction and air cushion suspension. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202608

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**039268**

**COUPLED DYNAMIC INTERACTIONS BETWEEN HIGH SPEED GROUND TRANSPORT VEHICLES AND DISCRETELY SUPPORTED GUIDEWAYS**

Chiu, WS Wormley, DN Smith, RG Richardson, HH

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts, 02139

DSR-76115-1, Final Rpt, July 1970, 130 pp

Contract DOT-C-85-65

The coupled dynamic interactions between high speed ground transport vehicles and discretely supported guideways is investigated using modal analysis techniques to determine the performance of vehicles traversing spans with distributed mass, flexibility and damping and which rest on rigid discrete supports. Results indicate that for typical advanced transportation systems span dynamic deflections at vehicle speeds of 100-300 mph may approach values which are twice the span static deflection due to the vehicle weight and that vehicle heave accelerations may substantially exceed the desired 0.05 g level unless very strong constraints are placed upon system parameters. Parametric design charts are presented which provide an initial basis for the selection of vehicle and guideway system parameters to meet a given specified limit on vehicle heave acceleration. A number of numerical design examples are described to illustrate the use of the design charts and to indicate specifically the influence of vehicle weight, and suspension damping and stiffness, and guideway span configuration and length upon span deflection per unit length, mass, and stress. Limited data are also presented for the multiple vehicle passage case. (Author)

**ACKNOWLEDGEMENT**

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039271

**ATTRACTION/REPULSION FORCES IN A SINGLE-SIDED LINEAR INDUCTION MOTOR**

Dukowicz, JK

Mitre Corporation, McLean, Virginia

WP-7519, Final Rpt, Mar. 1971, 33 pp

Contract OHSGT-7-35248

Calculations of the normal force-to-thrust force ratio are made for some simple one-dimensional LIM secondary models, (i.e., effects of finite geometry are not considered). The principal result is the determination of the cross-over when the normal force changes from being attractive to being repulsive. At this point, one-sided LIMs begin aiding the guidance/support system instead of opposing it. The results indicate that for a single-sided LIM similar to the TACRV/ADLIM, the normal force is repulsive for almost the entire operating range. This is less true for a low-speed LIM. (DOT abstract)

**ACKNOWLEDGEMENT**

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039276

**4 GHZ DIELECTRIC WAVEGUIDE COMMUNICATION LINE**

Abele, M Medeck, H

General Applied Science Laboratories, Incorporated, Westbury, New York

GASL-TR-762, Final Rpt, 7102-7111, Nov. 1971

59 pp

Contract DOT-FR-10030

The report presents the study of a 4 GHz dielectric waveguide communication line. Section 2 of the report presents the conclusions and the recommendations for an operational system. Sections 3 and 4 present the details of the technical work. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208474

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039278

**TRACKED AIR CUSHION RESEARCH VEHICLE. VEHICLE PERFORMANCE**

Savatteri, C Helgesen, J

Grumman Aerospace Corporation, Bethpage, New York

PMT-B4-R71-02, Mar. 1971

38 pp

Contract DOT-FR-00005

The performance of the TACRV in terms of speed, acceleration and deceleration is discussed in this report and the range of cushion operating gaps is summarized. There performance items are presented for the vehicle operating at the Department of Transportation High Speed Ground Test Center at Pueblo, Colorado (5000 ft altitude). (Author)

**ACKNOWLEDGEMENT**

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039282

**AIR CUSHION SUPPORT FOR EVACUATED TUBE SYSTEM VEHICLES**

Fraize, WE

Mitre Corporation, McLean, Virginia

FRA-RT-72-21, Tech Rpt, Sept. 1971, 22 pp

Contract C-7-35248

The practicality of a plenum-type air cushion suspension for evacuated tube system (TVS) vehicles is examined from the standpoint of ideal air cushion/vehicle characteristics (power, mass flow, self-support velocity, cushion temperature), the compressor design, and the compressor efficiency under low pressure operating conditions. For a representative 100,000 lb TVS vehicle, an air cushion suspension is shown to be practical from all standpoints, providing tube pressure is no less than .015 atm, and the cushion gap is of the order of .01 ft. The method of analysis is presented graphically in a manner readily permitting analysis of other TVS configurations. (Author)

**ACKNOWLEDGEMENT**

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039283

**DYNAMIC INTERACTIONS BETWEEN MOVING LOADS AND THEIR SUPPORT STRUCTURES, WITH APPLICATIONS TO AIR CUSHION VEHICLE-GUIDEWAY DESIGN**

Wilson, JF

Duke University, Department of Civil Engineering, Durham, North Carolina

FRA-RT-72-27, Final Rpt, 7006-7110, Nov. 1971, 207 pp

Contract DOT-FR-0-0037

Several realistic models of vehicle-guideway systems are formulated and evaluated. Emphasis is on the dynamic responses (deflections and bending moments) of guideways designed for air cushion vehicles with speeds up to 300 mph. Design optimization for passenger comfort is discussed. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205325

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039284

**SUMMARY OF RESEARCH AT MIT ON TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT**

Seifert, WW

Massachusetts Institute of Technology, Cambridge, Massachusetts

FRA-RT-72-18, Summ Rpt, 6909-7010, May 1971, 80 pp

Contract DOT-C-85-65

See also Progress rept. dated 31 Aug 70, PB-198 015.

The work includes: Vehicle suspension systems, vehicles and tube aerodynamics, rock fracture and mechanics, settlement and leave analysis, and automated guideways. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202809

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**039285**

**AN EXPERIMENTAL STUDY OF A FLAT-BOTTOMED SEMI-CIRCULAR WING IN VERY CLOSE PROXIMITY TO THE GROUND**

Pepin, JN Widnall, SE Barrows, TM

Massachusetts Institute of Technology, Fluid Dynamics Research Laboratory, Cambridge, Massachusetts

FRA-RT-72-73, Final Rpt, Sept. 1971, 27 pp

Contract DOT-C-85-65

An experimental investigation of a semicircular wing flying very close to a solid boundary is performed to verify recent analytical results. Comparison is made between first order theory and data through plots of lift coefficient versus angle of attack for various clearances. Reasonable agreement is obtained for these cases within the limitations of the theory. Lift/drag ratio plots are also presented which show the potential of such a technique for support vehicles. A brief outline of the theoretical development is also included to give some insight into the type of analysis which was used.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-203602

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**039290**

**DYNAMIC RESPONSE TESTS OF AN AIR CUSHION SUSPENSION SYSTEM FOR THE LINEAR INDUCTION MOTOR (LIM) OF THE TRACKED AIR CUSHION RESEARCH VEHICLE(TACRV)**

Meisenholder, SG Graham, HR Birchill, J

TRW Systems Group, Redondo Beach, California

17617-6003-RO-00, Final Rpt, July 1971

293 pp

Contract DOT-FR-00044

The report presents the results of a test program to determine the dynamic response characteristics of an air cushion suspension system. The air cushion and secondary suspension are designed for the support and guidance of the linear induction motor (LIM) on the 300 mph Tracked Air Cushion Research Vehicle (TACRV). The tests simulate the motion of the suspension system on the TACRV moving over a guideway with sinusoidal surface irregularities. The test variables included oscillatory excitation amplitude, air supply system admittance, air cushion skirt configuration and reaction rail flexibility. Test results are compared to theoretical response predictions for both the LIM support and guidance systems. (Author)

**ACKNOWLEDGEMENT**

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**039291**

**SYNCHRONOUS LONGITUDINAL GUIDANCE (SLG) ALLOCATION ALGORITHM EFFECTIVENESS STUDY**

Kan, IF Lukas, MP Arquette, LK Boyd, RK

TRW Systems Group, Washington Operations, McLean, Virginia

06818-W033-RO-00, Final Rpt, June 1971

76 pp

Contract DOT-C-353-66

A previously developed algorithm for allocating guideway space in a deterministic automated transportation network has already been verified as being a useful traffic management technique. This report investigates the algorithm's effectiveness under a variety of network operating policies and demand conditions. The report develops a methodology for the evaluation of algorithm effectiveness, evaluates the algorithm's effectiveness in representative transportation network traffic conditions which may degrade effectiveness. Algorithm operation, as determined by computer simulation, is defined to be effective if it produces traffic patterns which match those obtained using linear programming optimization techniques. It was concluded that the algorithm is a useful, flexible and effective tool in controlling traffic patterns in a deterministic transportation system. (Author)

**ACKNOWLEDGEMENT**

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**039292**

**AUTOMATED GUIDEWAY TRANSPORTATION BETWEEN AND WITHIN CITIES**

Wilson, DG

Massachusetts Institute of Technology, Urban Systems Laboratory, Cambridge, Massachusetts

FRA-RT-72-14, Final Rpt, Feb. 1971, 251 pp

Contract DOT-C-85-65

The general characteristics and specifications of automated guideway transportation, defined as systems in which individual vehicles travel at close spacings under full lateral and longitudinal control, and in which all stations off line, have been studied. The areas examined include travel demands; costs; performance requirements; guideway spacing; dual-mode use; safety; reliability and emergency procedures; control and communications systems; information organization and transfer; network and terminal design; and guideway structures. The potential of guideways for providing inter-city movement, predominantly of miscellaneous freight, considered.

**ACKNOWLEDGEMENT**

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PB-206269

**039293**

**UNSTEADY FLOW IN TUBES AND TUNNELS**

Brown, FT Knebel, G Margolis, D

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

DSR-76107-4, Final Rpt, Aug. 1971

327 pp

Contract DOT-C-85-65



A theory is presented for the attenuation and dispersion of small sinusoidal waves superimposed on gross turbulent flow in cylindrical tubes. Three frequency bands are distinguished: a low-frequency band in which a constant-inertance-resistance-compliance model applies, a high-frequency band in which a time-invariant-eddy-viscosity model applies, and an intermediate transition band for which no complete theory is given. Experiment corroborates the theory, and reveals dramatic resonances in the transition band associated with nonequilibrium turbulence. A quasi method of characteristics is presented in general and in detail for the case of fluid transients with history-dependent properties such as occur at intermediate and high frequencies. Historic weighting functions are the key to the method, and are found for laminar flow and several different turbulent flows. Results are extended to include the effects of heat transfer in a perfect gas contained by isothermal walls.

## ACKNOWLEDGEMENT

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039296

**TRACKED AIR CUSHION RESEARCH VEHICLE  
VEHICLE/GUIDEWAY DYNAMIC ANALYSIS**

Pulgrano, L

Grumman Aerospace Corporation, Bethpage, New York

PMT-B4-R71-07, Design Rpt, Mar. 1971

247 pp

Contract DOT-FR-00005

A primary test objective of the TACRV research program is the evaluation of dynamic performance. A basic measure of dynamic performance is ride quality, which can be defined in terms of acceleration on the body of the vehicle. The major objectives of the vehicle/guideway dynamic analyses were to provide information needed for the vehicle suspension and guideway design, to provide assurance of stable dynamic characteristics up to maximum speed, and to estimate ride quality. (Author)

## ACKNOWLEDGEMENT

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039298

**THE SINGLE-SIDED LIM WITH SATURATED BACK IRON**

Dukowicz, JK

Mitre Corporation, McLean, Virginia

MTR-6094, Final Rpt, Jan. 1972

62 pp

Contract DOT-FR-7-35248

For reasons of economy, the single-sided Linear Induction Motor should be designed to operate with saturated reaction rail back iron. The report discusses the effects on back iron saturation on the performance of the motor, and formulates a technique for determining the minimum thickness of iron required. As a specific example, the TACRV motor is analyzed in detail. It is found that a laminated iron backing of only 3/4 inch thickness is required. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, PB-207327

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039302

**SINGLE-SIDED LINEAR INDUCTION MOTOR (SLIM); A  
STUDY OF THRUST AND LATERAL FORCES**

Lipkis, RS Wang, TC

TRW Systems Group, Washington Operations, McLean, Virginia

06818-W032-RO-00, Final Rpt, June 1971

127 pp

Contract DOT-C-353-66

The report represents a steady-state linear analysis of single-sided linear induction motors. Electromagnetic field equations are used to describe the magnetic field distribution across the air gap and inside the reaction rail, from which the induced current density and force vectors are determined. The tangential component of the magnetic field and the secondary current result in a body force perpendicular to the stator surface. Analytical expressions for this lateral force and the thrust parallel to the stator surface are derived. Special attention is given to the magnitude of the lateral force under various design conditions. It appears that a SLIM can be used for both the propulsion and the levitation of a high-speed vehicle for ground transportation. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, PB-205029

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PB-205029

039372

**DESIGN OF A GENERIC CONTROL SYSTEM FOR  
DETERMINISTICALLY CONTROLLED GROUND  
TRANSPORTATION SYSTEMS. VOLUME III.  
APPENDIXES**

TRW Systems Group, Washington Operations, McLean, Virginia

Vol. 3, 06818-W043-RO-00, Final Rpt, 7009-7202, Feb. 1972,  
379 pp

Contract DOT-C-353-66

See also Volume 2, PB-210869.

A preliminary design of a controls system applicable to a wide range of automated ground transportation systems is specified and discussed. The design covers the functions of safety assurance, navigation, space allocation and communications. A four-level hierarchy control system is described which includes hardware and software for the network control center, local controllers, a distributed control and communications line for guideway installation, and vehicle control equipment. The three volume report discusses in detail the rationales involved in the major tradeoff decisions. Application notes are furnished. Discussions of reliability, maintainability and availability appear as well as those relating to the relative safety and capacity of a deterministically controlled system. Theoretical analyses relating to the vehicle-to-ground communication link are furnished; also the results of laboratory experimentation for the link are summarized. A description of basic Synchronous Longitudinal Guidance (SLG) techniques is provided.

## ACKNOWLEDGEMENT

National Technical Information Service, PB-211206

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PB-211206

039386

**THE TRACKED AIR CUSHION RESEARCH VEHICLE (TACRV)**

Mitre Corporation, Bedford, Massachusetts

Sum Rpt, May 1972, 212 pp

Contract C-7-35248

See also report dated March 1971, PB-209511.

The Department of Transportation's (DOT) Tracked Air Cushion Research Vehicle (TACRV) System is described using descriptive material and data provided by the design contractors and the Federal Railroad Administration, Office of Research, Development, and Demonstrations. The TACRV is an experimental vehicle that will carry out research pertinent to evaluating the technical feasibility of the tracked air cushion vehicle (TACV) concept for commercial high-speed ground transportation. The report includes background information, detailed design descriptions, and vehicle performance estimates. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211216

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PB-211216

039830

**CONTROL CONSIDERATIONS FOR SHORT-HEADWAY ACGV SYSTEMS**

Hinman, EJ    McDowell, RB    Makofski, RA

Johns Hopkins University, Applied Physics Laboratory, Silver Spring, Maryland    UMTA-TRD-73

APL/JHU-TPR-018, Final Rpt, Oct. 1971, 321 pp

Contract DOT-UT-109

Command and control systems for automatically controlled and guided vehicle (ACGV) systems were investigated with emphasis on systems for short (up to 30 seconds) headway operation. Ten proposed systems which employ either conventional block control techniques or one or more large digital processors were evaluated. The conventional block approach and the central computer approach were both used in the study. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205013

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PB-205013

039834

**TUBE VEHICLE SYSTEMS: AERODYNAMIC CHARACTERISTICS**

Gouse, SWJ    Wali, EI

Carnegie-Mellon University, Transportation Research Institute, Pittsburgh, Pennsylvania

Final Rpt, Oct. 1971, 157 pp

Contract DOT-UT-237,

The study presents the results of an investigation of the dependence of the drag forces exerted on vehicles having the shape of a cylinder with streamlined nose and conical tail, moving coaxially with uniform linear relatively low velocity in solid wall tubes of finite length, on the velocity of approach ratio, defined as the ratio of the relative velocity of the induced fluid pushed ahead of the vehicle to the absolute velocity of the vehicle. A theoretical analysis was carried

out by dividing the fluid flow about the vehicle into two regions; i.e., near and far flow regions. The flow regions were matched together by the condition that the pressures are continuous at the boundaries. An experimental investigation was conducted employing a vertical acrylic test tube, 25 feet high and 1.732 inch inside diameter. The tube was provided with water flow of different negative and positive pressure gradients. Vehicle drop tests were then conducted.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204933

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PB-204933

039839

**OPEN TUBE GUIDEWAY FOR HIGH SPEED AIR CUSHIONED VEHICLES**

Goering, RS

National Aeronautics and Space Administration, Langley Research Center, Langley Station, Virginia    NASA-CASE-LAR10256-1

N220785, Patent App, Jan. 1972, 7 pp

The invention is comprised of a tubular guideway structure having open sides located on opposite sides of the structure, which function as a travel medium for high speed air-cushioned vehicles. The open sides of the tubular structure permit air to escape, thereby precluding a piston effect, and simultaneously provides for passenger viewing of the environment. Louvers may selectively be closed to protect the internal tubular structure from inclement weather conditions.

**ACKNOWLEDGEMENT**

National Technical Information Service, N72-2053

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N72-2053

039843

**COMMENTS ON WAVE COMPRESSIBILITY AND STATIC COMPRESSIBILITY ON SUBWAY VEHICLE PERFORMANCE**

California Institute of Technology, Graduate Aeronautical Laboratories, Pasadena, California    DOT-D.C. MTD-7

Intrm Rpt, Mar. 1971, 43 pp

Contract DOT-UT-290

The effects of wave compressibility and static compressibility as they relate to subway vehicle performance are examined. An idealized environment was assumed in which a one dimensional piston moved without friction or leakage through an infinite tube. The equations developed to measure aerodynamic drag are outlined in detail. The total unsteady drag exerted upon a dynamic vehicle was found to include both near field (wave drag) and far field (shock drag) effects. Wave drag effects on a vehicle accelerating in a confined space filled with compressible inviscid fluid were examined. This analysis revealed that shock drag contributed substantially to total drag effects during deceleration (as much as 30%), but that it was of a much lesser importance during acceleration.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205876

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PB-205876

**039846**  
**TECHNICAL FEASIBILITY OF MAGNETIC LEVITATION AS A SUSPENSION SYSTEM FOR HIGH-SPEED GROUND TRANSPORTATION VEHICLES**

Davis, LC Reitz, JR Wilkie, DF Borcherts, RH

Ford Motor Company, Scientific Research Staff, Dearborn, Michigan

Final Rpt, Feb. 1972, 132 pp

Contract DOT-FR-10026

The report examines the technical feasibility of magnetic levitation as a suspension system for high-speed ground transportation vehicles in the 300 mph cruise speed range. Of the various magnetic suspensions which have been proposed one appears to provide all the desired features of good ride quality, moderate guideway tolerance, basic stability, and moderate drag forces. This is high clearance (about 10 inch vehicle-track clearance) suspension using superconducting magnets in the vehicle and a conducting, nonmagnetic, continuous guideway. If a high tolerance track can be successfully laid and maintained, then a low clearance suspension using magnetic attraction forces such as being developed in Germany becomes a strong contender. Analyses of ride quality show the importance of a high clearance suspension in smoothing track irregularities without allowing the vehicle to come into contact with the Track. Methods for increasing passive damping are explored, and a preliminary design for a vehicle magnet using a superconducting coil is given.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210506

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**039847**  
**THE FEASIBILITY OF MAGNETICALLY LEVITATING HIGH SPEED GROUND VEHICLES**

Coffey, HT Chilton, F Hoppie, LO

Stanford Research Institute, Menlo Park, California

SRI-R-1080, Final Rpt, Feb. 1972, 230 pp

Contract DOT-FR-10001

To determine technical feasibility of magnetically levitated and guided highspeed ground transportation vehicles theoretical analyses of four suspension systems were conducted: permanent magnet, electromagnet-ferromagnetic guideway, superconducting magnet, conducting coil guideway, superconducting magnet, conducting sheet guideway. All four were found to be feasible with the last preferred. A magnet-guideway interaction theory was formulated for it based on a Fourier transform calculation of fields from rectangular magnets, assuming the guideway conducting sheets to be infinite. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210505

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**039858**  
**PRELIMINARY STEADY-STATE SUBWAY AERODYNAMIC ANALYSIS (INCOMPRESSIBLE)**

California Institute of Technology, Graduate Aeronautical Laboratories, Pasadena, California DOT-D.C. MTD-7

Tech Rpt, May 1971, 132 pp

Contract DOT-UT-290

The report contains the formulation of several analytical models assuming incompressible flow which can be used for developing an understanding of the aerodynamic characteristics of various tube-vehicle systems. These analytical models are used to guide the experimental program, reduce, and analyze the data. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205877

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**039866**  
**LINEAR INDUCTION MOTOR RESEARCH. VOLUME I. INTRODUCTION AND BACKGROUND**

Dannan, J D'Sena, GO

AiResearch Manufacturing Company, Torrance, California

Vol. 1, 71-7094-Vol-1, Final Rpt, 6706-7103, Oct. 1971, 33 pp

Contract OHSGT-7-35399

A 2500-hp linear induction motor (LIM), a complete test vehicle, a propulsion control system, test instrumentation, and an on-board auxiliary power supply have been designed, fabricated, and checked out. The system was designed to operate at test speeds up to 250 mph on a standard-gauge railroad track bed fitted with an aluminum reaction rail (secondary member), at the Office of High Speed Ground Transportation Test Center, Pueblo, Colorado. Design criteria and supporting data for configuring the system are presented. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212041

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**039867**  
**TRACKED AIR CUSHION RESEARCH VEHICLE SUBSYSTEM DEVELOPMENT TEST REPORT AERODYNAMIC**

Helgesen, J

Grumman Aerospace Corporation, Bethpage, New York

PMT-B4-R71-12, Mar. 1971, 66 pp

Contract DOT-FR-00005

A 1/10 scale model of the Grumman Tracked Air Cushion Research Vehicle (TACRV) was tested in the Grumman Low Speed Wind Tunnel for purposes of obtaining aerodynamic force and moment data on the total vehicle and individually on the body and chassis, and to obtain additional insight into the flow simulation requirements for high-speed tracked air cushion vehicles. This report presents the results of the tests. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212042

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 PB-212042

**039868**  
**TRACKED AIR CUSHION RESEARCH VEHICLE AERODYNAMIC ANALYSIS**

Pierson, J Helgesen, J

Grumman Aerospace Corporation, Bethpage, New York

PMT-B4-R71-06, Mar. 1971, 77 pp

Contract DOT-FR-00005

Basic aerodynamic coefficients for the Tracked Air Cushion Research Vehicle (TACRV) are developed by analysis of data obtained during wind tunnel tests of a 1/10 scale model. Vehicle lift and drag are found to be primarily a function of the dynamic pressure to average cushion pressure ratio. Vehicle lift is 8370 lb at 300 mph (11,900 lb in a 60 mph crosswind at that speed), well below the vehicle cushion supported weight of 51,950 lb. Vehicle drag is 7920 lb at 300 mph; drag levels can be reduced 10-15 percent with an aft streamline tail fairing. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-212051

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039879

#### MODERN CONTROL ASPECTS OF AUTOMATICALLY STEERED VEHICLES

Pasternack, S

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-OST-72-3, Tech Note, Dec. 1971, 19 pp

In the study of automatically steered rubber tired vehicles, little emphasis in the past has been placed on the steering control laws. The report examines the control law problem from the state variable point of view and it is shown that, except for possibly one velocity, the system is both controllable and observable allowing arbitrary system dynamics. It is also shown how optimal control theory may be used to select the feedback gains in order to minimize a cost function containing the square of the vehicle lateral acceleration. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211955

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039880

#### AUTOMATED GUIDEWAY NETWORK TRAFFIC MODELING

Toye, CR

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-OST-72-7, Tech Note, Feb. 1972, 29 pp

In the literature concerning automated guideway transportation systems, such as dual mode, a great deal of effort has been expended on the use of deterministic reservation schemes and the problem of merging streams of vehicles. However, little attention has been focused on the problem of developing models to determine space allocation on the guideway as a function of the user service level required for satisfactory operation of the system. The problem must be addressed in the early design phase of any automotive guideway system and is pertinent to site selection. The paper develops probability models and uses statistical variance analysis techniques to develop procedures which can be used to determine the required guideway space necessary to satisfy a user service level for a particular demand rate. It provides the building blocks upon which various network traffic management strategies can be developed. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211956

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039881

#### ALTERNATIVE DUAL MODE NETWORK CONTROL STRATEGIES

Kangas, RD

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-OST-72-10, Tech Note, Mar. 1972, 29 pp

From a literature survey a qualitative evaluation was made of four network control strategies for the fundamental control philosophy of the moving synchronous slot. In the literature concerning automated transportation systems, such as dual mode, a great deal of effort has been expended in discussing the pros and sometimes the cons of a specific control concept without reviewing other control strategies that may be available. The paper summarizes the major advantages and disadvantages associated with four control strategies for the moving synchronous slot. A description of each of these control strategies is provided and conclusions are made showing that the deterministic slot/cycle concept and the quasi-synchronous slot concept with entrance station throughput modulated by historic demand data are the most promising. Additional investigations of these two concepts showed that a further study of alternative network control strategies is needed, oriented towards addressing the issues of network capacity, interchange design, passenger convenience and system failure and recovery. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211957

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039882

#### THE TRACKED AIR CUSHION RESEARCH VEHICLE (TACRV) SYSTEM

Mitre Corporation, McLean, Virginia

Sumry Rpt, May 1972, 207 pp

Contract DOT-FR-7-35248

The Department of Transportation's (DOT) Tracked Air Cushion Research Vehicle (TACRV) System is described using descriptive material and data provided by the design contractors and the Federal Railroad Administration, Office of Research, Development, and Demonstrations. The TACRV is an experimental vehicle that will carry out research pertinent to evaluating the technical feasibility of the tracked air cushion vehicle (TACV) concept for commercial high-speed ground transportation. The report includes background information, detailed design descriptions, and vehicle performance estimates. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211992

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040614

#### INTEGRATED SYSTEMS FOR MAGNETIC SUSPENSION AND PROPULSION OF VEHICLES

Danby, G Powell, J

Brookhaven National Laboratory, Upton, New York

CONF-720513-7, 1971, 6 pp

From Applied Superconductivity Meeting- Annapolis, Md. (1 May 1972).

For abstract, see NSA 26 18, number 45071.

**ACKNOWLEDGEMENT**

National Technical Information Service, BNL-1609

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**040619**

**DYNAMIC ANALYSIS OF AN ELECTROMAGNETIC SUSPENSION SYSTEM FOR A SUSPENDED VEHICLE SYSTEM**

Meisenholder, SG Wang, TC

TRW Systems Group, Redondo Beach, California

06818-6052-RO-00, Final Rpt, Jan. 1972, 109 pp

Contract DOT-C-353-66

The report presents the results of a theoretical study which was conducted to determine the feasibility of an electromagnetic (EM) suspension system for a conceptual 200 mph high speed ground transportation vehicle which is suspended from an overhead guideway. The EM suspension provides levitation for the vehicle by use of the magnetic attraction forces between vehicle borne electromagnets and a ferromagnetic plate on the guideway. These electromagnets must be provided with a feedback control system which senses the air gap between the magnet and guideway and regulates the current in the field coil of the electromagnet. A dynamic analysis is presented which results in the synthesis of a linear control system, thus providing the desired stability and dynamic response characteristics of the EM suspension. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211592

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**041634**

**RAPID TRANSIT VEHICLES FOR CITY SERVICES**

Institution of Mechanical Engineers Proceedings (Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1, England)

Vol. 184, Proceeding, 1971, 180 pp

This report consists of the proceedings of the Symposium on Rapid Transit Vehicles for City Services, arranged by the Automobile Division of the Institution of Mechanical Engineers, London, England, April 22-23, 1971.

Thirteen papers were presented at the conference which covered design of rolling stock, gas turbine-electric cars, computer control of vehicles, guided buses and moving pavements. Following is a list of titles and authors: Rail vehicles for urban and underground service, by W.G. Jowett, Automatic fare collection on buses in London Transport, by S. Haines, The automatic digital computer control of vehicles in rapid transit systems for urban transportation, by J.H. Anderson, E.T. Powner and N. Bergman, Future developments in personal transit, by H.R. Ross, Guided buses on segregated ways by A.J.M. Hitchcock and H.B. Sedgfield, A single-deck bus for future urban transport, by A. Fogg; Gas turbine/Electric cars in commuter service, by W.J. Ronan, High-speed moving pavements—some of the human problems, by D.L. Turner, Light rail vehicles for the Gothenburg transit system, by J. Mansson, Design of railway rolling stock for heavy urban service, by S.A. Driver, Double-deck buses, by G.G. Harding, Automatic fare collection for railways, by J. Kent, The new

VOEV (Public Transport Authority) Model O 305 standard service bus, by W. Hornung.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 072070

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**041666**

**BRITAIN KILLS OFF THE HOVERTRAIN**

International Railway Journal (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 13, No. 3, Mar. 1973

Britain's Hovertrain project has been killed—after more than five year's research costing 5.25 million English pounds. Britain's Minister for Aerospace and Shipping said the project was being terminated "because we cannot see a use for it in Britain." It was not, that the project had failed technically. But it would have cost about 20 million English pounds to take the project to the stage of developing a passenger-carrying prototype capable of a speed of more than 30 km/h. A factor in the decision was the calculations for the proposed high-speed rail link between London and the planned third London airport, at Maplin. A hovertrain travelling at 210 mph (338 km/h) would show only a five-minute advantage over BR's advanced passenger train (APT) travelling at 150 mph (241 km/h), said Hestline. In any case, it was unlikely that the hovertrain could be ready for full-scale service by 1980, as the APT was expected to be. And with an anticipated track cost of about 1,000,000 English pounds a mile, it was impossible to anticipate an alternative track for the hovertrain being acceptable for any route in Britain in the foreseeable future.

**ACKNOWLEDGEMENT**

International Railway Journal

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**041776**

**RAPID TRANSIT SYSTEM 1985 212 SCHNELLBAHNEN 1985**

Umwelt (VDI Verlag GmbH, Postfach 1139, Graf Recke Strasse 84, 4 Dusseldorf 1, West Germany)

Vol. 1, No. 1, 1971, pp 35-37

A traffic study titled Street Traffic 1985 comes to the conclusion that more public transportation systems are necessary to reduce the number of passenger cars on the streets. Several such rapid transit systems are in the planning stage in various countries, e.g., the Aero-train in France and the Hovertrain in Great Britain. In West Germany, efforts are under way to abolish long-distance transportation of material by trucks. Rail-bound vehicles traveling at high speed but producing no noise or waste gas will be used instead. To some extent such rail-bound trains are also being developed for passenger transport. The transrapid system is designated to carry passengers at a speed of 500 to 600 km/h. The trains will run on rails resting on a structure rising 6 m from the ground. No final decision has yet been made as to the drive of the train. Three methods are under consideration: the magnetic suspension, air cushion and linear motor, or air cushions and jet engines. It is expected that development will take 7 years. The train itself will be 45 m long and will have a total weight of 70 mp. It will seat 150 to 220 passengers.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 29140

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**041867**  
**TRACKED AIR CUSHION RESEARCH VEHICLE**  
**SUBSYSTEMS ANALYSIS**

Schlosser, A

Grumman Aerospace Corporation, Bethpage, New York  
 PMT-B4-R71-08, Mar. 1971, 213 pp

Contract DOT-FR-00005

The TACRV is composed of a body containing the cabin, equipment compartment and air supply engines, and a chassis which has ducts to distribute the air to the cushions. The vehicle has secondary suspensions between the body and chassis, and between the chassis and air cushions. Two propulsion modes are available, the Linear Induction Motor (LIM) Propulsion System and the Aeropropulsion System. This report describes the selection, sizing and installation of the air supply system air cushions, secondary suspension, braking system, environmental control system and electric, hydraulic, and pneumatic power systems. The LIM, and TACRV electric propulsion thruster currently being developed under a separate DOT contract, is described along with its performance and salient features. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212470

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**041868**  
**TRACKED AIR CUSHION RESEARCH VEHICLE**  
**AERODYNAMIC ANALYSIS**

Pierson, J Helgesen, J

Grumman Aerospace Corporation, Bethpage, New York  
 PMT-B4-R71-06, Mar. 1971, 76 pp

Contract DOT-FR-00005

Basic aerodynamic coefficients for the Tracked Air Cushion Research Vehicle (TACRV) are developed by analysis of data obtained during wind tunnel tests of a 1/10 scale model. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212469

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**041869**  
**TRACKED AIR CUSHION RESEARCH VEHICLE**  
**SUBSYSTEM DEVELOPMENT TEST REPORT,**  
**AERODYNAMIC**

Helgesen, J

Grumman Aerospace Corporation, Bethpage, New York  
 PMT-B4-R71-12, Mar. 1971, 62 pp

Contract DOT-FR-00005

A 1/10 scale model of the Grumman Tracked Air Cushion Research Vehicle (TACRV) was tested in the Grumman Low Speed Wind Tunnel for purposes of obtaining aerodynamic force and moment data on the total vehicle and individually on the body and chassis, and to obtain additional insight into the flow simulation requirements for high-speed tracked air cushion vehicles. This report presents the results of the tests. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212468

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**041871**  
**CHARACTERISTICS OF A LINEAR REGULATION**  
**CONTROL LAW FOR VEHICLES IN AN AUTOMATIC**  
**TRANSIT SYSTEM**

Brown, SJJ

Johns Hopkins University, Applied Physics Laboratory, Silver Spring, Maryland TRD-73

APL/JHU-CP009/TPR020, Final Rpt, Jan. 1972, 91 pp

Contract DOT-UT-109

Automatic speed and headway regulation of closely spaced vehicles by use of a linear single-car-follower control law is examined. Performance criteria are identified and formulated as algebraic relations for controller gains applied to both the vehicle's tachometer feedback and to inputs representing the relative velocity and the spacing variation between vehicles. A parameter using the ratio of stopping distance of a vehicle under control to the emergency stopping distance is discussed. It is shown that design criteria are dependent on knowledge of the vehicle loading and the velocity of headwinds encountered during operation.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212502

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**041874**  
**NONLINEAR AND FINITE PAD LENGTH PERFORMANCE**  
**OF VEHICLE AIR CUSHION SUSPENSIONS**

Wormley, DN Garg, DP Boghani, AB

Massachusetts Institute of Technology, Engineering Projects Laboratory, Cambridge, Massachusetts

EPL-72-72966-1, Final Rpt, Feb. 1972, 130p

Contract DOT-FR-10007

Nonlinear and small perturbation linear models for the one-dimensional heave motion of a basic flexible-skirted air cushion suspension are formulated. A study of linear and nonlinear model characteristics under transient guideway and external force inputs is conducted to determine over what range of cushion configurations, operating conditions and input disturbance levels a linear model provides a good approximation to the nonlinear cushion model. The performance of a finite pad length suspension on a guideway containing random irregularities is determined. To illustrate the design information resulting from the transient performance and finite pad length study, the prototype designs of suspensions for intraurban and intercity vehicles are discussed.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212705

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**043235**  
**TRANSPORTATION SYSTEMS ON CURBSIDE SERVICE**  
**SUBWAYS**

Swet, CJ

Applied Physics Laboratory, Johns Hopkins University, Silver

Spring, Maryland

APL/JHU-CP-002, Mar. 1971, 25 pp

On-call subways offer excellent urban transit service at low hourly route demands, but they cannot handle peak loads in large cities within the usually assumed constraints on headway and station investment cost. A concept is presented that circumvents these constraints by innovative design of a cable driven vehicle network, thereby making on-call subway systems competitive with scheduled trains for all classes of urban and suburban service. Such systems can comfortably transport 10,000 passengers per hour per line with attractively low trip times and station investment costs no higher than those of much lower capacity conventional systems.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212922

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**043237**

**CHARACTERISTICS OF A LINEAR REGULATION CONTROL LAW FOR VEHICLES IN AN AUTOMATIC TRANSIT SYSTEM**

Brown, SJJ

Applied Physics Laboratory, Johns Hopkins University, Silver Spring, Maryland UMTA-TRD-103

APL/JHU-CP/TPR-020, Jan. 1972, 95 pp

Transportation Program Report.

Automatic speed and headway regulation of closely spaced vehicles by use of a linear single-car-follower control law is examined. Performance criteria are identified and formulated as algebraic relations for controller gains applied to both the vehicle's tachometer feedback and to inputs representing the relative velocity and the spacing variation between vehicles. A technique is provided for selecting a headway maintenance policy by choosing a parameter defined as the ratio of the stopping distance of a vehicle under control of the regulation system to the emergency stopping distance. Gains that meet the design criteria are dependent on vehicle loading and the velocity of headwinds encountered.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212995 /

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PB-212995 /

**043241**

**COMMUNICATIONS FOR HIGH SPEED GROUND TRANSPORTATION**

Chin, G Eaves, R Frenkel, L Kodis, R

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-FRA-71-8, Tech Rpt, Nov. 1971, 69 pp

The report is an account of investigations and analyses undertaken for the OHSGT, beginning in July of 1970, which relate to communications systems for high speed ground vehicles. The authorized scope of the effort was at the rate of one man-year. The first task undertaken was a survey of work carried out by OHSGT contractors and others since 1968. Subsequently, specific aspects of the problem were explored in greater detail, and reports were prepared on the following: mechanical properties of long rigid lines; electromagnetic properties of surface wave couplers; electromagnetic properties of bends in surface wave lines; propagation properties of a trench line;

pulse code modulation for long line communications. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212745

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**043249**

**DEVELOPMENT AND MANUFACTURE OF A LINEAR INDUCTION MOTOR PROPULSION SYSTEM FOR THE TRACKED AIR CUSHION RESEARCH VEHICLE**

AiResearch Manufacturing Company, Torrance, California

71-7289, Final Rpt, 7005-7104, Apr. 1971, 196 pp

Contract DOT-FR-00029

The report describes the design of a linear induction motor (LIM) electrical propulsion system for a tracked air cushion research vehicle (TACRV). System and component design drawings are included. Optimization and tradeoff study results are summarized. Applicable publications referenced include those containing electrical, mechanical, and thermal analyses conducted during the design effort, and laboratory tests to derive critical design data and prove selected design concepts. This propulsion system provides 10,000-lb continuous thrust and 15,000-lb short-duty thrust at TACRV speeds of 0 to 300 mph. Weight-to-thrust and volume-to-thrust ratios are significantly better than other current systems. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212977

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**043250**

**TRANSPORTATION SYSTEMS TECHNOLOGY: A TWENTY-YEAR OUTLOOK**

Kovatch, G Barber, JB Casey, RF Zames, G

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-OST-71-10, Final Rpt, 7010-7108, Aug. 1971, 195 pp

An overall technology assessment of new and improved transportation systems is given. A broad survey has been made of new systems concepts for passenger and freight transportation in urban and interurban applications. Results of the findings are reported and projections of expected innovations and improvements are made along with discussion of some of the major limitations to wide scale applications over the next two decades. Some recommendations for research and development emphasis in some of the more promising areas are given.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213012

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PB-213012

**043287**

**AUGMENTED BLOCK GUIDANCE FOR SHORT-HEADWAY TRANSPORTATION SYSTEMS**

Pitts, GL

Applied Physics Laboratory, Johns Hopkins University, Silver Spring, Maryland

APL/JHU-CP019/TPR023, Sept. 1972, 179 pp

Contract DOT-UT-20005.

Transportation Programs Report.

The report describes a vehicle control concept that meets the requirements for automatic fail-safe operation of short-headway transportation systems. A discussion of the principal design tradeoffs and constraints associated with this control concept is included. The detailed computer simulation results of the overall control system presented establish the feasibility of this approach to vehicle control.

**ACKNOWLEDGEMENT**

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**043625**

**LOWER BOUNDARY CONDITION EFFECTS ON LIM  
(LINEAR INDUCTION MOTORS) REACTION RAIL  
MECHANICAL BEHAVIOR: ANALYSIS AND  
EXPERIMENTS**

Haight, EC Hutchens, WA

Mitre Corporation, 1820 Dolley Madison Boulevard, McLean,  
Virginia

MTR-6038, Tech Rpt, 7212-7207, July 1972, 91 pp

Contract DOT-FR-7-35248

Comparison of analytical results with field experiments conducted at Lomita, California, has shown that the lateral behavior of the LIM reaction rail is strongly influenced by the type of boundary conditions used in the analysis along the lower rail edge. An earlier MITRE analysis utilizing a thin plate with a continuously clamped lower edge is improved by adding a base flange with lateral and torsional rigidity which is discretely clamped at the cross-ties only. Good agreement between theory and experiments is obtained. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213350

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PB-213350

**043783**

**ACTIVE CONTROL OF VEHICLE AIR CUSHION  
SUSPENSIONS**

Hullender, DA, Texas University, Arlington  
Wormley, DN  
Richardson, HH

ASME Transactions-J of Dyn Sys, Meas & Control (American  
Society of Mechanical Engineers, 345 East 47th Street, New  
York, New York, 10017)

Vol. 94, No. 1, Ser G, Mar. 1972, pp 41-49, 20 Ref

The optimum linear suspension which minimizes a linear combination of vehicle heave acceleration (a passenger comfort index) and suspension-guideway displacement (a measure of required suspension strike length) is synthesized using a Wiener-Hopf technique. This optimum suspension, which is independent of specific mechanical, magnetic, or fluid methods of implementation, is used to determine the form of active control required to make the performance of a flexible-skirted air cushion suspension approach the optimum performance. The optimally compensated suspension acceleration, flexible base, and gap height excursions are computed and compared with those of optimum passive suspensions.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 019273

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**043784**

**REVIEW OF THE STATUS OF AIR CUSHION  
TECHNOLOGY INCLUDING SUGGESTIONS FOR THE  
ORGANIZATION OF A CANADIAN RESEARCH AND  
DEVELOPMENT PROGRAMME**

Sullivan, PA Placek, R

UTIAS Review (Toronto University, Institute for Aerospace  
Studies, Toronto, Ontario, Canada)

No. 33, 228 pp

This review attempts to present a basis for discussion of requirements for effective exploitation of air cushion technology in Canada. Detailed reviews of the status of two important applications, namely amphibious air cushion vehicles (ACV) or Hovercraft and tracked ACVs or Hovertrains, are given. An examination of the relationship of R & D to transportation vehicles is also included to provide a basis for taking an adequate perspective of needs in this new technology. Some recommendations on the form of an appropriate R & D programme are also made in the light of trends in other fields. A summary of available information on amphibious ACV costs, and an annotated bibliography of the research literature together with a subject index.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 023624

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**043792**

**AUGMENTED BLOCK GUIDANCE FOR SHORT-HEADWAY  
TRANSPORTATION SYSTEMS**

Pitts, GL

Applied Physics Laboratory, Johns Hopkins University, Silver  
Spring, Maryland, 20910 MD-RDC-2

APL/JHU-CP-019/TPR-0, 23, Sept. 1972, 178 pp

Contract DOT-UT-20005

Transportation programs report. (Final)

The report describes an automated block guidance vehicle control concept that meets the requirements for automatic fail-safe operation of short-headway transportation systems. The automated block guidance (ABG) concept represents a specific vehicle-follower approach to headway regulation and control for personal rapid transit and other short-headway passenger systems. The ABG is described in detail with reference to collision-avoidance control, vehicle overspeed protection and spacing control. Results of a detailed computer simulation to evaluate the performance of ABG control are presented. Derivation of the Collision Avoidance Constraint equations is appended. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214391/5

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PB-214391/5

**044197**

**VEHICLES IN CONFINED SPACES (VICS-120) FACILITY  
DESIGN-INTERIM REPORT**

California Institute of Technology, 1201 East California Street,  
Pasadena, California, 91109 Dc-mtd-7

June 1971



A comprehensive description of testing facilities employed in an aerodynamic analysis of vehicles in confined spaces is presented. The VICS-120 consists of a 120-foot vertical test section tube assembly. The vertical configuration is employed to allow for a constant acceleration of the models. The facility was designed for maximum flexibility in its operational parameters, particularly to accommodate high pressures. The complete facility is described with reference to site preparation, plenum assembly, test section tubes, launcher, arrestor, scaffold, handling fixtures, control room, valve and interlock system, and instrumentation. Schematic illustrations of the facility are appended.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-203776

**044198****URBAN GRAVITY-VACUUM TRANSIT SYSTEM: MARK 4B AND MARK 3B BASELINE DEFINITIONS**

Tube Transit Corporation, P.O. Box 11335, Palo Alto, California, 94306 Trd-43

May 1970

The mark 4b urban gvt is best suited to large cities. The smaller system, mark 3b urban gvt, is better suited to the small city that does not require the larger capacity of the mark 4b. The smaller size of the mark 3b configuration also affords significant savings in capital and operating costs. Conventional trains traveling at 200 mph require approximately 10,000 horsepower simply to overcome aerodynamic drag; at higher speeds, the drag increases in proportion to the square of the velocity. To avoid prohibitive power requirements at such speeds, a vehicle must avoid traveling through air at sea level density, nonetheless, the vehicle must be surrounded by normal air pressure when passengers enter and leave. To satisfy these two conditions, gvt trains will travel through evacuated tubes but will emerge from the tubes at each station. As a mark 4b train enters or leaves the tube, its 10,750 square-inch cross section generates an axial pneumatic force of 77 tons,—a force which, utilized to assist gravity acceleration/deceleration by means of pneumatics, can be perceived by the passengers; to maintain comfortable levels for acceleration and deceleration, each mark 4b gvt train will weigh no less than 350 tons. The same pumps and valves that evacuate the tubes can furnish propulsive power to the entire system by means of selective control of the 77-ton thrust. Each pump, mounted close to the station, can enjoy the luxury of a fixed location, a conservative design, and unrestrained access for maintenance; the train, in turn, avoids the weight, bulk, safety hazards, and maintenance problems associated with an on-board power plant. A cost estimate is presented for a system consisting of three lines that would traverse Manhattan Island; each line would provide peak passenger capacity of 50,000 per hour per direction for Manhattan's central business district. The total estimated cost of the 92.9-mile, 74-station system is \$2.055 billion (about \$22 million per mile).

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-192730

**044199****STUDY OF TECHNICAL AND COST QUESTIONS RELATED TO THE FEASIBILITY OF THE GRAVITY-VACUUM TRANSIT SYSTEM**

Skov, BE

Tube Transit Corporation, P.O. Box 11335, Palo Alto, California,

94306 Trd-85

July 1970

Cost and operational problems identified previously by subcontractors of the tube transit corporation are addressed in a detailed analysis that begins with maintenance requirements for gvt rights-of-way and equipment. The effects of temperature extremes on the sub-surface structures and ventilation facilities are emphasized, along with summaries of cost computations for the various maintenance activities. Systems operations are examined with regard to the headways necessary for moving different passenger volumes. The report also discusses human factors in terms of ventilation, air conditioning, heating, etc. The gvt poses special problems in this regard due to frequent acceleration and deceleration situations and the need for pressurized vehicles. Cost factors in the construction of stations, tunnels, and tubes are outlined briefly. Technical analyses of system reliability focus on brakes, doors, and suspensions of the proposed gvt vehicles. The system breakdown evaluation notes particularly the lack of turn-around capabilities at midpoints of a gvt line. The evaluation describes a method for "dynamic retrieval" of stalled trains midway between stations. A final section deals with recommended procedures for retrieval of a fully-loaded gvt vehicle which has become immobilized between stations. Appended material includes a technical note from the Aerotherm Corporation outlining tube, tunnel, and station environments with regard to temperature, ventilation, and air conditioning requirements. Additional material covers the baseline profile of a mark 4b/15 gvt design for which maximum slope would not exceed 15% and thereby facilitate retrieval as discussed above.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-186844

**044200****BASELINE SYSTEM DEFINITION: URBAN GRAVITY-VACUUM-TRANSIT**

Edwards, LK Skov, BE

Tube Transit Corporation, P.O. Box 11335, Palo Alto, California, 94306 Trd-43

May 1968

Details of the construction and operation of the baseline urban gravity vacuum transit system (gvt) are presented. Cylindrical, pressure-tight trains travel through a pair of steel tubes in underground tunnels, which dip between stations to depths as great as 2,000 feet. These tubes are evacuated by electrically-powered pumps or compressors located near the stations. The "baseline system" described in this report reflects a configuration that is considered to be best suited for very large cities (populations above two million people). The gvt concept employs gravity for roughly 70% of its total energy requirement and atmospheric air for the remaining 30%. By accelerating passengers at a rate much higher than they feel, it permits average speeds roughly twice that of present-day urban transportation systems. At any arbitrary acceleration comfort level, gvt permits effective speeds substantially higher than the theoretical limit for horizontal transportation systems with stage lengths of less than 10 miles. Maximum speed would be 245 mph.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-179157

**044278**  
**APPLICATIONS OF AUTOMATIC VEHICLE LOCATION SYSTEMS TO RAILROAD OPERATIONS**

Jakobsberg, W, CENTS AVM Service

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

Paper 73-RT-6, Apr. 1973, 9 pp, 1 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the IEEE-ASME Joint Railroad Conference, St. Louis, Mo., April 11-12, 1973.

There are several techniques for automatically sensing the location of a vehicle in real time. Among these are dead reckoning, "sign post" electronic transmitters and pulse or phase trilateration systems. Of all of them, the LORAN based AVM system currently offers the best combination of high location accuracy, large area coverage, low cost and high dependability. Location accuracies of plus minus 100 feet at ranges of 1,000 miles from Coast Guard operated LORAN navigation transmitter stations are attainable over virtually all of the eastern half of the United States. The vehicle based equipment is portable and can be attached to a vehicle such a locomotive within minutes. LORAN'S unique combination of high accuracy and long-range performance attributes make it an ideal system for displaying to a dispatcher or yardmaster the location of all locomotives and trains under his control as well as information on their speed and the distance between them. Most prominent among these applications are terminal areas where the LORAN-AVM system can be used to maintain surveillance over the activities of switching engines insuring efficiency of movement, adapting work assignments to engine location and reducing conflicts in interchange operations. The system can be used to extend control over "dark" portions of a track system at a fraction of the cost of CTC.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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**044279**  
**AN ELEVATED TAXICAB COMMUTER SYSTEM**

Goodykoontz, JR, New Extensions for Utilizing Scientists

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

Apr. 1973, 7 pp, 10 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the IEEE-ASME Joint Railroad Conference, St. Louis, Mo., April 11-12, 1973.

The basic attributes of the taxicab are used as design guidelines for a community commuter system. The system consists of many small cablike vehicles with a capacity range of 4 to 6 passengers. These travel in closed, elevated tubes with street level boarding stations every block or every other block. Track system consists of one-directional loops which may be operated independently or interlinked. Stopping and starting are minimized. Accessibility is maximized. Important to the esthetics of the system is the innovation of vertical switching which permits the system to be slim and unobtrusive. The community system discussion is augmented with a brief description of an intercommunity system which would be needed to tie the community systems together. Optimum performance curves are given for the integrated system.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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**044340**  
**EXPERIMENTAL DETERMINATION OF THE COMPRESSIVE BEHAVIOR OF A LINEAR INDUCTION MOTOR REACTION RAIL**

Haight, EC Hutchens, WA Williams, JG

Mitre Corporation, 1820 Dolley Madison Boulevard, McLean, Virginia

MTP-374, 7202-7205, Nov. 1972, 82 pp

Contract DOT-FR-7-35248

The reaction rail provides guidance for and reacts the thrust of the motor in the Department of Transportation's Linear Induction Motor Research Vehicle (LIMRV). The tests described in this paper provide data which lead to the understanding of the behavior of the rail in compression. Tests were performed to determine the buckling load and buckling mode shape, the effect of initial imperfections on static lateral stability, and the effect of compressive forces on rail lateral stiffness. Included is a recommendation for an improved field installation. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214506/8

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**044343**  
**SURVEY OF PUBLIC REACTION TO TRANSPON PERSONAL RAPID TRANSIT SYSTEMS AND UMTA-SPONSORED BUS AND RAIL EXHIBITS**

Century Research Corporation, Arlington, Virginia, 22207 UMTA-IT-06-0037

CRC-UT-TPO-72-1, Final Rpt, Nov. 1972, 160 pp

Contract DOT-UT-20027

Surveys of visitors to the United States International Transportation Exposition (TRANSPON-72) were conducted to determine the public reaction to four Personal Rapid Transit (PRT) systems, an experimental urban transit bus, and a rail car from the new San Francisco Bay Area Rapid Transit system. The purpose of these surveys was to determine what people did or did not like about the vehicles, their acceptance of the guideways in various locations, and their estimates of the types of trips for which they would use the vehicles. Methods and questionnaires used in the surveys are described along with special problems encountered and general results and conclusions. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214819/5

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 PB-214819/5

**044494**  
**HOW TO RUN AN AUTOMATED TRANSPORTATION SYSTEM**

Boyd, RK, TRW, Incorporated  
 Lukas, MP

IEEE Transactions on Systems Man and Cybernetics (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. SMC2, No. 3, July 1972, pp 331-341, 11 Ref

The synchronous longitudinal guidance (SLG) approach to allocating guideway space and controlling traffic in a ground transportation network is described in this paper. The transportation system

considered is one in which completely automated vehicles follow deterministic position-time profiles during their travel through the network. The key feature in the SLG approach is a dynamic scheduling algorithm which allocates guideway space to vehicles in such a way that the capacity of critical points (or bottlenecks) in the network is not exceeded. This guarantees that traffic flows smoothly through the entire network and that queues are confined to the entrances. Two scheduling algorithms are identified. The basic slot allocation algorithm used in processing vehicle trip request is outlined first. Then the more general cycle allocation algorithm, which is suitable for control of large networks, is described. The results of a computer simulation of a network run using the latter algorithm are summarized, and the required auxiliary SLG functions of entrance and exit control, merge control, and safety assurance are discussed briefly.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 001558

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**044530**

**FLYING LOW WITH MAGLEV**

Thornton, RD, Massachusetts Institute of Technology

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 10, No. 4, Apr. 1973, pp 47-54

A new transportation system is on the horizon—the first in the history of man in which electrical and electronics engineering seems destined to play the dominant role. Successful magnetic-levitation (Maglev) high-speed ground transportation now appears almost certain for a variety of reasons. There is no fundamental flaw in using magnetic forces for both suspension and propulsion, and various technological options are available for optimizing system design. The system can operate with a relatively "soft" large-clearance suspension that has no contact with the ground, not even for power pickup. Energy consumption can be less than that for jet aircraft, even at Maglev speeds of 500 km/h (311 mi/h).

**ACKNOWLEDGEMENT**  
IEEE Spectrum

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10 Repr PC: Repr Price

032182

**FIRE HAZARD CLASSIFICATION OF CHEMICAL VAPORS  
RELATIVE TO EXPLOSION-PROOF ELECTRICAL  
EQUIPMENT—REPORT II**Committee on Hazardous Materials, 2101 Constitution Avenue,  
NW, Washington, D.C., 20418

Oct. 1971, 27pp

At the request of the U.S. Coast Guard, a detailed study has been made by the Electrical Hazards Panel of the Committee on Hazardous Materials to determine the feasibility of classifying some 200 chemicals of commerce according to the classifications given in the National Electric Code, NEC 500, by using a scheme based entirely on available physical and flammability properties only. This is the second progress report submitted by the Committee to the U.S. Coast Guard.

**ACKNOWLEDGEMENT**

Committee on Hazardous Materials

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NW, Washington, D.C., 20418, Repr P Req Price

037107

**DERAILMENT OF TOLEDO, PEORIA AND WESTERN  
RAILROAD COMPANY'S TRAIN NO. 20 WITH  
RESULTANT FIRE AND TANK CAR RUPTURES,  
CRESCENT CITY, ILLINOIS, JUNE 21, 1970**

National Transportation Safety Board, Washington, D.C.

NTSB-RAR-72-2, Mar. 1972, 47p

Railroad Accident Report

Train No. 20, an eastbound freight train of the Toledo, Peoria and Western Railroad Company, consisting of a four-unit diesel-electric locomotive and 109 cars derailed the 20th to the 34th cars, inclusive, at the west switch of the siding in Crescent City, Illinois, at about 6:30 a.m. on June 21, 1970. Included in the 15 derailed cars were nine tank cars loaded with liquefied petroleum gas. During the derailment one of the tank cars was punctured, and the leaking propane was immediately ignited, engulfing the other tank cars in the fire. A series of explosions of the remaining tank cars occurred, beginning about 1 hour following the derailment, resulting in the injury of 66 persons and the destruction of a number of buildings within the town of Crescent City. The National Transportation Safety Board determines that the probable cause of this accident was the breaking of the L-4 journal of CB and O 182544, the 20th car, due to excessive overheating, which permitted the truck side to drop to the track and derail the leading wheels of the car. The cause of the overheating could not be determined. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210614

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037185

**STABILITY AND DERAILMENT SAFETY OF COG  
RAILWAYS 212 STAND-UND ENTGLEISUNGSSICHERHEIT  
BEI ZAHNRADBÄHNEN**

Borgeaud, G

Schweizerische Bauzeitung (Verlags-Ag der Akademischen  
Technischen Vereine, Staffelstrasse 12, Zurich 45, Switzerland)

Vol. 87, No. 4,5, Jan. 1969, pp 71-89

Problem is analyzed, effect of single, double, and triple rack rail being taken into consideration. Motion along straight and curved track, and effect of transversal wind pressure and centrifugal force are considered for cases of ascending and descending trips. Numerical analysis of stability is made for train consisting of cogwheel locomotive pushing two cars. Calculation method can be easily adapted for computer application.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 20543

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039166

**A RECOMMENDED RAIL SAFETY RESEARCH PLAN FOR  
FISCAL YEARS 1971-1975**

Melpar, Incorporated, Falls Church, Virginia

FRA-RP-70-1, Oct. 1969, 115 pp

Contract DOT-FR-9-0047

The document is concerned with the initial picture of railroad safety, configured research projects which address specific needs as expressed by industry, labor and government, an estimation of the resources (in time and dollars) required to accomplish each project, and 3 alternative 5-year safety research program plans for the fiscal years 1971-1975. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-188967

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PB-188967

039249

**HAZARDOUS MATERIAL TANK CARS—TANK HEAD  
PROTECTIVE 'SHIELD' OR 'BUMPER' DESIGN**

Everett, JE Phillips, EA

Association of American Railroads, Chicago, Illinois

Final Rpt, Aug. 1971, 187 pp

Contract DOT-FR-00035

The objective of the study program is to design a railroad tank car head protective device which will reduce the frequency of head punctures in accidents. Accident data were reviewed in detail for the years 1965 through 1970 to correlate head damage frequency and severity with various types of tank cars, to determine distribution patterns of damage over tank car head surfaces, and to assess the costs to the railroad shipping industry of head punctures. Full scale head impact tests, previously run were also reviewed. From these two reviews, design criteria were established and used to reduce an initial compilation of 74 concepts to a group of 15, which when applied to various classes of cars, comprised a semi-final total of 42 combinations, or schemes, as referred to in this report. Designs for these 42 schemes were then detailed and cost estimated. Next, a comprehensive cost/benefit analysis was applied. Three schemes appear attractive for the non-insulated pressure cars of the DOT 112A or 114A type. A recommended test program is outlined, and a preliminary estimate of its cost is given. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202624

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039269

**A STUDY TO REDUCE THE HAZARDS OF TANK CAR TRANSPORTATION**

Bullerdiek, WA Vassallo, FA Adams, DE Matheis, CW

Cornell Aeronautical Laboratory, Incorporated, Buffalo, New York

Final Rpt, Nov. 1970, 177 pp

Contract DOT-FR-00028

The report details the findings of a 4-month study contract directed at reducing the hazards of tank car transportation. A number of shortcomings with existing safety-relief specifications were indicated. A key finding was that the controlling condition in sizing for propane relief should be the liquid feed, or 'upset' car condition, and not vapor feed per the current criterion. The net result is a significant undersizing of relief area considering the existing heat flux criterion to be accurate. Analytical studies and review of test data indicate the existing heat flux criterion to be significantly low—further increasing the possibilities of overpressure. A staged safety relief system was recommended for cars with liquefied compressed gas ladings. The primary relief element would be a pressure-maintaining system sized for handling abnormal operating conditions other than severe fire exposure. The secondary relief system would be a 'dump' type to drop system pressures to levels preventing catastrophic rupture and 'rocketing' under severe fire exposure conditions. Both model and full scale test programs are recommended. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-199154

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PB-199154

039803

**PENN CENTRAL TRANSPORTATION COMPANY. FREIGHT TRAIN DERAILMENT, PASSENGER TRAIN COLLISION WITH HAZARDOUS MATERIAL CAR, SOUND VIEW, CONNECTICUT, OCTOBER 8, 1970**

National Transportation Safety Board, Washington, D.C.

NTSB-RAR-72-1, Dec. 1971

55p

Railroad accident report.

At 8:50 p.m., October 8, 1970, Penn Central Transportation Company's freight train derailed near Sound View, Connecticut. Freight cars obstructed track in the path of Penn Central passenger train. The passenger train struck the freight cars, puncturing an LPG tank car designated as 'empty.' The derailed units of the passenger train passed through ignited gases from the punctured tank car and crossed a railroad bridge. Train crewmembers and passengers were injured. The Safety Board has determined that the probable cause of the derailment of the freight train was the breakage of a truck side of a car on the freight train which followed a progressive fatigue crack failure. The breakage of the truck side resulted in damage to a turnout, which caused derailment of the following cars. The cause of the collision to the passenger train was the obstruction of track No. 2 by cars of the freight train. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207621

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207621

039814

**HAZARDOUS MATERIALS TRANSPORTATION INTRUSION PROTECTION FOR HAZARDOUS CARGO TANKS**

Krasner, LM Wiener, SA Buckley, JL

Factory Mutual Research Corporation, Norwood, Massachusetts, 02062

Final Rpt, June 1971, 42 pp

Contract DOT-FH-11-7269

Tanker population data was collected along with data resulting from accidents involving over-the-road tank carriers of flammable liquids. This data was evaluated and analyzed with respect to the incidence of lateral piercing or intrusion. Significant results include the total number of tank trucks in the country including combinations, the number of tank combinations meeting flammable liquid specifications and the percent of these reporting to DOT, the finding the lateral intrusion is not a significant problem, but that fire on tankers is a significant problem, and the finding that onboard fire suppressing system are feasible and desirable.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207374

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PB-207374

039855

**PROCEEDINGS OF THE CONFERENCE ON HAZARD EVALUATION AND RISK ANALYSIS HELD IN HOUSTON, TEXAS ON 18-19 AUGUST 1971**

National Research Council, Division of Chemistry and Chemical Technology, Washington, D.C., 20418 CG-11775-A

Aug. 1971, 169p

Contract DOT-OS-00035

The report presents papers on a symposia concerning the transportation of hazardous materials by water. The papers primarily discuss hazard evaluation and risk analysis as they relate to hazardous materials in transport.

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-736942

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
AD-736942

039856

**SIGNALS AND OPERATING RULES AS CASUAL FACTORS IN TRAIN ACCIDENTS**

National Transportation Safety Board, Washington, D.C.

NTSB-RSS-71-3, Spec Study, Dec. 1971, 16p

Railroad signal systems, even though performing as designed, do not compensate for human failure and prevent accidents. Many collisions attributable to negligence of employees result from lack of compliance with operating rules which do not relate compatibly with the signal systems. A relationship is developed between signal systems, operating rules, and the human element that is responsive to both. Specific cases are cited in which the discrepancies are exposed and examined within the context of the foregoing. Recommendations are directed to the Federal Railroad Administration that they take steps under the increased scope of authority of the Federal Railroad Safety Act of 1970, to develop a comprehensive program for future requirements in signal systems and operating rules that will reduce or

eliminate the present ambiguities and lax, ill-defined operating rules.  
**ACKNOWLEDGEMENT**  
 National Technical Information Service, PB-206407

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 PB-206407

**039862**

**RAILROAD ACCIDENT REPORT. PENN CENTRAL COMPANY. ELECTROCUTION OF JUVENILE TRESPASSER ON PENN CENTRAL TRACKS AT WASHINGTON, D. C. MAY 14, 1971**

National Transportation Safety Board, Washington D.C.  
 NTSB-RAR-72-3, Mar. 1972, 25p

On May 14, 1971, a male juvenile climbed on top of a draft of freight cars which had been left temporarily adjacent to the Penn Central Sixth Street Yard, Washington, D. C., and was electrocuted when he contacted the electrified catenary system. Within minutes thereafter, a police officer was seriously burned and knocked from the top of an adjacent car when he attempted to reach the stricken youth. The youth was apparently killed outright, but the police officer survived. There are few effective warning indicators in and around the accident area and no barriers that would discourage trespassers. Compounding the hazard in the area is a parking lot on which children congregate to play. There are no positive separation barriers between the railroad and the parking lot. Also prominent in causal factors to the injury of the policeman is the practice of Penn Central of immediately restoring an actuated circuit breaker when the cause of actuation is not known. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210249

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**039863**

**BURLINGTON NORTHERN INCORPORATED, DERAILMENT OF EXTRA 5701 EAST AT SHERIDAN, WYOMING, MARCH 28, 1971**

National Transportation Safety Board, Washington, D.C. NTSB-RAR-72-4

SS-R-14, Apr. 1972, 31p

Burlington Northern Extra 5701 East, approaching Sheridan Yard, Sheridan, Wyoming, on the morning of March 28, 1971, called the Yard Office for a track on which to deliver the train. The main track was assigned, but as the approach was continued, cars were sighted standing on the main track. The cars were sighted too late. The train did not stop, and there was a collision. The engineer and fireman were killed, two brakemen were injured, and three diesel units and eleven cars were derailed. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210188

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 PB-210188

**039884**

**A STUDY OF HAZARDOUS MATERIALS INFORMATION NEEDS AND IDENTIFICATION SYSTEMS FOR TRANSPORTATION PURPOSES**

Rath, GJ Bottoms, AM Hagerty, D Morin,  
 D Money, WH

Northwestern University, Design and Development Center,

Evanston, Illinois

DDC-72-4, May 1972, 183p

Contract DOT-OS-10042

Information needs and methods to transmit that information are analyzed to determine the basic requirements of a hazard identification system for packages containing, and vehicles carrying, hazardous materials. Persons who come in contact with hazardous materials shipments are identified and a typology is developed. Information needs by type, amount, and timing are listed by category, and sixteen existing labeling systems are evaluated according to these and human factors criteria. Another dimension of users considered is transportation mode and job function of personnel. Conclusions and recommendations based on this analysis are discussed.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210143

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**040620**

**SPECIAL STUDY, TRAIN ACCIDENTS ATTRIBUTED TO THE 'NEGLIGENCE OF EMPLOYEES'**

National Transportation Safety Board, Bureau of Transportation Safety, Washington, D.C.

NTSB-RSS-72-1, Spec Study, May 1972, 27p

The report identifies and ranks the leading causes of train accidents attributed to the negligence of employees for the period 1961-1970. Analyses of the leading accident causes are performed to explore contributory factors such as rules, rule enforcement procedures, equipment design or maintenance, and environment. The relationship between accidents attributed to employee negligence and employee training, railroad safety efforts, the financial condition of the industry, and organized labor's role in advancing safety is discussed. A recommendation is directed to the Federal Railroad Administration to analyze the identified leading accident causes and to take appropriate corrective action. Safety Board recommendations from previous accident reports and special studies are reiterated as applicable to the circumstances identified in the report. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211577

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 PB-211577

**041295**

**MOVING PEOPLE SAFELY**

Institute for Rapid Transit, 1612 K Street, NW, Washington, D.C., 20006

166 pp

This book was prepared by the Passenger Safety Committee of the Institute for Rapid Transit and Announced in Railway Locomotives and Cars, V146, N8, September 1972.

The 166-page paperback was prepared as a means of enhancing the already enviable safety record of the rail transit industry. It contains guidelines in a number of areas of safety and in is intended not only for those systems now operating but also for the systems which are now building or are being planned. From the guidelines in this volume it is intended that specific safety rules can be prepared for each system. The seven chapters cover Safety First, Inspections: Facilities; Inspections: Cars; Inspections: Communications; Power; Uniform Code of Operating Rules; and Emergency. There is also a

section on uniform accident reporting.  
**ACKNOWLEDGEMENT**  
 Railway Locomotives and Cars

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
 Institute for Rapid Transit, 1612 K Street, NW, Washington,  
 D.C., 20006, Repr PC: \$5.00

041296

**1971 ANNUAL REPORT TO CONGRESS**

Government Printing Office, Superintendent of Documents,  
 Washington, D.C., 20402

64 pp

This report was prepared by the National Transportation Safety Board and announced in Railway Locomotives and Cars, V146, N8, September 1972.

This 64-page document is the fifth annual report of the Federal body charged with a constant review of safety and accidents involving all modes of transportation. The independent agency made 246 separate recommendations on accident prevention involving railroads, aviation, marine transportation, highways and pipelines. During the year NTSB involved itself in five railroad accidents on which it is issuing final reports:

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

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 Government Printing Office, Superintendent of Documents,  
 Washington, D.C., 20402, Repr PC: \$0.3  
 5000-0053

041665

**SPECIAL BIBLIOGRAPHY: SAFETY-RELATED TECHNOLOGY**

Highway Research Board, 2101 Constitution Avenue, NW,  
 Washington, D.C., 20418

7351, Mar. 1973, 339 pp

Contract DOT-OS-00035

This book contains over 1,900 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 Rail Vehicles and Components. The abstracts are arranged according to the RRIS Classification Scheme. The book also contains Subject Term, Author, and Source Indexes.

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 PB-220220

041781

**CHICAGO, BURLINGTON, AND QUINCY RAILROAD COMPANY TRAIN 64 AND TRAIN 824 DERAILMENT AND COLLISION WITH TANK CAR EXPLOSION, CRETE, NEBRASKA, FEBRUARY 18, 1969**

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C.

NTSB-RAR-71-2, RR Acc Rpt, Feb. 1971, 82 pp

A train accident is reported in which one consequence was the complete fracture of a tank car and release of its load of 29,200 gallons of anhydrous ammonia into the atmosphere. A gas cloud was formed which blanketed the surrounding area for a considerable time because of prevailing weather conditions. All persons directly exposed

to the cloud of ammonia gas received either fatal (six people) or serious (53 people) chemical injury to the respiratory tract; people within the area of the gas concentration who remained in their homes or who had adequate protection escaped with little or no injury. The cases of the complete failure of the tank car following derailment were heavy impact with another car and the brittleness of the tank car steel at the ambient temperature of four F. More than 11,000 tank cars of this type are in service, most carrying liquefied petroleum gas. In low-temperature conditions, the consequences of accidents involving some large LPG cars are most likely to be catastrophic than in warm weather. The failure to thoroughly test tank cars for such hazards as flammability and brittleness before they are put in service is both false economy and an injustice to persons living along the tracks. Thorough study of tank car materials and of methods for rapid dispersion or absorption of clouds of toxic vapors is recommended.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 34825

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 PB-198790

043622

**RAILROAD ACCIDENT REPORT. DERAILMENT OF AMTRAK TRAIN NO. 1 WHILE OPERATING ON THE ILLINOIS CENTRAL RAILROAD NEAR SALEM, ILLINOIS, JUNE 10, 1971**

National Transportation Safety Board, Bureau of Surface Transportation Safety, Washington, D.C.

NTSB-RAR-72-5, Aug. 1972

68 pp

Amtrak train No. 1, a southbound passenger train operating on the tracks of the Illinois Central Railroad between Chicago, Illinois, and New Orleans, Louisiana, derailed near Salem, Illinois, on June 10, 1971. Two locomotive units, and the first seven cars were turned over on their sides. The derailment resulted in 11 fatalities and 163 injuries. The National Transportation Safety Board determines that the probable cause of this accident was the displacement of the east stock rail of the southward main track by the false flange on the left-hand wheel on the leading axle of the rear truck of locomotive unit 4031. This wheel slid flat when the traction-motor armature bearings failed and locked the driving wheels. Failure to detect the sliding wheels was caused by an inoperative wheel-slip indicator. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213130 /

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 PB-213130 /

043672

**VANDALISM**

Sanders, M Welton, JH

Naval Ammunition Depot, Crane, Indiana

NAD-CR-RDTR-218, July 1972, 199 pp

The objectives of the report were to review and summarize current literature on vandalism, to investigate, on a preliminary basis, the nature of railroad vandalism, and to recommend research areas for future consideration. To accomplish these objectives published literature was reviewed, interviews were conducted with railroad officials, and a questionnaire was sent to members of the Association of American Railroads. The report includes a summary of questionnaire responses, research recommendations, and an annotated bibliography.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214136 /

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PB-214136 /

043673

**IDENTIFICATION AND CATEGORIZATION OF  
ACCIDENTS AND INJURIES IN CABS OF LOCOMOTIVES**

Kurz, F

Central Technology, Incorporated, 8115 Fenton Street, Silver  
Spring, Maryland

Summ Rpt, Sept. 1972, 84 pp

A review and categorization is made of available published locomotive cab accident reports and statistics, as well as of unpublished accident reports from a number of individual railroads. Major hazards related to locomotive control compartment accidents are identified and categorized in summation form. Conclusions stress the need for designing greater elemental safety in strength and location of the control compartment, as well as providing a more livable environment for occupants in the control compartment of locomotives. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, PB-214129

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043676

**CONFERENCE PROCEEDINGS ON LNG (LIQUEFIED  
NATURAL GAS) IMPORTATION AND TERMINAL SAFETY  
HELD IN BOSTON, MASSACHUSETTS ON 13-14 JUNE  
1972**

Fawcett, HH Basiliko, ML Jacobs, RC

National Academy of Sciences, Committee on Hazardous  
Materials, Washington, D.C., 20418 CG-733211

June 1972, 299 pp

Contract DOT-OS-00035

The purpose of a two-day conference held in Boston in June 1972 was to review the current state of knowledge of LNG safety. The proceedings provide a useful reference for persons concerned with technical aspects of transporting LNG. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, AD-754326

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043788

**PROCEEDINGS: CONFERENCE ON HAZARDOUS  
CARGOES (7TH) HELD AT THE U. S. COAST GUARD  
ACADEMY, NEW LONDON, CONNECTICUT ON 8-9 JULY  
1970**

Fawcett, HH

National Academy of Sciences, Committee on Hazardous  
Materials, Washington, D.C., 20418 CG-713211

Aug. 1970, 259 pp

Contract DOT-OS-00035

The report presents articles given at the symposium on chemical reactions and hazard information control systems as they relate to hazardous materials in transport. (Author)

## ACKNOWLEDGEMENT

National Technical Information Service, AD-754891

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
AD-754891

043791

**RECLASSIFICATION OF MATERIALS LISTED AS  
TRANSPORTATION HEALTH HAZARDS**

Back, KC Thomas, AA MacEwen, JD

Aerospace Medical Research Laboratory, Wright-Patterson Air  
Force Base, Dayton, Ohio

Final Rpt, 7102-7206, Aug. 1972, 347 pp

Contract DOT-AS-10028

The study consisted of three phases. Phase I—An extensive literature search was conducted for pertinent human and acute animal toxicity data for about 200 materials, classed as Poison A, B, or C in the Commodity List, Section 172.5, Title 49 CFR, and/or as Toxic (Class 6.1) in the Subsidiary Risk Category in the United Nations publication, Volume I, Transportation of Dangerous Good, 1966. Materials were classified according to the proposed classification criteria. Phase II—Inhalation (LC50) toxicity tests were run on mice and rats for five materials and oral toxicity (LD50) tests were run on mice and rats for 40 other materials. The phosphine evolution rate for aluminum phosphide in air (55% relative humidity) and in water were determined. The results were summarized and the materials classified. Phase III—Verification inhalation toxicity (LC50) tests were run on mice and rats exposed to chlorine, anhydrous ammonia and hydrogen sulfide. Results were included and reflected in the classification of these materials.

## ACKNOWLEDGEMENT

National Technical Information Service, PB-214270/1

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PB-214270/1

044001

**STUDY OF HAZARDOUS MATERIALS INFORMATION  
NEEDS AND IDENTIFICATION SYSTEMS FOR  
TRANSPORTATION PURPOSES**

Rath, GJ

Northwestern University, Design and Development Center,  
Evanston, Illinois, 60201

May 1972, 183 pp

Information needs and methods to transmit that information are analyzed to determine the basic requirements of a hazard identification system for packages containing and vehicles carrying hazardous materials. Persons who come in contact with hazardous material shipments are identified, and typology is developed. Information needs by type, amount, and timing are listed by category, and 16 existing labeling systems are evaluated according to these and human factors criteria. Another dimension of users considered is transportation mode and job function of personnel. Conclusions and recommendations based on this analysis are discussed.

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PB-210143



044085

**AUTO-TRAIN DERAILED IN CROSSING ACCIDENT**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, p 8

Southbound Auto-Train No. 107 was derailed early, on the morning of March 13 at Hortense, Ga., after being struck by a pulpwood truck at a grade crossing. No. 107 consisted of two diesel units and 30 cars. It was carrying 298 passengers and 107 automobiles, and was reportedly traveling at 70 to 75 mph. The pulpwood truck, loaded and moving at high speed, is said to have ignored crossing signal lights, plowing into the second diesel unit, causing the derailment of both units and 27 of the 30 cars. The truck driver was killed. Of the 298 passengers, only 35, along with three crew members, were hospitalized. All but four passengers were released. An adjustment to Auto-Train's daily schedules from Lorton, Va., to Sanford, Fla., to trips southbound on odd dates and northbound on even dates has been placed in effect until equipment can be repaired and returned to service. Auto-Train pointed out that this is its first derailment since service was inaugurated Dec. 6, 1971—900 trips have been operated since that time.

**ACKNOWLEDGEMENT**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

044503

**SERVICE FAILURES AND THEIR IMPLICATIONS FOR BRITISH RAILWAYS**

Waldron, GWJ, British Rail Research Division  
Wise, S

Sheffield University Metallurgical Society, Journ (Sheffield University Metallurgical Society, Sheffield 510-2TN, Yorkshire, England)

Vol. 11, 1972, pp 31-42

Failures in welded and bolted track, tram wheels, nozzle rings, frames and similar components, due to fatigue cracking, thermal cracking, spalling, voids, fracture, and similar mechanisms are discussed. Photomicrographs are used to evaluate failure modes.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 022603

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

039155

**POWER COLLECTION, CATENARY/PANTOGRAPH DYNAMICS: DEVELOPMENT OF COMPUTER PROGRAM; VERIFICATION; RESULTS**

General Electric Company, Transportation Systems Division, Erie, Pennsylvania

Final Rpt, Sept. 1969, 74 pp

Contract DOT-7-35121

Errata sheet inserted.

This report describes a mathematical model and digital computer program to simulate the dynamics of one or more pantographs in contact with and traversing an overhead catenary system. The computer program was written in the Fortran IV compiler language for a GE-635 computer, but it has been adapted to other computers and is generally available to others interested in this subject through the DOT. The report describes the computer program briefly, the work completed to validate the program, and general conclusions about the program's usefulness. The validation of the program included comparison of computed results with data measured on the four car DOT test train at speeds up to about 130 mph.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-186230

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PB-186230

039275

**DESIGN AND DEVELOPMENT OF A SERVO-OPERATED PANTOGRAPH FOR HIGH SPEED TRAINS**

United Aircraft Corporation, Sikorsky Aircraft Division, Stratford, Connecticut

STER-10004, July 1970, 45 pp

Contract DOT-7-35415

The report describes the results of the work performed by Sikorsky Aircraft to design, fabricate, and develop a breadboard model of a servo operated pantograph for use on high speed trains. Design criteria were generated from an investigation made of overhead wire contact problems. Based on these criteria and the results of a servo-analysis performed, a pantograph system was designed and fabricated. Using a fabricated test rig, laboratory tests were conducted to determine the feasibility of the system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209056

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PB-209056

041109

**THEORETICAL STUDY ON FAULT LOCATING METHOD IN AT FEEDING CIRCUIT**

Fujie, H

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

Vol. 13, No. 1, Mar. 1972, pp 44-46, 4 Fig

The reactance type fault locating method has been used for electrified railroads with autotransformer feeding system. Although this method has given actual results, the error is too large, about 8 km at maximum, and increases when the fault line is unknown. The autotransformer neutral current type fault locating method, although not yet proven in service, promises to be a better method since the ratio

relates with the distance linearly, does not relate with fault resistance, yields high accuracy of fault location, and the distance ratio straight line is easy to draw. Calculations of the fault currents and ratios are presented.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,

Repr PC: Req Price

041118

**TRANSVERSE VIBRATION AND INSTANTANEOUS MINIMUM CLEARANCE OF WIRES CAUSED BY SHORT-CIRCUIT CURRENT**

Fujie, H

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

Vol. 13, No. 2, June 1972, pp 93-94, 3 Fig, 1 Tab

The instantaneous minimum clearance between two wires is examined so that the proper arrangement of the wires can be fixed. In order to prevent the occurrence of a short-circuit accident, calculations were made to examine the tension, the dip and the actual length. A tension equation was derived varying the temperature and the current. This method was then transformed into computer program and completed.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan, Repr PC: Req Price

041119

**ANALYSIS OF TRAVELING WAVES IN AN ELECTRIC FEEDING SYSTEM BY DIGITAL COMPUTER**

Arai, K

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

Vol. 13, No. 2, June 1972, pp 95-96, 6 Fig

In a feeding circuit of the AC electrified railway section, a switching surge occurs very frequently as compared to the three phase system. In particular, making or breaking operations are performed at every train passage at a neutral section in SHIN-KANSEN. Up to now, the level of a switching surge generated in feeding circuit has been investigated on the field test, but the author developed an analytical method with the aid of signal flow graph and digital computer, which curtails the tedious calculation with figures. The method was applied to the Rokko Sub-Station in SHIN-KANSEN as an example and showed satisfactory results.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan, Repr PC: Req Price

041120

**DEVELOPMENT OF INSPECTION CAR FOR OVERHEAD CATENARY SYSTEM**

Shimomae, T Koriki, K

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

Vol. 13, No. 2, June 1972, pp 97-98, 4 Fig

The prototype inspection car for overhead catenary system was developed in 1969. Measuring items include residual diameter of the trolley wire, zig-zag deviation and height of the trolley wire from the rail, hard spot sensing, obstacle detection and pole position sensing. After the laboratory tests at this institute, the on-rail test was conducted on Ban-Etsu Line with satisfactory results.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan, Repr PC: Req Price

**041150**

**RAILROAD ELECTRIFICATION: PAST, PRESENT, AND FUTURE**

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 5, No. 7, July 1968, pp 50-65, 8 Fig, 1 Tab, 11 Phot, 6 Ref, 1 App

Mainline steam railroads have electrified for four reasons: the elimination of smoke, soot, and noise in tunnels; relief of congestion in peak passenger terminal and suburban service; elimination of locomotive changing and soot and dirt from mainline passenger track service; and to overcome heavy grades in freight service. This article summarizes the electrification of mainline steam railroads in the United States. Brief histories and basic technical characteristics of the electrifications are presented. Descriptions and photographs of some electric locomotives are included. Some basic circuit diagrams are presented, and maps are included of the Pennsylvania RR and the Milwaukee RR electrified lines. The advantages of electrification over steam locomotion are reviewed.

**ACKNOWLEDGEMENT**

IEEE Spectrum

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10 Repr PC: Req Price, Microfiche: Req Price

**041661**

**PLANNING FOR RAILWAY ELECTRIFICATION**

Clemow, CJ, British Railways Board

Institution of Electrical Engineers, Proceedings (Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, England)

Vol. 119, No. 4, Apr. 1972, pp 431-440

Paper describes the preparatory stages that should be followed before a decision to proceed with any railroad electrification is given. The purpose of such work is to provide a report to management on comparisons between the proposal and alternative courses of action. Consideration is given to capital and maintenance costs, performance characteristics, commercial appeal, train service quality, levels of utilization, fuel costs, track, signalling, politics and environment. Alternatives to electric traction are diesel and gas-turbine propulsion. Discounted-cash-flow appraisal is described. The position of British Railways relative to other undertakings is indicated, and it is suggested that further electrification could be justified.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 015055

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**041987**

**RECENT DEVELOPMENTS IN THE DESIGN OF OVERHEAD EQUIPMENT**

Suddards, AD

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse, Munich 80, West Germany)

Vol. 43, No. 3, Mar. 1972, pp 59-69

Paper reviews some recent British developments in the design of overhead equipment systems and components. Although these developments have been related mainly to British Railway's equipment, many of them have also been applied to recent overseas schemes in Finland, India, Norway, Pakistan, South Korea and Yugoslavia.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 061913

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**041989**

**PLANNING FOR RAILWAY ELECTRIFICATION**

Clemow, CJ, British Railways Board

Institution of Electrical Engineers, Proceedings (Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, England)

Vol. 119, No. 4, Proceeding, Apr. 1972, pp 431-440

Paper describes the preparatory stages that should be followed before a decision to proceed with any railroad electrification is given. The purpose of such work is to provide a report to management on comparisons between the proposal and alternative courses of action. Consideration is given to capital and maintenance costs, performance characteristics, commercial appeal, train-service quality, levels of utilization fuel costs, track, signaling, politics and environment. Alternatives to electric traction are diesel and gas-turbine propulsion. Discounted-cash-flow appraisal is described. The position of British Railways relative to other undertakings is indicated, and it is suggested that further electrification could be justified.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 61906

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**041990**

**CREWE GLASGOW ELECTRIFICATION**

Nock, OS

Engineering (IPC Business Press Limited, 33-39 Bowling Green Lane, London EC19 1AH, England)

Vol. 211, No. 8, Nov. 1971, pp 881-884

The execution of this great scheme of railway modernization will be watched with the greatest interest, with the definite prospect of Inter-City express travelling at 110 mph on the open road, of freight services worked at higher speeds than ever previously, and such an abundance of power built into the new locomotives that maximum line speed can be maintained regardless of gradient—even though gradients include the mile pull at 1 in 75 from Tebay up to Shap Summit and the similarly graded 10 miles of the Beattock Bank, in Dumfriesshire.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 061908

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**041991**  
**LATEST DEVELOPMENTS IN ELECTRICAL RAILWAY**  
**SUBSTATIONS**

Akai, M

Toshiba Review (Tokyo Shibaura Electric Company Limited, 1-1 Uchisaiwaicho, Chiyoda-ku, Tokyo, Japan)

No. 68, Apr. 1972, pp 7-12

Electric railway substations can be classified broadly into d-c substations and a-c substations. D-c substations using silicon rectifiers are simple to operate and highly reliable. In a-c electrification, the conventional booster transformer system is yielding to a newly-developed autotransformer system. These substations are so-called unattended substations supervised and controlled from a control center. Lately, computer control of railway substations has been realized.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 06192

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**043000**  
**COLD PRESSURE WELDING OF TROLLEY WIRE**

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

Vol. 12, No. 3, Sept. 1971, pp 167-170

The optimum condition for cold welding of copper trolley wires and the aging characteristics of the joint as well as the mechanical properties were investigated. An improved process and practical devices were developed from the results. Several sections of trolley wire with butt-joints welded by this process were set up for test on actual service lines in the suburbs of Tokyo.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 31502

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**043001**  
**CATENARY SYSTEMS FOR HIGH VOLTAGE A-C**  
**RAILROAD ELECTRIFICATION**

Suddards, AD, Kirkby Industrial Estate  
 Rosbotham, TH  
 Bamford, TB

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

ASME 70-RR-6, Paper, 1970, 12 pp, 9 Ref

Following reference to international applications of high voltage a-c systems, the paper reviews the development of the catenary system used in Great Britain. The influence of special characteristics of American railroads on the selection and design of catenary systems is discussed. The processes involved in electrifying a conventional railroad are reviewed and recommendations are made in respect to the adoption of high voltage a-c electric traction in the United States.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 48704

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**043002**  
**GROUND TRANSPORTATION ENERGY TRANSFER**

Ward, EJ, Department of Transportation  
 Lawson, KL

Intersociety Conversion Eng. Conference (4th), Washington, D.C.  
 699096, Proceeding, 1971, pp 778-794

The conference was held from September 22-26, 1969.

Sliding contact power transfer is feasible throughout the economical range of high speed intercity ground transportation. Non-contact power transfer is not practical at present. Dividing line between the overhead catenary approach and alongside contact rail concepts is somewhere around 200 mph. Catenary distribution will very likely carry 50 kv, 60 Hz single phase power, while contact rails will most probably deliver three-phase, 60 Hz power at about 15 Kv.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 28755

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**043003**  
**BRITISH RAILWAY'S EXPERIENCE WITH**  
**PANTOGRAPHS FOR HIGH-SPEED RUNNING**

Taylor, K

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1, England)

Vol. 2, 1971, pp 348-373

Reference is made to the factors which govern the design of the pantograph and the need to relate its performance to the dynamic behavior of the overhead line equipment and locomotive or electric multiple unit set body throughout the speed range. Some difficulties which were experienced in operating at speeds up to 100 mi/hr and the measures taken to overcome these are described. Some lines of further development to make the pantograph suitable for operation at higher speed are suggested.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 30698

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**043004**  
**DEVELOPMENT OF THE PANTOGRAPH FOR HIGH-**  
**SPEED COLLECTION**

Souch, DJW Taylor, G

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1, England)

Vol. 2, 1971, pp 406-467

The basic factors that influence pantograph design are discussed and include dimensional limitations, transverse rigidity, contact pressure, system voltage, current rating and pan profiles. The relative merits of frame and roof-mounted air motors are considered, a long with aerodynamic behavior and its effect on the contact quality and the problems that arise due to snow and ice formation. Factors affecting contact strip wear are discussed and an analysis of strip life obtained on various railroad systems using different materials is given. The merits of contact surface lubrication are also discussed.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 30700

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**043005**  
**PANTOGRAPHS FOR HIGH-SPEED RUNNING**

Graniato, MC

Railway Division Journal (Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London SW1, England)

Vol. 2, 1971, pp 374-406

Simplified method for the analysis of dynamic stresses and movements occurring in collection by a pantograph under the contact wire. Design of an FD Mini-Pantograph (40 cm. lift). Theoretical study of a double pantograph with dual damping, 1.5 kv pantograph for high-speed collection under a 63 m. span 1500 v contact wire.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 30699

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**043006**

**DYNAMIC BEHAVIOR OF THIRD CONTACT SHOE FOR HIGH SPEED TRANSPORTATION**

Magnus, DE

Institute of Environmental Sciences, 940 East Northwest Highway, Mt. Prospect, Illinois, 60056

Apr. 1968, pp 415-421

Proceedings from the 14th Annual Technical Meeting, St. Louis, Missouri, April 29 to May 1, 1968.

Demand for higher speed ground transportation is dependent upon suitable methods for collecting electrical energy to power vehicle; dynamic response of electric contact shoe and rail system is considered; analytical models are presented and applied to typical design for contact shoe; rational design approach is developed and design modifications for high speed operation are recommended.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 17296

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**043007**

**CATENARY SYSTEM AND POWER SUPPLY FACILITIES OF THE MUSKINGUM ELECTRIC RAILROAD**

Oliver, TA, American Electric Power Service Corporation  
Ross, BA  
Cowal, AR  
Thompson, JS

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 1GA7, No. 5, Sept. 1971, pp 658-665

The substation and catenary facilities described were developed to provide ideas, examples, and cost samples to show what can be done in electrifying main-line railroad freight service. Catenary for the project is the first 25-kv 60-Hz system installed in the United States. Three types of catenary hangers were used to provide a measure of comparison of different ideas. Installation procedures are described in detail.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 25266

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**043008**

**MUSKINGUM ELECTRIC RAILROAD**

Fisher, HA      Ross, BA

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

1968, pp 295-305

Project description and general railroad data; major features of equipment and facilities being provided for almost 100% all electric coal mining and transport operation; data for 1495 Mw steam-electric generating plant and loading-unloading terminals.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 06842.

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**043009**

**OHIO ELECTRIC LINE TESTS NEW TECHNIQUES**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 142, No. 12, Dec. 1968, pp 20-21

Advantages and economy of 60-cycle, h-v electrification of latest technology for railroad electrification was completed in southeastern Ohio; primarily new Muskingum Electric Railroad was built for transporting coal from surface mining operation 15 mi to conveyors supplying newly expanded generating station of Ohio Power Co. on Muskingum River; railroad is designed to transport minimum of 3.5 million tons of coal annually; basic cycle involves two 15-car trains traveling over single-track line and transporting average of 18,000 tons of coal daily with six trips of each train.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 16953

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**043011**

**MODERN RAILROAD ELECTRIFICATION AT MUSKINGUM**

Wefers, HJ, General Electric Company

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

ASME 70-RR-2, 1970, 8 pp

General aspects of railroad electrification. Discussion of the reason for a renewed interest in straight electric operation and modern economic aspects is followed by a comparison of modern diesel electric and straight electric locomotives. The performance capabilities, the apparatus and the control system of the electric locomotives. The locomotives' operation at Muskingum Electric Railroad with particular emphasis on the fully automated operations control system.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 49754

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**043012**

**MODERN RAILROAD ELECTRIFICATION**

Wefers, HJ, General Electric Company

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

Vol. 92, No. 9, Sept. 1970, pp 39-43

This article presents the economic analysis underlying purchase of two General Electric 5000 rail-hp locomotives for surface transportation use in coal mining operations. Also described is the extensive system automation, which includes train loading, unloading, and operation, and system regulation.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 04034

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**043013**

**ELECTRIFICATION OF THE PUGET SOUND LINES OF THE CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY**

Armstrong, AH

High Speed Ground Transportation Journal (International Society for Terrain-Vehicle Systems, Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 5, No. 2, 1971, pp 244-250

The author gives a brief account of the scope of the work to be undertaken on this, the most important of steam road electrifications. He gives a description of the power supply available, the cost of power to the railway company, the type of substation and rolling stock equipment, and the overhead construction to be adopted. It is of special interest to note that the trolley potential is to be 3000 v, which is the highest direct-current potential yet adopted in this country for railway work.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 33787

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**043014**

**ELECTRIFICATION PROTOTYPE**

Houser, FN

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 165, No. 19, Nov. 1968, p 20-20A-D

New coal-hauling Ohio industrial railroad uses commercial-frequency, high-voltage system; electric railroad was built by coal-producing subsidiary of American Electric Power System to link major surface mining operation with newly expanded Muskingum River generating station of Ohio Power; 25,000-v, 56-cycle electrification makes it unnecessary to have special railroad transmission lines; rectifier locomotive weighs 402,000 lb and has continuous tractive effort of 82,300 lb; car configuration was chosen to assure stability in operation.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 07621

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**043015**

**SURVEY OF WESTERN EUROPEAN AC ELECTRIFIED RAILWAY SUPPLY SUBSTATION AND CATENARY SYSTEM TECHNIQUES AND STANDARDS**

Ross, BA, American Electric Power Service Corporation

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. IGA7, N5, Sept. 1971, pp 66-672

British and Western European experience, design standards, and techniques associated with electrified railway power supply facilities are outlined. Aspects surveyed include utility supply to commercial frequency railway loads, substation design standards, catenary system design and maintenance, telecommunication and radio interference experience and suppression techniques, costs, and construction time.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 25451

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**043016**

**MEETING TOMORROW'S RAILROAD POWER REQUIREMENTS**

Ross, BA, American Electric Power Service Corporation

IEEE Transactions on Power Apparatus and Systems (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 90, No. 2, 70 TP 676-PWR, Paper, Mar. 1971, pp 393-400, 8 Ref

The railroad electrification is examined from the viewpoints of competitive position, load characteristic, service requirements and facility design. Summaries of foreign developments are presented. Potential electrified railway load magnitudes and characteristics are considered. Service techniques are recommended and possible characteristics for railroad substations, switching, and overhead power delivery facilities are presented. There are no insurmountable technical problems associated with servicing anticipated railway loads, and the electric locomotive's many benefits make it a strong competitor for moving tomorrow's trains.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 62505

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**043017**

**CATENARY SYSTEM AND POWER SUPPLY FACILITIES OF MUSKINGUM ELECTRIC RAILROAD**

Oliver, JA Ross, BA Cowal, AR Thompson, JS

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

1968, pp 307-318

Records from the 3rd Conference, IEEE Industry and General Applications Group, Sept. 29 to Oct. 3, 1968.

Transmission system, substation supply facilities, and protective relaying; overhead contact system is considered to be unique, and is described in more detail, including catenaries, messengers, contact wires, protection, etc; circuitry and design features.

**ACKNOWLEDGEMENT**

Engineering Index, EI 69 07287

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**043515**

**CENTRALIZED SUBSTATION CONTROL SYSTEM FOR THE SAN-YO SHIN KANSEN (CSC TYPE TEKKEN-H3)**

Itoh, K Hoshino, M

Railway Technical Research Institute (Japanese National

Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 13, No. 4, Dec. 1972, pp 213-219, 9 Fig, 1 Tab

Centralized substation control system type Tekken-H3 for the SAN-YO SHIN KANSEN was desined following the Tekken-H2 type system of the SHIN KANSEN. The features of design renewal and improvement are as follows. (1) System reliability is highly guaranteed and any error due to single failure of logical element is removed by expansion of answer-back collation loop. (2) Circuits of the control station logic can be tested on line (3) The message about the system disturbance and failure in the control or controlled station logic are printed out on typewriter and watt-hour data of the controlled station are punched out on papertape. For these purpose, so-called mini-computer (compact type computer) is used as the processing unit. (Author)

#### ACKNOWLEDGEMENT

Railway Technical Research Institute

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan

**043516**

#### DATA PROCESSING OF OVERHEAD CATENARY INSPECTION CAR

Sakaguchi, T Shimomae, T

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

Vol. 13, No. 4, Dec. 1972, pp 220-221, 3 Fig, 1 Tab

Data processing system using a mini-computer was employed on the overhead catenary inspection car. For the possible malfunctions caused by vibration and electric noise, some appropriate measures were adopted. At each pole position the processed data is typed out. In several field tests and practical use the system showed satisfactory results. Although some problems remain, the data processing system using a mini-computer and its on-line real time program proved to meet practical use.

#### ACKNOWLEDGEMENT

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
Repr PC: Req Price

**043780**

#### LATEST DEVELOPMENTS IN ELECTRIC RAILWAY SUBSTATIONS

Akai, M

Toshiba Review (Tokyo Shibaura Electric Compnay Limited, 1-1 Uchisaiwaicho, Chiyoda-k4, Tokyo, Japan)

No. 68, Apr. 1972, pp 7-12

Electric railway substations can be classified broadly into d-c substations and a-c substations. D-c substations using silicon rectifiers are simple to operate and highly reliable. In a-c electrification, the conventional booster transformer system is yielding to a newly-developed auto-transformer system. These substations are so-called unattended substations supervised and controlled from a control center. Lately, computer control of railway substations has been realized.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 020458

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**043781**

#### RECENT DEVELOPMENTS IN THE DESIGN OF OVERHEAD EQUIPMENT

Suddards, AD

Elektrische Bahnen (Verlag R. Oldenbourg, Rosenheimer Strasse 145, Munich 80, West Germany)

Vol. 43, No. 3, Mar. 1972, pp 59-69

Paper reviews some recent British developments in the design of overhead equipment systems and components. Although these developments have been related mainly to British Railways' equipment, many of them have also been applied to recent overseas schemes in Finland, India, Norway, Pakistan, South Korea and Yugoslavia.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 023480

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**044015**

#### 50 KV THROUGH THE ROCKIES

Fisher, GT

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 10, Oct. 1971, 4 pp, 3 Fig, 2 Phot

CP Rail has thoroughly probed the case for electrification of its transcontinental main line between Calgary and Vancouver. While the financial and operating implications require further study, the author, Director of Special Projects, feels that the balance of economic advantage is still moving in favour of electrification.

#### ACKNOWLEDGEMENT

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044018**

#### FINLAND ELECTRIFIES ITS FIRST MAIN LINE

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 4, Apr. 1971, 2 pp, 2 Fig, 1 Phot

With the Helsinki suburban electrification nearing completion, work is under way on conversion of the 346-km truck line to Seinajoki.

#### ACKNOWLEDGEMENT

British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044021**

#### TROLLEY-WIRE OVERHEAD APPEARS ON AN S.N.C.F. MAIN LINE

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 10, Oct. 1971, p 403, 2 Phot

On September 9th the SNCF switched over to electric traction the 38-km line between Bellegarde and Annemasse, just over the Swiss border from Geneva. This project could have profound implications for future electrification costs in countries where very high

speeds are not essential. The overhead consists of a single 107 sq mm copper contact wire supported only at structures spaced 63 m apart.  
**ACKNOWLEDGEMENT**  
 British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
 IPC Transport Press Limited, Dorset House, Stamford Street,  
 London SE1 9LU, England, Repr PC: R Price

**044025**  
**AUTOMATED BLACK MESA IS FIRST 50 KV RAILWAY**

Railway Gazette International (IPC Transport Press Limited,  
 Dorset House, Stamford Street, London SE1 9LU, England)  
 Vol. 129, No. 1, Jan. 1973, 3 pp, 2 Fig, 3 Phot

Apart from its primary interest as the longest fully-automated freight railway, the Black Mesa and Lake Powell Railroad in Arizona is the first line in the world to be electrified at 50 kV 60 HZ. This voltage has been adopted so that the 78-mile line can be fed from a single substation at one end, with consequent savings in installation and maintenance costs. Additionally the line is a prototype for 50 kV electrification schemes now being considered by a number of North American railways.

**ACKNOWLEDGEMENT**  
 British Railways Board

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 IPC Transport Press Limited, Dorset House, Stamford Street,  
 London SE1 9LU, England, Repr PC: R Price

**044035**  
**ELECTRIC OR DIESEL TRACTION—THE RIGHT BASIS FOR COMPARISON**

Nouvion, FF  
 Railway Gazette International (IPC Transport Press Limited,  
 Dorset House, Stamford Street, London SE1 9LU, England)  
 Vol. 127, No. 10, Oct. 1971, pp 377-380

The author points out that straight unit-for-unit economic comparisons are seldom valid because diesel traction can never offer the same level of service as electrification.

**ACKNOWLEDGEMENT**  
 British Railways Board

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 IPC Transport Press Limited, Dorset House, Stamford Street,  
 London SE1 9LU, England, Repr PC: R Price

**044037**  
**CURRENT COLLECTION AT HIGH SPEEDS**

Morris, RB  
 Railway Gazette International (IPC Transport Press Limited,  
 Dorset House, Stamford Street, London SE1 9LU, England)  
 Vol. 128, No. 5, May 1972, pp 176-178

One of the main technical limitations affecting high speed guided transport is the transmission of large amounts of electric power from the track to the vehicle through a sliding of rolling contact. The problem is primarily one of dynamics, and on the 300 to 400 km/h region the shorter and stiffer mechanical circuit offered by the conductor rail is likely to prove more attractive than a light catenary.

**ACKNOWLEDGEMENT**  
 British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
 IPC Transport Press Limited, Dorset House, Stamford Street,  
 London SE1 9LU, England, Repr PC: R Price

**044057**  
**CALCULATION OF THE OPTIMUM DISTANCE BETWEEN THE TRACTION CURRENT SUB-STATIONS OF ELECTRIFIED RAILWAY**

Miroschnitschenko, RI  
 Rail International (International Railway Congress Association,  
 17-21 rue de Louvain, 1000 Brussels, Belgium)  
 Vol. 3, No. 9, Sept. 1972, pp 484-492

The article describes a method for the calculation of the optimum distance between the traction current sub-stations of d.c. and a.c. electrified single and double track lines. The method is based on theoretical research, the analysis of completed railway electrification projects and studies of the working of existing electrified railway lines. The Scientific Research Institute as well as other Planning and Teaching Institutes participated in the working out of the method.

**ACKNOWLEDGEMENT**  
 British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
 International Railway Congress Association, 17-21 rue de  
 Louvain, 1000 Brussels, Belgium, Repr Req Price

**044058**  
**EQUIPMENT FOR THE CONTACT POINTS BETWEEN DIFFERENT ELECTRIC TRACTION SYSTEMS ON THE SOVIET RAILWAYS**

Lapin, VB  
 Rail International (International Railway Congress Association,  
 17-21 rue de Louvain, 1000 Brussels, Belgium)  
 Vol. 3, No. 9, Sept. 1972, pp 473-483

The present paper deals with problems of linking catenaries for 25 kV, 50c/s a.c. and for 3 kV d.c., respectively, and discusses the question whether, under the operating conditions prevailing on the Soviet Railways, it is preferable to separate the traction systems by switching over the catenary voltages at the stations or to use electric locomotives equipped for dual traction voltages. Each of these methods has its applications. A more detailed description is given of the method of alternative voltage feed to the catenary which has already been introduced at 17 stations and found to be fully practicable and reliable for the heavy train services largely concentrated on the principal railway arteries of the USSR.

**ACKNOWLEDGEMENT**  
 British Railways Board

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 International Railway Congress Association, 17-21 rue de  
 Louvain, 1000 Brussels, Belgium, Repr Req Price

**044512**  
**SOUTHERN MAY ELECTRIFY 338 MILES**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
 Broadway, New York, New York, 10013)  
 Vol. 174, No. 8, Apr. 1973, p 8

Southern Railway System is considering a \$200-million project to electrify a 338-mile line between Cincinnati and Chattanooga. If undertaken, the plan would be the biggest rail electrification project since the former Pennsylvania converted its lines between New York, Washington and Harrisburg, Pa., in the 1930's. Disclosed in a laconic one sentence in the road's annual report, the Southern project is currently the subject of discussions between the carrier and General Electric and three utility companies. According to Southern Executive Vice President L. Stanley Crane, the electric utilities—TVA, Kentucky Utilities Co., and Cincinnati Gas and Electric—would make the necessary capital investment to build and maintain the overhead wire



system, while the railroad pays for the electricity.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: Req Price

**044520**

**POWERLINE FOUNDATIONS INSTALLED ALONG  
RAILROAD TRACKS**

Chapman, RS, Blakeslee (CW) and Sons, Incorporated

Civil Engineering (American Society of Civil Engineers, 345 East  
47th Street, New York, New York, 10017)

Oct. 1972, pp 64-66, 5 Fig

When the only practical location for a transmission line for the Connecticut Light & Power Co. was along the heavily traveled main line tracks of the Penn Central Railroad, the contractor had to solve a series of construction problems for the tower foundations. The solution to these problems (provide adequate support for operating railroad tracks; keep relocation of railroad facilities; minimize access problems for equipment, and minimize blasting costs) were found in the use of varied installation techniques and low cost foundations.

**ACKNOWLEDGEMENT**

Civil Engineering

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
American Society of Civil Engineers, 345 East 47th Street, New  
York, New York, 10017, Repr PC: Price

**044560**

**LOCOMOTIVES: A SHIFT IN THE BALANCE OF POWER?**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 35-36, 4 Phot

Based on a paper contributed by the ASME Rail Transportation  
Division.

For the first time in four decades of dieselization, railroads are encountering real fuel difficulties. As an answer to that problem, electrification has been investigated by quite a few railroads, and soon, the world's first 50,000-volt alternating current electric locomotive will be ready to operate on the continent's newest electrified line in Northeastern Arizona. The 50-kv commercial-frequency AC system, which is being pioneered by GE, could well be a prototype for the system that would be applied to western lines. In the east, railroads would probably be electrified with 25-kv. The new 50-kv technology makes possible fewer substations and utilizes thyristor-controlled electric locomotives. The solid-state control and rectification equipment makes possible high-capacity freight locomotives. The 50-kv also involves a low cost catenary system.

**ACKNOWLEDGEMENT**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

041225

**THE ST. LOUIS-SAN FRANCISCO TRANSCONTINENTAL RAILROAD**

Miner, HC

Kansas University Press, 358 Watson Hall, Lawrence, Kansas, 66044

236 p, p

The book's subtitle, "The Thirty-Fifth Parallel Project, 1853-1890," indicates the aspirations of organizers of the pioneer company. The goal was establishment of a snow-free route to the coast followed by a push north to San Francisco. Five different railway corporations attempted to do this between 1850 and 1890; all failed due to accidents of timing, faulty administration, labor troubles, fickle public sentiment and apparently the whims of fate. Santa Fe took control of the Frisco in 1890 and itself went into receivership in 1893. In the reorganization, Santa Fe retained A&P's Western Division which is today the Santa Fe main line across New Mexico and Arizona. Some years previously Frisco had been forced to relinquish the land grants that had led to the building of this isolated western section.

**ACKNOWLEDGEMENT**

Railway Age

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Kansas University Press, 358 Watson Hall, Lawrence, Kansas, 66044, Repr PC: \$8.50

041302

**LOCOMOTIVE CYCLOPEDIA 1941**

Kalmbach Books, 1027 North Seventh Street, Milwaukee, Wisconsin, 53233

1300 pp

This Cyclopeda was edited by Roy Wright, Dept. RLC, and announced in Railway Locomotives and Cars, V146, N4, April 1972.

This historical Simmons-Boardman publication has just been reprinted by special arrangement. More than 1300 pages and all color plates are reproduced with great fidelity. Says Kalmbach Books: "This is an edition as faithful to the original as modern printing technology can make it." The big blue volume portrays the first road-freight diesels and marks the introduction of mass-production diesel electrics for passenger and switching service. Because 1941 was a year of real motive-power transition, most of the book portrays the culmination of development of the steam locomotive. Kalmbach's Dave Morgan observes that "as a reference for locomotive history and development, the 1941 Cyc sets the standard".

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Kalmbach Books, 1027 North Seventh Street, Milwaukee, Wisconsin, 53233, Orig HC: \$40.00

019385

**U.S. FOREIGN TRADE. WATERBORNE EXPORTS AND GENERAL IMPORTS**

Bureau of the Census, /Department of Commerce, Washington, D.C., 20233

1971

12 Issues, FT-985-71-1 to FT-985-71-12 published in 1971 are available at the yearly rate of \$3.00 including series FT-900 and FT-975

The report presents data on shipping weight and value of U.S. waterborne exports, outbound intransit merchandise and shipments of Department of Defense (DOD) controlled cargo and 'special category' non-Department of Defense controlled cargo; U.S. general imports and inbound intransit merchandise moving on dry cargo and tanker vessels by customs district and port of lading/unlading. Data on shipping weight are shown for waterborne exports, general imports, and Department of Defense (DOD) controlled cargo and 'special category' non-DOD controlled cargo by trade area, U.S. coastal district, type of service and U.S. flag. Detailed figures are for the current month; summary figures are given for previous months for comparative purposes. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-71-50214

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Bureau of the Census, /Department of Commerce, Washington, D.C., 20233, Repr PC: \$0.10  
COM-71-50214

019565

**TRANSOCEANIC CARGO STUDY. FORECASTING MODEL AND DATA BASE. VOLUME I**

Planning Research Corporation, 1100 Glendon Avenue, Los Angeles, California, 90024

Vol. 1, T8-498, Final Rpt, Mar. 1971, 555pp, 30 Fig, 99 Tab, 163 Ref

Contract DOT-OS-A9-024

This is the first of three volumes presenting the results of the Transoceanic Cargo Study. It presents the three methodologies used for effecting the forecasts: exponential smoothing and trend extrapolation, functional forecasting, and share-of-the-market forecasting. The establishment of the trade histories and histories of the appropriate explanatory variable are described. Updating procedures are established. Forecast results of Transport Homogeneous Groups are presented. Special "trades" (the assistance programs of Food for Peace, AID and Military Assistance programs, Hawaii, Alaska, Puerto Rico, and logistics support of U.S. forces abroad) are treated in terms of establishment of histories, development of forecasting or assessment techniques, and documentation of forecasts where applicable.

**ACKNOWLEDGEMENT**

Planning Research Corporation

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-201040

019567

**TRANSOCEANIC CARGO STUDY. VOLUME III. COMPUTER PROGRAM DOCUMENTATION: DEMAND FORECASTING MODEL AND DISTRIBUTION COST AND PRODUCTION MODEL**

Planning Research Corporation, 1100 Glendon Avenue, Los Angeles, California, 90024

Vol. 3, T8-498, Mar. 1971, 305pp, 23 Fig, 17 Tab

Contract DOT-OS-A9-024

This report documents the computer programs of the demand forecasting models and cost model of the Transoceanic Cargo Study, and provides a guide to the user of these programs. The following topics are covered: overall program organization and design specification, giving the general description of the functions and operations of each computer program and subprogram; the subprogram design specifications, providing the detailed design for each subprogram; the acceptance test specification, providing the structure and design of the testing activity; the coding specifications, containing the detailed flow diagrams of each subprogram and subprogram listings; the computer operator's manual, containing the procedures enabling the computer operator to load and run the programs; the computer programmer's manual containing the information required by the computer programmer for the maintenance and modification of the programs.

**ACKNOWLEDGEMENT**

Planning Research Corporation

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-201042

019628

**TECHNOLOGICAL FORECAST OF MARINE TRANSPORTATION SYSTEMS 1970 TO 2000**Moore, CG, University of Southern California  
Pomrehn, HP

Society of Naval Architects and Marine Engineers, 74 Trinity Place, New York, New York, 10006

Feb. 1971, 78pp, 30 Fig, 6 Tab, 37 Ref

Presented at Los Angeles Section of the Society of Naval Architects and Marine Engineers.

The subject of this investigation and technological forecast is the commercial marine transportation system of the United States. The U.S. Marine Transportation Industry is portrayed within a time frame extending from 1970 to the year 2000. The authors have utilized a spectrum of technological forecasting methods and techniques that appear to be most appropriate for ocean transport systems. A general overview of the environment and major evolutionary elements of the marine transportation system over the next 30 years is presented in Section 1. In Section 2, industry needs are developed utilizing a combination of trend extrapolation, envelope curve, and figure of merit techniques. Section 3 represents an investigation of the limits of existing technologies and possible new developments. Figure of merit and envelope curve forecast methods were utilized. Also, the Delphi forecast method was used with a group of limited size and varied marine technology experience. The technique of relevance and project weighting was used in Section 4 to integrate the needs forecast and the technological forecast. A preliminary development schedule of the major projects that could contribute toward the United States again becoming a leading maritime nation is also presented in Section 4. An integrated planning and development management system is suggested to ensure cost-effective and coordinated progress in the sociopolitical as well as the technical programs.

**ACKNOWLEDGEMENT**

Society of Naval Architects and Marine Engineers

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

SNAME, Repr PC: Req Price

032627

**A FORECAST OF 1970-1985 WORLD SHIPPING**Wiederkehr, RRV  
Deltenre, J

Saclant ASW Research Centre, La Spezia, Italy

SACLANTCEN-TR-199, Sept. 1971, 75pp

As part of a study on the future use of shipping in the North Atlantic by NATO nations, the numbers, average speeds, average tonnages, fleet capacities, annual trade (tonnage transported) and fleet productivity (cargo tons per deadweight ton) of merchant shipping in the world has been forecast up to 1985. For this purpose the ships are divided among four classes: tankers, bulk carriers, container ships and other cargo ships. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-731015

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
AD-731015

032179

**TRENDS AND FORECASTS OF DEVELOPMENT IN WORLD TRANSPORT**

Earle, C

ICHCA Journal (International Cargo Handling Coordination Assn, Trade News Ltd, Abford House, 15 Wilton Road, London SW1V 1LX, England)

Jan. 1971, 6 pp

Review of world advances in international cargo handling by an interconnected transportation network is presented. Control and documentation of transport containers and other packaging is discussed. Economic pressures, mechanization, growth in volume, barge carrying vessels and the port interface are viewed in light of newly developing door to door freight handling. Air freight is interrelated.

**ACKNOWLEDGEMENT**

Engineering Index, EI-72 01974

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

032698

**TRADE FORECASTING**Wing, JF, Booz-Allen Applied Research, Incorporated  
Hillman, JF

Society of Naval Architects and Marine Engineers, 74 Trinity Place, New York, New York, 10006

May 1972, 15 pp, 28 Ref

Presented at Spring Meeting of SNAME, Williamsburg, Va.

This paper presents basic principles for the forecasting of ocean trade movements. These methods include trend extrapolation, in-depth economic analysis, input-output analysis, and methods based primarily on the judgment of experts. The strengths and weaknesses of each in terms of accuracy, cost, time, and data required are discussed and data sources for the preparation of trade forecasts are given. Two examples are presented: twenty-five year forecasts of U.S. wheat exports, and imports of bauxite and alumina. These forecasts were used for fleet planning.

**ACKNOWLEDGEMENT**

Society of Naval Architects and Marine Engineers

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SNAME, Repr PC: Req Price

032745

**THE IMPACT OF THE SUPER-CARRIER UPON OCEAN CARGO FLOWS, ROUTES AND PORT ACTIVITY**

Bruffey, JA

New York State University, Oswego, Oswego, New York

PhD Thesis, Aug. 1971, 195pp, 43 Tab

The effects of the super-carrier innovation upon ocean cargo flows, routes, and port activity are examined in this study. Because of their size these vessels require abundantly flowing cargo sources. This and the locations of market demand have a strong bearing on super-port locations. Super-carrier terminals have been developed at certain favored physical sites, sometimes to the detriment of important traditional ports. From the physical need for deep water, super-carrier use has also required certain route changes and an increase in transshipment except where modifications of natural constraints can be economically realized. From analyses of trends in size, construction costs, and characteristics of world fleets, recent shipbuilding records and records of the heavy volume of bulk cargo now moving in large vessels, the super-carrier with its greater cargo capacity, high degree of automation, and functional specialization has proved more economical to construct, operate, and maintain than scaled smaller bulk carriers. For the super-ships themselves, routes are restricted by the locations of sufficient cargo potentials and the still-limited number of adequate super-ports. Major super-carrier routes are few in number, but heavily used. However, with larger single vessel cargo capacities, the actual number of vessel voyages has increased far less than cargo tonnages. Financial and technical burdens have been placed on many conventional ports by vessel requirements for harbor depth and area as well as for sophisticated facilities. While some ports are specializing in accommodation of other forms of shipping, private corporations are still developing special terminals for super-carriers at new locations. Despite sometimes difficult physical obstacles, these developments are undertaken near important supply and demand areas. Economic, political, or social objectives are at least as important as natural port possibilities. Super-carrier innovation appears to encourage port specialization, and considering development costs and new environmental concerns, discharge duplication of facilities. Development of super-carriers has modified the geography of ocean shipping; these modifications can be expected to continue, perhaps at a diminishing rate as problems of giant vessel size and "over-specialization" become more acute. Trade has been stimulated, route patterns changed, and port functions altered. The relative infancy of the super-carrier concept implies that geographical patterns are being restructured; however, ocean trading patterns are characteristically dynamic, owing to the mutable nature of marine technology and the fluidity of supply and demand circumstances.

**ACKNOWLEDGEMENT**

New York State University, Oswego

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan, 48106

034733

**THE IMPACT OF MARITIME CONTAINERIZATION ON THE UNITED STATES' TRANSPORTATION SYSTEM. VOLUME 1. EXECUTIVE SUMMARY**

Manalytics, Incorporated, 625 Third Street, San Francisco, California, 94107

Vol. 1, 43pp

Contract C-1-35494

See also Volume 2, COM-7210406, MRIS #34734.

The report represents the second phase of an earlier study entitled 'The Impact of Containerization on the U.S. Economy' (N.T.I.S. numbers COM-71-00050 and COM-71-00051). The executive summary gives synopsis of the main body report which describes

various effects that containerization has had to date and might have in the future. The topics covered include: forecasts of container fleets, container trade, and container port capacities; a description of a computer analysis model; and a projection of trends in containerization.

**ACKNOWLEDGEMENT**

Maritime Administration

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COM-72-10405

034734

**THE IMPACT OF MARITIME CONTAINERIZATION ON THE UNITED STATES TRANSPORTATION SYSTEM. VOLUME 2. MAIN BODY**

Manalytics, Incorporated, 625 Third Street, San Francisco, California, 94107

Vol. 2, 339pp

Contract C-1-35494

See also Volume, 1, COM-72-10405, MRIS #34733.

The report represents the second phase of an earlier study entitled 'The Impact of Containerization on the U.S. Economy' (N.T.I.S. numbers COM-71-00050 and COM-71-00051). The main body report describes various effects that containerization has had to date and might have in the future. The topics covered include: forecasts of container fleets, container trade, and container port capacities; a description of a computer analysis model; and a projection of trends in containerization.

**ACKNOWLEDGEMENT**

Maritime Administration

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NTIS, Repr PC: \$6.00, Microfiche: \$0.95

COM-72-10406

035049

**CAR/BULK CARRIERS: THEIR IMPACT ON THE FREIGHT MARKET**

Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England

Dec. 1971, 53pp

With one in ten of the world's bulk carriers between 10,000 and 40,000 D.W.T. capacity committed to carrying cars or commercial vehicles to North America, etc., returning to Western Europe or Japan with back-haul cargoes of grain, coal, etc., the car/bulk carrier is a potential source of weakness in an already depressed freight market. There are almost 4.5 million D.W.T. of bulk carriers and tramps regularly employed to transport cars over the longer ocean routes and because of their trading pattern, normally compete for return cargoes in the principal North American trades, exerting a strong influence on the course of rates. The emergence of such a large fleet of specialized ships, the majority of which are car/bulkers specially built or converted for the purpose, to carry cars and commercial vehicles, has taken place against the background of an expanding world trade in cars and in this report, the second in a series from H.P. DREWRY (SHIPPING CONSULTANTS) LIMITED, recent trends in car production and exports are featured. The second part of the report takes a detailed look at the composition of the car/bulk fleet, information of age, size, car carrying capacity, ownership, conversion and newbuilding costs, order book, etc. being featured in both tables and text. Supplementary data is offered by the APPENDIX, which lists all the ships in the fleet. The report concludes with an examination of the trading pattern of car/ bulk carriers in order to assess their impact on the dry cargo market and identify the trades in

which they exert the strongest influence on rates.

**ACKNOWLEDGEMENT**

Drewry (HP) (Shipping Consultants) Limited

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England, Rep PC: Req Price

035050

**COMBINED CARRIERS: THEIR ROLE IN THE BULK TRADE**

Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England

Oct. 1971, 41pp

Combined carriers constitute one of the fastest growing segments of the world bulk fleet, with some 25 million D.W.T. scheduled to commence trading between now and 1975. The existing fleet of ore/oil and bulk/oil ships represents at least 10% of available crude oil carrying capacity and, although its rapid growth has had less impact on the dry bulk market, it is vital to evaluate the future role of the dual-purpose carrier in both its markets. In this report, the first of a series to be prepared by H.P. DREWRY (SHIPPING CONSULTANTS) LIMITED for the benefit of the world shipping industry, the existing fleet of combined carriers is analysed and future changes in its composition projected from the current order book. The second part of the survey is concerned with the existing trading pattern and is based on an exhaustive survey of the fleet's performance over a period of a year. Developed to operate in two-way or triangular trades, hauling crude oil or dry bulk cargoes alternately, the combined carrier has been in existence long enough to draw certain conclusions from the pattern of employment. The report concludes with an examination of future trading possibilities and whether these will call for larger vessels than those in service or on order. Finally, all known period oil commitments are shown in the APPENDIX, which lists the fleet in order of D.W.T. size.

**ACKNOWLEDGEMENT**

Drewry (HP) (Shipping Consultants) Limited

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Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England, Rep PC: Req Price

035051

**BAUXITE AND ALUMINA: A CHANGING PATTERN OF SEABORNE TRADE**

Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England

Apr. 1972, 47pp

While the raw materials employed in aluminium production— which are bauxite and an intermediate product, alumina—are not comparable to iron ore and other steelmaking materials in terms of the quantities moving in international trade, the tonnages shipped are still large at approximately 35 million tons annually. Taken together, bauxite and alumina rank fourth among the bulk commodities in seaborne trade, although the two differ greatly in bulk, in density and in handling characteristics. Originally, virtually all this raw material was received in the form of bauxite, but as the developing countries in which mining takes place have sought to increase their revenue and transport costs have risen, conversion to alumina has been increasingly carried out at source. Since the mid-1960's, alumina shipments by sea have quadrupled, rising to over six million tons in 1971. Since a little more than four tons of bauxite (which stows at around 35 cubic feet/ton) is required to produce two tons of alumina, the establishment of alumina capacity at or near major sources of bauxite supply in the Caribbean, Australia, etc. would, at first sight, appear to reduce demand for bulk shipping. In practice, average trading distances are increasing for both bauxite and alumina and will continue to do so now that Australia has emerged as the largest

supplier. Changes in the supply pattern are reviewed in this, the fourth in a series of reports from H. P. DREWRY (SHIPPING CONSULTANTS) LIMITED, which also includes a comprehensive survey of existing bauxite and alumina producing facilities. The first part, which is concerned with the past development of world trade in bauxite and alumina, also outlines recent trends in aluminium production. The fact that the aluminium industry is passing through one of its periodic crises of over-capacity ought not to obscure the prospects for continued strong growth in the second half of the 1970's. Control of raw material sources through integration—sometimes referred to as "going basic"—has always been a feature of the industry and, in the second part of the report, the operations of individual producers are detailed to show how the industry's structure affects the movement of raw materials. Reference is also made to planned additions to bauxite and alumina capacity to provide background to the projections of seaborne trade contained in the third section of the report. This also provides information on ship sizes, loading terminals, etc., all vessels regularly employed in the bauxite/alumina trades being listed in an appendix. Freight rates and the demand for bauxite/alumina tonnage are discussed in the final section.

#### ACKNOWLEDGEMENT

Drewry (HP) (Shipping Consultants) Limited

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Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England, Rep PC: Req Price

#### 035052

#### SEABORNE IRON ORE TRADE AND TERMINAL DEVELOPMENTS

Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England

May 1972, 57pp

Iron ore is easily the most important dry bulk commodity in international seaborne trade and changes in the volume and direction of seaborne iron ore movements have a profound influence on shipping demand and ship sizes. The present study, which has been prepared by the Research Division of H. P. DREWRY (SHIPPING CONSULTANTS) LIMITED for subscribers to its report series, surveys the current seaborne trade pattern and from an in-depth review of the capabilities of the producing countries and the projected requirements of the main consuming areas, forecasts trends to the mid-1970's. The medium-term forecasts, which are based on considerations like increases in productive capacity, existing ownership links, proximity to consuming centres, long-term supply contracts, shipping developments, etc., also take into account steel production trends, as well as the established pattern of trade. A heavy investment is being made in port facilities to permit the berthing of very large ore carriers and throughout the report particular emphasis is placed on terminal developments and the provision of deeper berths and high-capacity loading/unloading equipment as these will strongly influence the future iron ore trade pattern. The principal features of the seaborne trade pattern, as it evolved in the years 1969, 1970 and 1971, are identified in PART I. Tonnage movements are quantified and compared and the requirements of the importing countries analysed. PART II looks at the export capabilities of the producing countries, which are grouped according to their main market, in order to project future trade volumes to 1975. Information is presented on the past distribution of exports, mining developments, etc. in order to assess the importance of individual producing countries and their competitive strength. The projected import requirements of the three main consuming areas—Western Europe, the United States and Japan—are summarized in PART III, which also examines steel industry trends and the capacity of the principal iron ore unloading ports.

#### ACKNOWLEDGEMENT

Drewry (HP) (Shipping Consultants) Limited

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Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England, Rep PC: Req Price

#### 035053

#### THE OUTLOOK FOR WORLD GRAIN TRADE

Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England

June 1972, 36pp

The term "grain" used in this report comprises wheat, maize, oats, barley and rye, but excludes rice, sorghum, millet and soya beans. The report will attempt to examine the existing pattern of world demand and world supply and indicate the probable future changes in this pattern and the effects of such changes on shipping. Seaborne grain trade is third in importance of the major bulk commodities and accounts for approximately 8% of the total dry cargo shipments, but its real importance lies in its effects on the tramp voyage chartering market where it has accounted for, on average, about 55% of total bookings throughout the 1960's. The existing and future demand pattern is reviewed in PART I of the study, which examines the factors influencing demand in developed and developing countries and projects trends to the mid-1970's on the basis of varying growth rates. Supply considerations are treated in PART II, a comprehensive survey of world production illustrating how rapidly the supply situation is changing, particularly in developing countries. The attainment of self-sufficiency is already influencing grain trading while it is essential to recognise the importance of the "green revolution". Finally, PART III attempts to reconcile probable changes in the demand pattern on shipping requirements.

#### ACKNOWLEDGEMENT

Drewry (HP) (Shipping Consultants) Limited

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Drewry (HP) (Shipping Consultants) Limited, 87/91 New Bond Street, London W1Y 9LA, England, Rep PC: Req Price

#### 035244

#### A DEEPWATER PORT ANALYSIS DELAWARE RIVER BAY

Delaware River Port Authority, World Trade-Division, Public Ledger Bldg, Independence Sq, Philadelphia, Pennsylvania, 19106

May 1972, 35 pp, 7Ref

There are fifty-two ports around the world which are capable of handling bulk tankers and carriers greater than 150,000 dwt. The United States has no such ports. If the United States is to remain competitive with the rest of the world, then deepwater port facilities must be provided so that our industries receive the most competitively priced raw materials. The ideal location for an East Coast deepwater port would be within the lower Delaware Bay. At this location a deepwater transshipment terminal capable of handling shipping to 90' in draft should be built. This transshipment terminal would be connected to the mainland by a causeway and it would be a distribution center for the imports of oil and iron ore and exports of coal and grain. The products would be distributed from this transshipment terminal by pipelines, conveyor belt systems, oceangoing barges and fast unit trains. This transshipment terminal is vital for the protection of the heavy concentration of industry which presently exists in the Greater Delaware Valley. These would be the steel, oil, shipbuilding, building materials and chemical industries. In addition, a transshipment terminal within the lower Delaware Bay would serve our national interest by enabling our inland steel producing states, our coal producing states, our grainary states to remain more competitive because of the transportation economies of large bulk carriers. A deepwater transshipment terminal within the lower Delaware Bay would add substantially to the economic and the environmental quality of the entire Delaware River Basin.

#### ACKNOWLEDGEMENT

Delaware River Port Authority

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Delaware River Port Authority, World Trade-Division, Public Ledger Bldg, Independence Sq, Philadelphia, Pennsylvania, 19106, Repr PC: Req Price

035925

**CONTAINER AND ROLL-ON PORT STATISTICS GREAT BRITAIN 1971, PART I**

National Ports Council, 17 North Audley Street, London W1Y 1WE, England

July 1971, 39 pp

Annual publication providing comprehensive statistics of the total container and roll-on traffic passing through British ports in 1970. Detailed statistics on traffic by types of unit, service and country are given. Individual port details are also included where this does not involve disclosing information affecting individual operators.

**ACKNOWLEDGEMENT**

National Ports Council

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**National Ports Council, 17 North Audley Street, London W1Y 1WE, England, Repr PC: \$3.60  
SBN 901058173

039062

**INTERCITY FREIGHT TRANSPORTATION REQUIREMENTS OF THE WASHINGTON-BOSTON CORRIDOR IN 1980**

United Research, Incorporated, Cambridge, Massachusetts

Final Rpt, Nov. 1963, 243 pp

Contract Cc6224ct

The purpose of this research is to study the intercity freight transportation requirements of the Washington-Boston Corridor in 1980, and the improvements required in transporting commodities through and within the corridor by land, water and air. The study objectives are (1) to estimate in terms of traffic flows, the current total demand for intercity freight commodity transportation existing in the corridor; (2) to describe in qualitative terms the commodities making up these traffic flows; (3) to show how the current demand for commodity freight transportation is being met today; (4) to identify and establish a relationship between significant economic and sociological factors and levels of transportation demand; (5) to identify significant changes in these relationships which may occur in the future as a result of technological innovation; (6) to project the economic and sociological demand factors in 1980; (7) to forecast for 1980, total intercity freight transportation demand (as expressed in terms of traffic flows); (8) to allocate this total commodity flow to the various modes on the basis of foreseeable intermodal competitive relationships; (9) to identify and describe the economic and technical characteristics of the various ways and vehicles which may be made available to freight carriers by 1980; and (10) to describe the methodology by which the cost and technical characteristics of ways and vehicles could be related to possible future demand characteristics.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-166885

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-166885

039197

**STUDIES ON THE DEMAND FOR FREIGHT TRANSPORTATION, VOL. 1**

Mathematica Incorporated, Princeton, New Jersey

Vol. 1, Aug. 1967, 263 pp

Contract DC-7-35120

The volume is devoted to the estimation of freight demand in the Northeast Corridor. It is argued that a mode of freight transportation should be considered in terms of its abstract attributes, and the

demand for freight transportation is analyzed in inventory theoretic terms. A macro-economic approach to the matter provides a more complete micro-model designed for descriptive, as well as forecasting, purposes. The grand total demand for freight transportation at the macro-level is estimated at the first stage on the basis of the values of exogeneous variables; then, at the second stage, the total is sub-divided with the aid of some specifically pertinent variables. In the third stage, the second stage sub-totals are again sub-divided with the aid of still other specific variables, etc. The interdependence of macro-totals on sub-totals is exploited as a part of the estimation technique. The data requirements provided can be useful in developing data banks or future statistical system for the Department of Transportation. A more current data requirements list is also provided. A novel technique for estimation of origin-destination data on freight movements using incomplete information is presented.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176479

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-176479

039267

**NETWORK CONTROL STUDY**

Boyd, RK Bogert, LR Kan, IF

TRW Systems Group, McLean, Virginia, 22101

06818-W019-RO00, Final Rpt, July 1970, 103 pp

Contract DOT-C-353-66

The usefulness of a ground transportation system controlled by synchronous techniques would be severely limited if occurrences such as link blockage, reduced operating velocity or equipment failures could be accommodated only by loss of system-wide synchronism. Consequently, this study examined in depth the strategies and techniques which could accommodate a wide range of real life problems. It was found that excellent accommodations could be made for all types of problems, thus assuring the efficacy of the synchronous approach to traffic management. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-199124

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-199124

039326

**DOMESTIC SHIPPING INDUSTRY AND MARITIME POLICY**

Sansone, WT, Maritime Administration

Oct. 1972, 33 pp

Presented at the Chesapeake Section of SNAME.

Despite its vast importance to the U.S. transportation network and the fact that its vessels transport 400 million more tons than all of the vessels engaged in our foreign trade, the domestic shipping industry has always appeared curiously remote from any connection with shipping and the sea, an idea enhanced by its tug-barge approach, which, although its fleet included almost one million tons of barges over 10,000 deadweight tons, still seems to those familiar with deep sea trading purely a "sand and gravel" operation. However, appearances are deceptive, for the domestic fleet transports almost 25 percent of the total intercity ton miles of freight in the United States and is, because of the highly developed nature of our waterways network, best able to meet the growing transportation crisis that is facing this nation. The domestic trades have provided the impetus for the development of containerization and super tug-barge vessels and continues to provide the major raison d'etre for the U.S.

tanker fleet. Additionally, domestic vessels employ 70,000 more American seamen than its sister fleet engaged in our foreign commerce. This paper analyses the major components of the domestic merchant marine and sketches the background behind a major shift in maritime policy as well as the major domestic shipping program elements, as established at the National Planning Conference on Domestic Shipping in May 1972.

#### ACKNOWLEDGEMENT

Maritime Administration

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**039360**

#### TRANSPORTATION TECHNOLOGY FOR DEVELOPMENT. VOLUME I

Cheaney, ES    Leis, RD    Landreman, DM

Battelle Memorial Institute, Columbus Laboratories, Columbus,  
Ohio

Feb. 1968, 488p

Contract AID/csd-762

See also Volume 2, PB-210593.

This report provides background information on the technology of various transportation modes and their capabilities. It is intended primarily for use by economists, program officers, general engineers, and others in the economic development field. Information is included on the broad capacities of particular modes to handle freight and passenger traffic; major features and the advantages and limitations of each mode in terms of technical capabilities; levels of technological sophistication that can be adopted within each mode; and the 'inputs' of right-of-way preparation and construction, materials, vehicles, equipment, maintenance, and manpower required at each level to produce an 'output' of transport service. Volume One contains sections on: Intermodal factors of choice in transportation; highway transportation; railway transportation; conventional air transportation; V/STOL aircraft; inland waterway transportation; oceanway transportation; pipeline transportation; and intermodal freight exchange.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-210592

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**039370**

#### RAIL, BUS, AND OTHER CARRIERS

Middle Georgia Area Planning Commission, Macon,  
Georgia    HUD-CPA-GA-04-00-016

MGAPC-71-04, Final Rpt, Mar. 1972, 182p

The report contains a capacity and use survey and analysis of all rail, bus, pipeline, truck, river, and taxi forms of transportation in the Middle Georgia region. An inventory of all existing routes, mainlines, points of interchange, passenger and freight terminals and classification yards has been made and is included in this report. In addition, a general assessment is made of the potential development and overall impact of the proposed Ocmulgee River Barge Canal.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211195

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**039831**

#### MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES. VOLUME I. SUMMARY.

Pardee, FS    Phillips, CT    Smith, KV

Rand Corporation, Santa Monica, California

RM-6324-DOT-VOL-1, Aug. 1970, 56p

Contract DOT-FR-9-0054

Development of Methodology for evaluating potential benefit of alternative transportation proposals for regions. Volume 1.

#### ACKNOWLEDGEMENT

National Technical Information Service, N71-3445

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N71-3445

**039832**

#### MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES. VOLUME 2. METHODOLOGY.

Pardee, FS    Phillips, CT    Smith, KV

Rand Corporation, Santa Monica, California

RM-6324-DOT-VOL-2, Aug. 1970, 137p

Contract DOT-FR-9-0054

Development of methodology for evaluating transportation service with emphasis on effectiveness of the systems. Volume 2.

#### ACKNOWLEDGEMENT

National Technical Information Service, N71-3446

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N71-3446

**039833**

#### MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES. VOLUME 3 EXAMPLE

Pardee, FS    Phillips, CT    Smith, KV

Rand Corporation, Santa Monica, California

RM-6324-DOT-VOL-3, Aug. 1970, 148p

Contract DOT-FR-9-0054

Development of methodology for evaluating alternative proposed changes to mix of transportation modes in the northeast corridor of the United States. Volume 3.

#### ACKNOWLEDGEMENT

National Technical Information Service, N71-3447

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N71-3447

**039845**

#### TRANSPORTATION TECHNOLOGY FOR DEVELOPMENT. VOLUME II

Cheaney, ES    Leis, RD    Landreman, DM

Battelle Memorial Institute, 505 King Avenue, Columbus, Ohio,  
43201

Vol. 2, Feb. 1968, 265p



Contract AID/csd-762

See also Volume I, PB-210 592.

The second volume of the transportation technology for development study contains sections on: Aerial tramway transportation systems; beltway (endless moving belt) transportation systems; monorail transportation systems; air cushion (or ground effect, surface effect) vehicle transportation systems; hydrofoil transportation systems; special purpose vehicles (i.e., those capable of moving over terrain away from established route networks); new power sources and their effect on transportation technology; external technological factors (food production, water supply, mining and mineral processing, petroleum production, power generation) and their influence on transportation needs.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-210593

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PB-210593

039885

#### TRANSPORTATION SYSTEMS FOR MILITARY AND CIVILIAN OPERATIONS IN NORTHERN REGIONS

Sumner, NRJ Alper, S Girard, EW Villu, A

Research Analysis Corporation, McLean, Virginia RAC-011.618

RAC-TP-450, Tech Paper, June 1972, 130p

Contract DAHC19-69-C-0017

The report examines the performance and cost of various transportation systems in the northern (Arctic) environment. The scenarios used include both civilian and military transportation problems, and the study explores some of the relationships among these in an Alaskan environment. Systems examined include such conventional systems as railroads, trucks, boats, and tracked vehicles, plus more advanced systems as fixed- and rotary-wing aircraft and surface effect vehicles (SEVs). In addition to these comparative analyses, certain specific issues are examined in some detail. Included in such issues are the economics of using SEVs as transitional vehicles in undeveloped regions, prior to investment in roads and railroads, the potential utility of a SEV-helicopter team in search and rescue missions, and the relationship between transportation and Alaskan development. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, AD-743990

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040608

#### CONNECTICUT MASTER TRANSPORTATION PLAN-1972

Connecticut Department of Transportation, Bureau of Planning and Research, Hartford, Connecticut

Dec. 1971, 78p

The report discusses the effort being expended in the refinement of a more balanced approach to the development of a better integrated transportation system for Connecticut. It summarizes capital improvement costs for each mode based on preliminary cost estimates using 1971 prices. Most important, the report emphasizes the fact that the development and implementation of a comprehensive integrated transportation plan is the responsibility of all levels of government and encourages governmental and non-governmental agencies to involve themselves in this effort.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-208394

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PB-208394

040965

#### INDUSTRIAL DEMAND FOR SULFUR AND ALTERNATIVE INPUTS

Hee, O

American Inst of Mining, Metallurg & Petrol Engrs, 345 East 47th Street, New York, New York, 10017

OP 83-72, Proceeding, June 1972, pp 103-112

Notification of this article, Proceedings from the Council of Economics, AIME, appeared in the Bureau of Mines--New Publications, June 1972, Monthly List 686.

Historical time series show that industrial uses for sulfur exhibit diverse trends and significant fluctuations. A plausible reason for this behavior of industrial demand is the presence of alternative inputs used to replace sulfur. On the other hand, sulfur may replace existing inputs used by respective industries because of a more favorable relative price or because of its superior qualities. This study makes use of regression analysis to examine direct demand and cross-demand for sulfur and alternative inputs. The major industries that currently choose between sulfur and alternative inputs include the following: Chemicals, inorganic pigments, pulping processes, nonferrous ores leaching, and iron and steel pickling. Some of these industries show an increasing demand for sulfur while others show a declining demand. By examining and evaluating direct price elasticities and cross price elasticities, degree of substitution can be detected. Proper evaluation of the statistical results lends background support for action programs for the sulfur industry to promote uses where alternative inputs are at an economic disadvantages, and withdrawal from those uses where alternative inputs have a pronounced economic advantage.

#### ACKNOWLEDGEMENT

Bureau of Mines

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American Inst of Mining, Metallurg & Petrol Engrs, 345 East 47th Street, New York, New York, 10017 Repr PC: Req Price

040966

#### STEEL IMPORTS: A CASE OF DIFFERENTIAL MARKET PENETRATION

Leary, R

American Inst of Mining, Metallurg & Petrol Engrs, 345 East 47th Street, New York, New York, 10017

Proceeding, 1972, pp 139-146

Notification of this article, Proceedings from the Council of Economics, AIME, appeared in the Bureau of Mines--New Publications, June 1972, Monthly List 686.

The growth of imported steel products in the U.S. market since 1957 is examined. A strong pattern of product-by-product market invasion is demonstrated. Domestic producers of products subjected to concentrated competition from imports are shown to have suffered much larger losses of market shares than the industry as an aggregate, and these differential losses of market occurred earlier in time. It is pointed out that the economic and social impacts of steel product imports are experienced at the plant level, where the loss of production occurs. Only aggregate statistics are available, however. Need exists for better input of economic information from plants and for a better understanding of how to relate plant and aggregate data to national statistics for policymaking. Better timing of action and more

effective remedies should result.

**ACKNOWLEDGEMENT**

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**040970**

**STRIPPABLE LIGNITE RESERVES OF NORTH DAKOTA.  
LOCATION, TONNAGE AND CHARACTERISTICS OF  
LIGNITE AND OVERBURDEN**

Pollard, BC Smith, JB Knox, CC

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

IC 8537, 1972, 37 pp, 19 Fig

Notification of this Information Circular appeared in the Bureau  
of Mines--New Publications, October 1972, Monthly List 690.

The location and production potential of a large block of strip-  
pable reserves in North Dakota were determined by using published  
data as a base and adding new drill hole data or other data contrib-  
uted by companies that presently own or lease coal lands. Only beds  
exceeding 5 feet in thickness, under less than 120 feet of overburden,  
and in large blocks of 5 million tons or more were included in the  
estimates. All such reserves are in the Fort Union Formation of  
western North Dakota and are lignite in rank. Sixteen large blocks of  
reserves evaluated in this study are estimated to contain a total of 4.1  
billion tons of strippable lignite.

**ACKNOWLEDGEMENT**

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**040971**

**STRIPPABLE COAL RESERVES OF WYOMING.  
LOCATION, TONNAGE, AND CHARACTERISTICS OF  
COAL AND OVERBURDEN**

Smith, J Ayler, MF Knox, CC Pollard, BC

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

IC 3538, 1972, 51 pp, 14 Fig

Notification of this Information Circular appeared in the Bureau  
of Mines--New Publications, October 1972, Monthly List 690.

Coal resource data from published sources and company files  
were used by the Bureau of Mines to determine the location and ext-  
ent of strippable coal reserves in Wyoming. Total strippable reserves  
of 23 billion tons were estimated in seven major coal areas. Seven  
large strip mining operations were active in 1969, and their produc-  
tion totaled 4-1/2 million tons of coal. Cutoffs used to define strip-  
pable reserves were (1) minimum coalbed thicknesses of 5 feet; (2)  
overburden-to-coal ratios of less than 10 cubic yards of overburden  
per ton of coal, and (3) total overburden thicknesses of less than 120  
feet, except where reserves occur in multiple beds or a single thick  
bed. Tertiary rocks along margins of the Powder River basin contain  
most of the strippable coal reserves in Wyoming. The Wyoming beds  
ranging in combined thickness from 30 to 130 feet, crop out on the  
east flank of the basin and contain an estimate 19 billion tons of  
strippable subbituminous C-rank coals under less than 200 feet of  
overburden. Partings between these beds total less than 60 feet. The  
100-to 200-foot-thick Healy bed on the western flank of the basin  
and the 35-foot-thick School and 20-foot-thick Badger beds on the  
south also contain large strippable reserves. Elsewhere in Wyoming,

strippable deposits are subbituminous coal of Late Cretaceous and  
Tertiary ages, mostly in the Hanna and Great Divide basins in the  
south-central portion of the State and in the Kremmerer-Hamms  
Fork region in the southwestern corner.

**ACKNOWLEDGEMENT**

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2404-1066

**040972**

**IMPENDING MINERAL SUPPLY PROBLEMS**

Feitler, SA

Communicator (Royal Navy, Communications Branch, HMS  
Mercury, East Meon, Petersfield, Hampshire, England)

Vol. 3, No. 5, Oct. 1972, pp 5-6

Notification of this article appeared in the Bureau of Mines--New  
Publications, January 1973, Monthly List 693.

Based on the trend of the 20-year period 1950-70, domestic  
primary mineral demand will exceed production by \$64 billion (1970  
dollars) in the year 2000. Several options are open to avoid future  
balance-of-payments crises or reduced living standards. The options  
briefly discussed are recycle more mineral scrap, increase exports, in-  
crease the rate of growth of mineral production, and decrease the  
rate of growth of consumption.

**ACKNOWLEDGEMENT**

Bureau of Mines

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Petersfield, Hampshire, England, Rep PC: Req Price

**040973**

**AN ECONOMIC ANALYSIS OF AN OIL SHALE,  
NAHCOLITE, DAWSONITE COMPLEX IN COLORADO,  
OPTION III, CIRCA 1971**

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

BuMines OFR 33-72, June 1972

This article was prepared by the Staff of the Bureau of Mines.  
Notification appeared in the Bureau of Mines--New Publications,  
Monthly List 690.

Option III concerns mining and processing a nahcolite deposit in  
the Piceance Creek basin, Colorado, plus an underlying measure of  
oil shale containing 14.8 percent nahcolite and 11.6 percent dawson-  
ite by weight, and yielding 37 gallons of shale oil per ton. Principal  
products are soda ash, alumina, and shale oil. Coke, sulfur, and  
ammonia are evaluated as byproducts. A two-level shaft mining op-  
eration, retorting, partial refining, and a minerals processing plant  
requires a capital investment of \$636,973,000 in 1971 dollars to pro-  
cess 8,000 tons per calendar day of white nahcolite ore and 60,000  
tons per calendar day of mineral-bearing oil shale. An income of  
\$257,599,600 based on 1971 prices requires \$151,373,400 annual  
operating expenditures including labor, materials, maintenance, taxes,  
insurance, overhead, and depreciation. The discounted cash flow rate  
of return is 14.45 percent based on a weighted average depreciation  
life of 14.155 years. This option differs from Option II in depth of the  
shale bed mined and analysis of the deposit.

**ACKNOWLEDGEMENT**

Bureau of Mines

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**040974**  
**AN ECONOMIC ANALYSIS OF A WHITE NAHCOLITE  
INSTALLATION IN COLORADO, OPTION 1, CIRCA 1971**

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

BuMines OFR 31-72, June 1972, 69 pp

This article was prepared by the Staff of the Bureau of Mines.  
Notification appeared in the Bureau of Mines--New Publication,  
Monthly List 690.

Option I is concerned only with material from a "white nahcolite bed" in the Piceance Creek basin, Colorado, containing a high concentration of sodium bicarbonate at a nominal depth of 1,900 feet. A nahcolite mine and processing plant is designed to mine 8,000 tons of nahcolite ore per calendar day yielding 4,071 tons per calendar day of soda ash product. This will require a total capital investment of \$80,213,200 based on 1971 conditions. The soda ash will yield an annual income of \$52,749,400. Annual operating expenses including labor, materials, maintenance, taxes, insurance, payroll overhead and depreciation will be \$18,821,900 in 1971 dollars. The discounted cash flow rate of return is equal to 30.74 percent based on a weighted average depreciation life of 12.88 years.

**ACKNOWLEDGEMENT**

Bureau of Mines

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**040975**  
**AN ECONOMIC ANALYSIS OF AN OIL SHALE,  
NAHCOLITE, DAWSONITE COMPLEX IN COLORADO,  
OPTION II, CIRCA 1971**

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

BuMines OFR 32-72, July 1972, 175 pp, 38 Fig

This article was prepared by the Staff of the Bureau of Mines.  
Notification appeared in the Bureau of Mines--New Publications,  
October 1972, Monthly List 690.

Option II concerns mining and processing a nahcolite deposit in the Piceance Creek basin, Colorado, plus an underlying measure of oil shale containing about 25 percent nahcolite and 9 percent dawsonite to yield soda ash, alumina, and shale oil as principal products. Coke, sulfur, and ammonia are also byproducts. A two-level shaft mining operation, rotorting, partial refining, and a minerals processing plant requires a capital investment of \$605,947,700 in 1971 dollars to process 8,000 tons per calendar day of nahcolite ore and 60,000 tons of the mineral containing oil shale. An income of \$268,283,000 requires \$143,188,700 in annual expenditures including labor, materials, maintenance, taxes, insurance, overhead, and depreciation. The discounted cash flow rate of return is 17.20 percent based on a weighted average depreciation life of 13.99 years. This option differs from Option III in depth of the shale bed mined and analysis of the deposit.

**ACKNOWLEDGEMENT**

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**040976**  
**TRENDS IN THE MINERALS INDUSTRY, 1970**

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

IC 8547, 1972, 89 pp, 19 Fig

This Information Circular was prepared by the Staff of the Bureau of Mines. Its notification appeared in the Bureau of Mines--New Publications, September 1972, Monthly List 689.

The Bureau of Mines annually publishes statistical data reflecting technological trends in the minerals industry (metals and nonmetals except fuels). This report outlines recent developments and trends and the technology outlook for mining practices and metallurgical processing based on a review of the minerals industry during the past 2 years. A historical statistical series which indicates trends in the minerals industry has been extended with 1970 data. In addition, data are given from a 5-year Bureau of Mines cyclic canvass of froth flotation plants. Data for 1970 are compared with those of 1960 and 1965.

**ACKNOWLEDGEMENT**

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**040977**  
**MINERALS YEARBOOK, 1970. VOLUME 1, METALS,  
MINERALS AND FUELS**

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

Vol. 1, Yearbook, 1970, 1235 pp, 42 Fig

This Yearbook was prepared by the Staff of the Bureau of Mines. Its notification appeared in the Bureau of Mines--New Publications, October 1972, Monthly List 689.

This publication contains chapters on metal and nonmetal commodities including mineral fuels. It includes a chapter reviewing the mineral industries, a statistical summary, and chapters on employment and injuries and technologic trends.

**ACKNOWLEDGEMENT**

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**040981**  
**SULFUR CONTENT OF UNITED STATES COALS**

DeCarlo, JA Sheridan, ET Murphy, ZE

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

BuMines IC 8312, 1966, 44 pp, 8 Fig

Notification of this article appeared in the Bureau of Mines--New Publications, July 1972, Monthly List 687.

This report attempts to show the sulfur content of the coal presently produced in the United States and to assess the remaining reserves of the various ranks of coal in each State, according to sulfur content. In most instances, the analyses used were those of cleaned coals. Coals were arbitrarily separated, according to sulfur content, as follows: Low sulfur--1.0 percent or less; medium sulfur--1.1 through

3.0 percent; and high sulfur—3.1 percent or more.

**ACKNOWLEDGEMENT**

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**040982**

**SULFUR REDUCTION POTENTIAL OF THE COALS OF THE UNITED STATES**

Deurbrouck, AW

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

RI 7633, 1972, 289 pp, 122 Fig.

Notification of this article appeared in the Bureau of Mines--New Publications, May 1972; Monthly List 685.

This report presents the results of a washability study of 322 coal mine samples showing the sulfur forms and distribution in the coals. The samples were collected from mines which were principally utility coal producers. Generally, the data show that the total sulfur content of the coals evaluated could be significantly reduced by some combination of stage crushing and specific gravity separation. However, few coals could be upgraded to a final product containing 1 percent or less total sulfur. The complete washability data are presented for each sample processed. A statistical evaluation is included for the coalbeds from which more than 10 samples were collected and for the geographical coal producing regions. A graphical summation is presented for the coal producing regions and selected coalbeds. Work done under an agreement with the Office of Air Programs, Environmental Protection Agency.

**ACKNOWLEDGEMENT**

Bureau of Mines

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**040985**

**STRIPPABLE COAL RESERVES OF WYOMING. LOCATION, TONNAGE AND CHARACTERISTICS OF COAL AND OVERBURDEN**

Smith, JB Ayler, MF Knox, CC Pollard, BC

Bureau of Mines, College Park Research Center

IC 8538, 1972, 51 pp, 14 Fig

Notification of this information circular appeared in the Bureau of Mines--New Publications, April 1972, Monthly List 684.

Coal resource data from published sources and company files were used by the Bureau of Mines to determine the locating and extent of strippable coal reserves in Wyoming. Total strippable reserves of 23 billion tons were estimated in seven major coal areas. Seven large strip mining operations were active in 1969, and their production totaled 4 1/2 million tons of coal. Cutoffs, used to define strippable reserves were (1) minimum coalbed thicknesses of 5 feet; (2) overburdened-to-coal ratios of less than 10 cubic yards of overburden per ton of coal; and (3) total overburden thicknesses of less than 120 feet, except where reserves occur in multiple beds or a single thick bed. Tertiary rocks along margins of the Powder River basin contain most of the strippable coal reserves in Wyoming. The Wyodak beds, ranging in combined thickness from 30 to 130 feet, crop out on the east flank of the basin and contain an estimated 19 billion tons of strippable subbituminous C-rank coals under less than 200 feet of overburden. Partings between these beds total less than 60 feet. The 100-to 200-foot-thick Healy bed on the western flank of the basin and the 35-foot-thick School and 20-foot-thick Badger beds on the

south also contain large strippable reserves. Elsewhere in Wyoming, strippable deposits are subbituminous coal of Late Cretaceous and Tertiary ages, mostly in the Hanna and Great Divide basins in the south-central portion of the state and in the Kemmerer-Haimms Fork region in the southwestern corner.

**ACKNOWLEDGEMENT**

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**040986**

**PREPARATION CHARACTERISTICS OF COAL FROM THE OHIO COALFIELD**

Bureau of Mines, 24 Zeilinger, JE, College Park, Maryland, 20742

RI 7616, 1972

Notification of this report of investigations appeared in the Bureau of Mines--New Publications, April 1972, Monthly List 684.

This Bureau of Mines report describes the preparation characteristics of the significant coalbeds of the Ohio coalfield. Washability analyses were made on 39 coalbed samples collected from a 14-county area. None of the samples were of metallurgical quality as received. None of the samples could be sufficiently upgraded to produce metallurgical-grade products, and the remaining 30 samples could not be upgraded to this quality because their sulfur contents could not be lowered to meet the standard. For steam or power generation, 10 of the samples were of medium sulfur content as received and one could be upgraded to a low sulfur content. Of the 29 samples having a high sulfur content as received, 18 could be upgraded to a medium sulfur content. The original sulfur content of the other 11 samples having a high sulfur content as received can be appreciably reduced by removal of the sink 1.58 specific gravity material; however, these coals would be classified as high sulfur coals both before and after removals of the sink 1.58 specific gravity material.

**ACKNOWLEDGEMENT**

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**040987**

**TECHNOLOGY AND USE OF LIGNITE, PROCEEDINGS: BUREAU OF MINE UNIVERSITY OF NORTH DAKOTA, MAY 12-13, 1971**

Kube, WR Elder, JL

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

IC 8543, 1972, 145 pp, 52 Fig

Notification of this information circular appeared in the Bureau of Mines--New Publications, August 1972, Monthly List 688.

This Bureau of Mines report contains the proceedings of a symposium cosponsored by the Bureau of Mines and the University of North Dakota concerning utilization and technology of Western coals and lignites. The symposium, the sixth in a series, comprised 12 papers.

**ACKNOWLEDGEMENT**

Bureau of Mines

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040988

**WASHABILITY EXAMINATIONS OF CORE SAMPLES OF SAN JUAN BASIN COALS, NEW MEXICO AND COLORADO**

Deurbrouck, AW

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

RI 7608, 1972, 26 pp, 1 Fig

Notification of this report of investigations appeared in the Bureau of Mines--New Publications, March 1972, Monthly List 683.

This report describes the washability characteristics of 18 coal samples taken from 11 drill hole cores from the San Juan Basin area of New Mexico and Colorado. The ash content of these coals could generally be substantially reduced by removing the heavy impurities. The coals were characteristically low in sulfur content; only one sample contained more than 1 percent sulfur after removing the sink 1.50 specific gravity material. The coals ranged in rank from subbituminous C to high volatile C; 11 of the samples were subsubumious A. Many of these core samples came from areas where very little fieldwork has been done; consequently, an outgrowth of this work has been an increase in known coal reserves of the San Juan Basin area.

**ACKNOWLEDGEMENT**

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040990

**STRIPPABLE RESERVES OF BITUMINOUS COAL AND LIGNITE IN THE UNITED STATES**

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

IC 8531, 1971, 148 pp, 6 Fig

Notification of this information circular appears in the Bureau of Mines--New Publications, January 1972, Monthly List 681. The report itself was prepared by the staff of the Bureau of Mines.

The strippable reserves of bituminous coal and lignite in the United States were calculated in accordance with the prevailing conditions of seam thickness and depth of overburden in each of the several coal-producing areas of the nation. Within defined limits of seam thickness and depth of overburden, it is estimated that there was a remaining strippable resource of 118 billion tons of raw bituminous coal and lignite as of January 1, 1968. Because of topography, natural and manmade features, and other limitations, only 45 billion tons of the resources are strippable reserves. Of this 32 billion tons is considered low sulfur (less than 1 percent), 4 billion tons is medium-sulfur (1 to 2 percent), and 9 billion tons is high-sulfur (over 2 percent) coal. Owing to a cleaning loss affecting that portion of strip coal that is mechanically cleaned, the 45 billion tons of strippable reserves are reduced to 39.6 billion tons of marketable coal. A brief discussion is given for each coal-producing state, summarizing past and present production, historical background, and outlook. Appendix A contains reserve data by state, county, seam, and sulfur content. Appendix B contains the general information and requirements necessary to comply with the current strip mining laws covering 20 states.

**ACKNOWLEDGEMENT**

Bureau of Mines

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040991

**LIST OF BUREAU OF MINES PUBLICATIONS AND ARTICLES, JANUARY 1 TO DECEMBER 31, 1971, WITH SUBJECT AND AUTHOR INDEX**

Sylvester, RD

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

1972, 116 pp

Notification of this information circular appears in the Bureau of Mines--New Publications, August 1972 Monthly List 688.

This compilation lists and summarizes publications by Bureau authors published in the regular Bureau of Mines series, in scientific, technical, or trade journals, or in other media; those available from the Bureau of Mines are indicated. Patents issued to Bureau personnel are also listed, and instructions are given on how to apply for permission to use them. One of the outstanding features of this Special Publication is an exhaustive subject and author index.

**ACKNOWLEDGEMENT**

Bureau of Mines

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041612

**RAILWAY TO THE ARCTIC: A STUDY OF THE OPERATIONAL AND ECONOMIC FEASIBILITY OF A RAILWAY TO MOVE ARCTIC SLOPE OIL TO MARKET**

Law, CE, Queen's University  
 Corneil, ER, Queen's University  
 Lake, RW, Queen's University  
 Helmers, HO, Queen's University  
 Macdonald, JA, Queen's University  
 Baldwin, JR, Queen's University  
 Rice, RA, Carnegie-Mellon University  
 Charles, JL  
 Olley, RE, Saskatchewan University  
 Dunford, FEF, Queen's University  
 Mackay, NAM, Queen's University  
 Roszner, ES, Carnegie-Mellon University  
 Kerr, CN, Queen's University

Canadian Institute for Guided Ground Transport, Queens University, Kingston, Ontario, Canada

Sumry Rpt, 7105-7110, July 1972

This is a summary report of a much more extensive study conducted by the Canadian Institute of Guided Ground Transport between May and October 1971, with co-operation and assistance from Carnegie-Mellon University, Canadian National Railways, Canadian National Telecommunications and PROCOR Limited, Rail Car Division. The study grew out of an earlier study by Carnegie-Mellon. It is concluded that a railway as proposed is technically and operationally feasible and appears financially attractive. The most appealing of three routes studied starts at Prudhoe Bay, proceeds along the Arctic slope to the Mackenzie Delta, and then Southeast along the Mackenzie River valley ending near the Trout River, a distance of some 1200 miles. From here the oil would proceed by pipeline, since permafrost is no longer a problem. The railway would require some 360 six-axle locomotive units and 11,000 tank cars of 94 tons capacity. Twenty trains per day, of 168 cars, pulled by five locomotive units, including two "slave" units, seems an optimum configuration to move the necessary 2 million barrels of oil. The railroad would be double track with advanced communications. The capital cost would be about 2.4 billion dollars, annual operating cost 193 million dollars.

A tariff of about 0.67 cents per barrel, producing \$489 million annual revenue, would return in excess of 10 percent on equity, with a 7 percent cost of debt (75-25 debt-equity ratio) using discounted cash flow calculations. Using 40 cents per barrel for Trout River to Chicago (in general agreement with Interprovincial Pipeline figures) the cost of transporting crude oil from Prudhoe Bay to Chicago using the rail and pipeline system is conservatively estimated at \$1.07 per barrel.

#### ACKNOWLEDGEMENT

Canadian Institute for Guided Ground Transport

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Canadian Institute for Guided Ground Transport, Queens  
University, Kingston, Ontario, Canada, R 6C 1A6

**041615**

#### WILL EVOLVING NATIONAL ISSUES CREATE A RAIL RENAISSANCE?

Davis, FW, Jr, Tennessee University  
Patton, EP, Tennessee University

MSU Business Topics (Michigan State University, East Lansing,  
Graduate School of Business Administration, East Lansing,  
Michigan, 48823)

Vol. 27, No. 1, Jan. 1973, pp 37-46

While outside factors may have been responsible for the current plight of the rail carriers, such factors may also hold the key to the future success of the industry. The energy crisis, concern for the environment, and the saturation of the highway network all should work to reverse past trends. Transportation consumes almost one quarter of the nations total energy, including over 50% of all petroleum. Railroad transportation is several orders of magnitude more efficient in fuel usage than other modes. A large portion of the nations freight could be shifted to the railroads quickly and cheaply. The diversion of freight to rail would be cheaper and faster than other means of energy conservation, such as power plant conversion. Railroads will also benefit from urban re-development plans that would reclaim downtown areas by moving railroad yards to the fringes. Railroads may finally be nearing cooperation with unions on labor productivity issues. In the past, political factors usually produced settlements that granted most of labor's demands. If the rail industry can survive the obstacles presented in the short run, external factors such as the energy crisis, concern for the environment, highway saturation, and new labor and government attitudes, will promote a movement of this society back to rail transportation.

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Michigan State University, East Lansing

**041668**

#### THE OIL CRISIS: THIS TIME THE WOLF IS HERE

Akins, JE

Foreign Affairs (Council on Foreign Relations, Incorporated, 58  
East 68th Street, New York, New York, 10021)

Vol. 51, No. 3, Apr. 1973, pp 462-490

It was a popular belief in the 1960s that the supply of oil was abundant. As late as 1970, it was believed that the U.S. could remain essentially self-sufficient in oil. Recognizing the dangers of dependence on oil from the Eastern Hemisphere, a Presidential Task Force recommended that imports from the Eastern Hemisphere be limited to 10% of total U.S. oil consumption, a level expected to be reached in the mid-1980s. These projections were spectacularly wrong. Imports from the Eastern Hemisphere amounted to 15% of consumption in 1972, and are expected to rise to 20% in 1973. The source of these errors were: (1) overestimates of domestic capacity, and (2) the decline of natural gas supplies and its impact on oil demand. Most of

the world's proven oil reserves are in Arab hands. We must recognize that previous political threats on restriction of oil have been directed against the U.S. alone, not against our allies. By 1980, we will be even more dependent on oil from the Middle East. The present price agreements are defined only through 1975. Production is leveling off in the Middle East. The only alternative to shortfall before 1980 will be Saudi Arabia, and its projected production seems improbably high. The U.S. has discussed a two-pronged approach to consumer cooperation: (1) development of new forms of energy, and (2) an international authority to avoid cutthroat competition in times of shortage. In the long run, the only satisfactory position for the U.S. must be alternative sources of energy. Effective mass-transit systems could do much to limit our present profligate use of energy in the form of oil.

#### ACKNOWLEDGEMENT

Foreign Affairs

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Council on Foreign Relations, Incorporated, 58 East 68th Street,  
New York, New York, 10021, Rep PC: Req Price

**041763**

#### THE ECONOMICS OF COAL SUPPLY

Gerber, A

American Chemical Society, Division of Fuel Chemistry,  
Pittsburgh, Pennsylvania

9(2), Preprint, 1965, pp 18-22

This paper was presented at the 149th National Meeting,  
American Chemical Society, Division of Fuel Chemistry,  
Symposium on Fuel and Energy Economics Joint with Division  
of Chemical Marketing and Economics in Detroit, Michigan on  
April 4-9, 1965.

The status of coal in the fuel market and the factors involved in its decline and acceleration are examined. The efforts of the coal and transportation industries to reduce the delivered cost of coal are described. The growth of the electric utility industry and the resulting effect of coal consumption is discussed. The problem of finding an economical means of eliminating the harmful effects of coal combustion products is also discussed. The wide range of substitution capabilities among the several sources of energy, and most importantly the advent of nuclear power as a competitive source of energy in coal's largest market, can be expected to elicit the technical and economic responses from both the coal and transportation industries that will make possible a rising level of coal use without significant increases in real costs.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 07642

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

American Chemical Society, Division of Fuel Chemistry,  
Pittsburgh, Pennsylvania, Repr PC: Req P

**041764**

#### SOME ASPECTS OF THE TRANSPORTATION OF BITUMINOUS COAL

Robinson, ME

American Chemical Society, Division of Fuel Chemistry,  
Pittsburgh, Pennsylvania

9(2), Preprint, 1965, pp 127-147

This paper was presented at the 149th National Meeting,  
American Chemical Society, Division of Fuel Chemistry,  
Symposium on Fuel and Energy Economics Joint with Division  
of Chemical Marketing and Economics in Detroit, Michigan on  
April 4-9, 1965.

An examination of the changes in the transportation pattern of bituminous coal is presented. Statistics in the last seven years have permitted the analysis of coal distribution by method of transportation, by user category and by district of origin and states of destination. Tables are presented for each of the three methods. The transportation patterns for coal in the U.S. range from the railroads which handle some three-fourths of all shipments through water and motor carriers, to the pipeline. Because of its confinement to one producer and its relatively limited life, the pipeline does not lend itself to statistical trending but it is briefly discussed. Distribution for the electric utility market has a more complete accumulation of data so it is discussed in greater detail.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 07645

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Chemical Society, Division of Fuel Chemistry,  
Pittsburgh, Pennsylvania, Repr PC: Req P

**041765****CEMENT-HANDLING EQUIPMENT**

Vincent, EJ

Public Health Service, Cincinnati, Ohio

Phs-Pub-999-AP-40, 1967, pp 339-340

This article appears in the Air Pollution Engineering Manual.

The equipment involved in the operation of a bulk cement plant which receives, stores, transships or bags cement includes hoppers, bins, screw conveyors, elevators, and pneumatic conveying equipment. Its main purpose is usually to transfer cement from one type of carrier to another, such as from railway cars to trucks or ships. In the handling of cement, a dust problem can occur if proper equipment or hooding is not used. Hooding and ventilation requirements of receiving hoppers, storage and receiving bins, elevators and screw conveyors, and hoppers trucks and car loading are discussed. A baghouse has been found to be the most satisfactory dust collector for handling the ventilation points. All sources are normally ducted to a single baghouse.

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 09807

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806-614-30

**041766****RAILROAD AND HIGHWAY TRANSPORTATION**

Eifel, PJ

Institute of Gas Technology, Information Services, 3424 South  
State Street, Chicago, Illinois, 60616

Proceeding, 1968, 10 pp, 5 Ref

This paper was presented at the First International Conference of Liquefied Natural Gas in Chicago, Illinois on April 7-12, 1968 as paper 38 in session No. 6.

A comparison is developed between railroad tank cars, highway trailers, truck mounted vessels and demountable tankage, based on the length of haul, volume of shipment, frequency of usage, cost of equipment, and expense of operation. Decreasing cost of cryogenic equipment due to design development and improved technology as exemplified by the history of cryogenic railroad cars is outlined. A tank car for the Transportation of Liquefied Natural Gas (LNG), together with applicable regulations, freight rates, and railroad handling procedures is presented. A vacuum insulated, optimum design trailer is described and its function is compared with truck mounted vessels and demountable tankage. State Highway Laws and their

effect on trailer design are discussed briefly, and some unloading methods are presented and their applications evaluated. (Author Abstract Modified)

**ACKNOWLEDGEMENT**

Air Pollution Technical Information Center, 20494

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Institute of Gas Technology, Information Services, 3424 South  
State Street, Chicago, Illinois, 60616, Repr PC: Req Price

**041876****OFFSHORE TERMINAL SYSTEM CONCEPTS. PART 2. CONNECTIONS BETWEEN DEEP-DRAFT TERMINALS AND EXISTING FACILITIES BY UTILIZATION OF FEEDER VESSELS, PIPELINES AND/OR SHORE FACILITIES RELOCATION**

Soros Associates, Incorporated, 575 Lexington Avenue, New  
York, New York

Pt 2, Final Rpt, Sept. 1972, 326p

Contract MA-1-35409

See also Part 1, COM-72-11372, and Part 3, COM-72-11374.

The report is Part 2, of a 3 part report which describes significant aspects of shoreline, seabottom, weather, and wave conditions at 17 regions and 33 sites, on all three U.S. coasts, and identifies what are considered to be the most suitable locations in each, discusses environmental and operational considerations for offshore terminals, identifies capital cost and total transportation unit costs for feeder vessel and pipe line systems; and provides data from which the total cost per ton of shipping oil from Persian Gulf to U.S. refineries and markets can be calculated for alternative transshipment terminal locations. The appendix discusses related subjects such as feeder systems, tanker designs, accident prevention. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-72113 7

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

NTIS, Repr PC: \$9.00, Microfiche: \$0.95  
COM-72113 7

**041877****OFFSHORE TERMINAL SYSTEM CONCEPTS. PART 3. FORMULATION OF ADVANCED CONCEPTS FOR OFFSHORE TERMINALS**

Soros Associates, Incorporated, 575 Lexington Avenue, New  
York, New York

Pt 3, Final Rpt, Sept. 1972, 243 pp

Contract MA-1-35409

See also Part 2, COM-72-11373.

The report is part 3 of a 3 part report, wherein site selection costs, environmental impact, design criteria and economic justification are weighed.

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-72113 7

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

NTIS, Repr PC: \$6.75, Microfiche: \$0.95  
COM-721137

**043247****THE POTENTIAL EFFECTS OF INCREASING OIL TANKER SIZE ON NARRAGANSETT BAY**

Rhode Island Statewide Planning Program, Providence, Rhode

Island

RISPP-TP-72-24, Final Rpt, July 1972, 27 pp

Sponsored in part by Federal Highway Administration,  
Providence, R.I.

The report outlines the possible ramifications of the growth of the world tanker fleet, both in size and in numbers, and this growth's subsequent effect on Narragansett Bay. It examines both ship-to-ship and ship-to-shore offloading and the possible pollution effects of these techniques. The three main causes of pollution—bilge, pumping, transfer leakage and collisions—are also considered in terms of a future increase in tanker traffic on the Bay. A bibliography of some thirty works is also included. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212918 /

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-212918 /**043285****THE TRANSPORTATION PLANNING LABORATORY**Applied Decision Systems, Incorporated, Wellesley Hills,  
Massachusetts

Final Rpt, Mar. 1972, 101 pp

Contract DOT-OS-00053

The subject Laboratory is a model which permits citizens, planners, technicians, businessmen, politicians, and decision makers to learn: how various interest groups assess and interpret the impact of transportation systems upon the economics, environment, and quality-of-life in urban communities and metropolitan areas; what kind of planning process is needed to assure that the natural conflict that arises over construction of transportation facilities satisfactorily is managed; what resources, in the forms of information, data, and personal expertise are available in the community to help solve serious planning problems; and how these resources can be shared and applied most effectively by a group of people with diverse backgrounds, interests, and power.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213688 /

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NTIS, NTIS Price: s: PC\$3.00, /MF\$0.95  
PB-213688 /**043591****CONTINUOUS HEAVY LIQUID CONCENTRATION OF  
HIGH-CLAY POTASH ORES**

Liles, KJ Brown, JW Sullivan, GV

Bureau of Mines, College Park Research Center, College Park,  
Maryland, 20742

RI 7724, 1973, 14 pp, 4 Fig

The announcement for this report of investigations appeared in the Bureau of Mines--New Publications, February 1973, Monthly List 694.

The Bureau of Mines conducted laboratory semi-continuous and continuous heavy liquid tests to determine the feasibility of producing commercial-grade products from the high-clay sylvinitic ores of the Permian Basin in New Mexico. Continuous test operations demonstrated that concentrates containing 59.9 percent K<sub>2</sub>O and recoveries of over 75 percent of the contained potash can be obtained. The organic heavy liquid was effectively recovered by vaporization, condensation, and absorption methods. Less than 5 parts per million of

heavy liquid vapors were released to the atmosphere. This loss represents only 0.02 pound of heavy liquid per ton of ore treated.

**ACKNOWLEDGEMENT**

Bureau of Mines

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Avenue, Pittsburgh, Pennsylvania, 15213, Repr PC: No  
Charge**043600****THE CASE OF NUCLEAR ENERGY**

Simpson, JW, Westinghouse Electric Corporation

IEEE Spectrum (Institute of Electrical and Electronics Engineers,  
345 East 47th Street, New York, New York, 10017)

Sept. 1972, pp 71-73

As the scarcity and cost of fossil fuels increase, nuclear fission holds promise as the next important source of energy. Coal, our most abundant fossil fuel, is also our dirtiest. Coal has an environmental cost. Because of price increases and availability problems, natural gas may well be out of the picture as a boiler fuel for power generation by 1990. Since 1967, the U.S. has been importing more petroleum to meet the demand. Many east coast power companies have turned to imported low sulfur oil. The wisdom of allowing so much vital power generating capacity to be dependent on imported fuel is questionable. Nuclear energy can be used to meet the energy needs of today. Although the nuclear power plant is rather inefficient, it is ahead of the fossil fuels because of the environmental impact situation. The new plans for off-shore nuclear plants will eliminate the problem of thermal pollution.

**ACKNOWLEDGEMENT**

IEEE Spectrum

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017, Repr PC: Req Price**043674****TRANSPORTATION IN THE ARCTIC**

Paddison, FC Stone, AM

Applied Physics Laboratory, Johns Hopkins University, Silver  
Spring, Maryland, 20910

APL-TG-1190, Tech Memo, Apr. 1972, 100 pp

Contract N00017-72-C-4401

There is no year-round transportation in the Arctic. Year-round roads and railroads and high-bearing-load air fields to accommodate today's heavy-lift cargo aircraft could be built to the edge of the broad Arctic Ocean, if military necessity or potential resource development warranted it. Shallow-draft barges and boats will continue to be used to transport bulk cargo during the brief season around the perimeter of the Arctic Ocean. Large, very powerful icebreaker cargo ships for transport through the Arctic Ocean ice mantle are feasible and have been demonstrated; however, docking, loading, and general operational problems must be solved. Travel across the Arctic Ocean ice mantle with a truly amphibious craft, the Surface Effect Vehicle (SEV) currently under development will eventually provide long range year-round transportation over the Arctic Ocean's permanent ice cover. The SEV with low footprint pressures can travel not only over the pressure ridged rubble fields of the pack ice, but also over the tender summer tundra without subsequent effect. The report discusses all the above points and, in addition, briefly reviews the history of exploration of the Arctic. The extent of Arctic ground and air transportation facilities in the USSR, USA, Canada, Greenland, Iceland, and Scandinavia is shown. The Arctic Ocean icebreaker cargo ship is discussed, as is the search and rescue problem. Arctic air, ground, and marine techniques are summarized, and the Arctic



SEV is discussed and the plans for its development outlined.

(Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-754381

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AD-754381

**043675**

**TECHNOLOGICAL FORECAST: 1975-2000. A DESCRIPTIVE OUTLOOK AND METHOD FOR QUANTITATIVE PREDICTION**

Golding, EI    Velona, WD    Poolè, G

Office of Systems Analysis and Information, Office of Policy and International Affairs/DOT, Washington, D.C.

May 1970, 369 pp

The report is divided into two parts. The first part provides a description of expected trends in transportation for both passenger and freight movements for the next 30 years. The second part describes a methodology for forecasting, at an aggregate level of detail and as a function of time value, out of pocket costs and trip distance, the modal split of passengers in a forecast year between 1975-2000. The second part also describes the use of the methodology to examine the probable effects of emphasizing the development of one technology over another. There are also 4 Appendices. Appendix 1 describes a 1965 Passenger Mile Data Base Table, as a function of mode and trip distance. Appendix 2 similarly describes a 1965 Commodity Ton-Mile Data Base Table. Appendix 3 describes the results of a Delphi Forecasting Exercise and Appendix 4 describes the parameters used to define each system used in the modal split. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-754178

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$9.00, Microfiche: \$0.95

AD-754178

**043999**

**PLANNING TRANSPORTATION TERMINAL SYSTEMS IN URBAN REGIONS: A MAN-MACHINE INTERACTIVE PROBLEM-SOLVING APPROACH**

Schneider, JB    Symons, JG, Jr    Goldman, M

Transportation Research (Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York, 10523)

Vol. 6, No. 3, Sept. 1972, pp 257-273

The problem addressed is that of locating transportation terminals in a large urban area. A man-machine interactive system, call LOCATOR, is developed and applied to a small test problem. The system permits the analyst to intuitively search a large combinatorial space in a conversational model with the computer. Initial exploratory experience leads to the development of two computer-based heuristic search techniques. Experiments show that the heuristic techniques are quite powerful but are not without weaknesses. Ten graduate students used the LOCATOR system to try to intuitively "find" a satisfactory solution to the test location problem. Nine of the ten were successful, and three of the ten found a solution identical to the best known solution. Possible extensions and applications of the LOCATOR system are briefly discussed.

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**044004**

**RAIL TRANSPORT OF THE FUTURE AS A PROBLEM FOR ENGINEERS TODAY**

Kniffler, EA

Universitas (Wissenschaftliche Verlagsgesellschaft GmbH, P.O. Box 40, Stuttgart, West Germany)

Vol. 15, No. 1, 1973, 10 pp

The structural transformation in our society, the socio-political aims and the economic needs presuppose to an ever greater extent safe, rapid, efficient and cheap rail transport. Present-day electrical engineering offers suitable solutions to the local and long distance transportation of passengers and freight. The ultimate aim is an automated and fully integrated control of transport. The appearance of completely new systems of rail transportation is already being heralded, and these can be realized with the aid of electrical engineering. The engineer of today occupies an especially important place in the solving of these problems.

**ACKNOWLEDGEMENT**

Universitas

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Universitas, Birkenwaldstrasse 44, 7 Stuttgart, West Germany,

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**044014**

**WEST GERMANY BACKS THE PRIVATE SIDING**

Strobel, M

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 5, May 1971, 3 pp, 2 Phot

Already 63% of DB's wagonload freight moves between private sidings and by the end of 1970 more than DM 500 million had been allocated for building new sidings under the Leber plan.

**ACKNOWLEDGEMENT**

British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

**044084**

**NEW LIFE FOR FAR NORTH RAIL LINE?**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, p 8

British Columbia Premier David Barret has endorsed a two-year study of the feasibility of an oil-hauling, double-track rail line from Alaska's North Slope to northern Alberta. It would be an alternative to building a pipeline across either Alaska or Canada. Last year the Canadian Institute of Guided Ground Transport reported that rail haulage was economically viable and would have less adverse environmental impact than a pipeline (RA, Aug. 28, 1972, p 57). A U.S. consortium has also proposed a single-track rail line across Alaska which would be integrated with the Alaska Railroad. It would roughly parallel the hotly contested pipeline alignment planned by Alyeska Pipeline Service Co.

**ACKNOWLEDGEMENT**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

**044255**  
**EVALUATION OF INLAND ROUTINGS OF IMPORT/  
 EXPORT CONTAINERS**

Rifas, BE, Manalytics, Incorporated

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp A21-A38, 21 Fig

A model of the U.S. Transportation System was designed and developed by Manalytics, Inc. for the U.S. Maritime Administration. This computer model provides a means of testing the effect on components of the transportation system of changing routing patterns. The structure of that model, the development of data for use in this model (in particular the inland origins and destinations of foreign trade) and some recent developments and future possibilities for developing data for the model are delineated.

**ACKNOWLEDGEMENT**

Railway Management Review

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
 Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

**044269**  
**RAILROAD OPERATIONS 10 YEARS FROM NOW**

American Association of Railroad Superintendents, 18154 Harwood Avenue, Homewood, Illinois, 60403

Proceeding, June 1971, pp 90-98

The 75th Annual Meeting of the American Association of Railroad Superintendents was held at Le Chateau Champlain, Montreal, Quebec Canada, June 15-17, 1971.

Railroads will carry 50 percent more freight in 1980 than at present. The merger movement will result in fewer, but healthier, properties. Light density branch lines will be abandoned. The National Freight Car Pool will become a reality. Research will be accelerated with government funds. Intermodal transportation companies will be formed. The railroads will be allowed adequate pricing freedom. Rapid expansion of electrification, both in commuter and in high density freight lines, is predicted. Track will be upgraded. Real-time computer systems will be commonplace. Waybilling as we know it now will be eliminated. Operational computers tied to ACI will provide terminals with information necessary for the movement of traffic. The opportunities are here. It remains for railroad managers to grasp these opportunities and remake the railroads into profitable organizations. Discussion of the committee report is presented on pages 43-53.

**ACKNOWLEDGEMENT**

American Association of Railroad Superintendents

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
 American Association of Railroad Superintendents, 18154 Harwood Avenue, Homewood, Illinois, 604 Repr PC: Req Price

**044342**  
**EVALUATION OF POTENTIAL EFFECTS OF U.S.  
 FREIGHT TRANSPORTATION ADVANCES ON HIGHWAY  
 REQUIREMENTS. RESEARCH PHASES 1 AND 2**

Miller, VEJ    Bartsch, MW    Davenport, SJ    Delaney, WW    Ellis, HB

Stanford Research Institute, Menlo Park, California, 94025 SRI-MSU-8729

Final Rpt, 7006-7205, Oct. 1972, 240 pp

Contract DOT-FH-11-7564

Paper copy available from GPO \$2.75 as stock no. 5001-0004.

Part of a nine-phase program, the objectives of the research were to identify recent and future technological, economic, legal, regulatory, and social advances and developments in U.S. freight transportation; to evaluate qualitatively the effects of such advances and developments on highway use and highway requirements. Statistical information on recent trends in motor freight and the other freight transportation modes are examined, and productivity in trucking is analyzed along with possible factors contributing to productivity changes. Recent and potential technological, business, government, and social developments having potential effects on highway planning are identified and evaluated. Implications for highway planning are discussed in terms of location of highway demand, highway design, highway use, and total freight transportation demand and modal share. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214752/8

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**044516**  
**BUREAU OF MINES RESEARCH 1972. A SUMMARY OF  
 SIGNIFICANT RESULTS IN MINING, METALLURGY,  
 AND ENERGY**

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

SP 1-73, 1973, 82 pp

The announcement for this special report appeared in the Bureau of Mines--New Publications, March 1973, Monthly List 695.

The Bureau of Mines research and development program is comprised essentially of projects on the extraction, processing, use, reuse, and disposal of minerals and mineral fuels. Scientific and engineering efforts are directed to the development of processes that will provide essential minerals without destruction or impairment of the environment and at minimal hazard to the health and safety of workers in the metal, nonmetal, and coal-producing industries. The research is carried out in the Bureau's 19 research centers and laboratories located throughout the United States and through contracts with industry, universities, and State agencies.

**ACKNOWLEDGEMENT**

Bureau of Mines

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 2404-01335

**044517**  
**ECONOMIC AVAILABILITY OF BYPRODUCT FLUORINE  
 IN THE UNITED STATES (IN TWO SECTIONS) 1.  
 UTILIZATION OF BYPRODUCT FLUOSILICIC ACID IN  
 THE MANUFACTURE OF ALUMINUM FLUORIDE. 2.  
 UTILIZATION OF BYPRODUCT FLUOSILICIC ACID IN  
 THE MANUFACTURE OF CALCIUM FLUORIDE**

Johnson, RC    Sweeney, JC    Lorenz, WC

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

IC8566, Mar. 1973, 97 pp, 5 Fig

The announcement for this Information Circular appeared in the Bureau of Mines--New Publications, March 1973, Monthly List 695.

Domestic byproduct fluorine (in fluosilicic acid) availability at various price levels of aluminum fluoride were determined and a contingency availability curve developed. The supply of byproduct fluosilicic acid is restricted in amount to certain geographic regions, where plants processing phosphate rock are located, and the byproduct can be collected. The maximum possible U.S. annual supply, based on potential plant capacities, is 373,400 tons of fluosilicic acid containing 295,400 tons of fluorine. Based on inputs of 5, 10, 25, 50, and 100 thousand tons per year, five levels of producing aluminum fluoride from fluosilicic acid (100 percent) were costed. Based on a 12-percent discounted cash flow rate, including the cost of salvaging

the fluosilicic acid, the calculated selling price of aluminum fluoride ranged from \$233 per ton to \$448 per ton. At the higher price, 98 percent of the potential supply of byproduct fluosilicic acid could be used profitably; at the lower price only 46 percent could be used profitably.

ACKNOWLEDGEMENT  
Bureau of Mines

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2404-01293

016654

**CONTAINER HANDLING BY THE LIFT ON/LIFT OFF METHOD IN RARELY MENTIONED PORTS**

Eriksson, L

ICHCA Journal (International Cargo Handling Coordination Assn, Trade News Ltd, Drummond House, 203-9 North Grove Street, London NW1, England)

Vol. 4, No. 3, Mar. 1970, pp9-10

Slewing crane for container handling is described, such as would be suitable for the few ports of Finland. Crane slewing is limitless, radius 30 m. The double level jib keeps the containers in a horizontal position irrespective of outreach, and the large outreach means that containers can be lifted off the ship straight onto a truck, train or quayside storage area, and vice versa.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 21805

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019177

**CONTAINERIZATION AND ITS EFFECT ON PORTS**

O'Hara, CB, Port of New York Authority

Technical Association of the Pulp & Paper Industry, 360 Lexington Avenue, New York, New York, 10017

Vol. 53, No. 8, Aug. 1970, pp1510-13

Considerations of economic aspects related to containerization which has had a dramatic effect on both the design and operation of ports throughout the world. New vessels which require loading facilities for roll-on/roll-off cargo loading are now in operation on the North Atlantic. Cargo which used to require 10 days to load or discharge is now handled in 2 days utilizing this new system. Problems of the future include standardization of container sizes, through-bills of lading, and single factor rates. The computer is assisting in the transition from conventional methods of container-handling, but must adopt new practices such as "freight all kinds" rates, if containerization is to become a truly intermodal system.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 32446

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019258

**SYSTEMS ANALYSIS OF INLAND CONSOLIDATION CENTERS FOR MARINE CARGO**

National Bureau of Standards, 14th Between E Street and Constitution Avenue, NW, Washington, D.C., 20231

NBS 530, Tech Note, Nov. 1970, 138pp, 46 Tab, 40 Ref, 7 App

This Technical Note documents a study, carried out for the U.S. Maritime Administration, to develop analytical techniques for use in optimizing the locations and characteristics of inland centers to facilitate the flow of containerizable marine cargo. Such centers would perform the consolidation of small lots (LCL) of break-bulk general cargo into container loads for export; for the reverse flow, they would carry out the handling and unloading of import containers for cargo distribution. The basic conclusions of this study are: (1) The present line-haul container rates and consolidation costs at inland consolidation centers, when compared with cost of shipment in less-than-container load lots of break-bulk, appear to give a distinct monetary advantage to the shipping community from the use of inland consolidation centers. (2) A computerized mathematical model to guide the selection of consolidation center locations is both feasible and useful; its use, level of detail, and the interpretations given its

outputs must be duly sensitive to the quality of the data available. (3) For a port authority, a freight forwarder, an exporter or transportation company, interested in containerization, or a government agency promoting such a program, it is essential to know points of origin, routes of transportation, times in transit, pertinent rates, volumes, seasonal variations, and points of destination of present and future flows of export and import cargo. These data are not presently available. The data are at least as important as the means by which they are manipulated. (4) The cost to a shipper of a center, can vary appreciably depending on precise center location, but given reasonably acute acquisition choices and operating practices, this variation should not be so appreciable as to affect a shipper's choice of center. Therefore, it is not necessary for the mathematical model to pinpoint the exact geographical location of each center in order to indicate how to achieve near-minimum total costs. The balance of this document, which reports fully the fact-finding and model-related work described just above, is relatively lengthy. It contains considerable technical detail, describes a number of data interpretations and modeling possibilities alternative to those actually adopted, and includes a good deal of material which (although relevant) proved peripheral to the main course of the study.

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019333

**DEVELOPMENTS AND PROBLEMS OF SEABORNE CONTAINER TRANSPORT, 1970**

Organization for Economic Cooperation and Devel, Suite 1306, 1750 Pennsylvania Avenue, NW, Washington, D.C., 20006

1970, pp1-49, 8 Tab, 3 Ref

Report by the Maritime Transport Committee-OECD

The report describes recent developments in seaborne container transport and other forms of unit transport on both deep-sea and short-sea routes as well as related developments in the ports they serve. It further surveys policy issues which have arisen from the extremely rapid growth of seaborne unit transport and which may create problems in future. The field covered by the report is extremely wide and it was not possible nor indeed desirable to describe all facets of the present situation and trends in containerisation. In presenting the statistical material an attempt has been made to preserve some continuity with previous reports while including additional information on short-sea services. Sections 1-3 of the report focus on the quantitative aspects of deep-sea containerisation during the second half of 1970 and relate them to past developments and programmes. Sections 4 and 5 survey coastal container and other unit transport services, especially in Western Europe, as at the end of 1970 and describe the various forms of unit transport, other than full container services, existing or planned on short- and deep-sea routes. Sections 6 and 7 deal with the commercial organisation of container services and with governmental policies and regulation affecting containerisation. Section 8 surveys specialised port installations and container handling in ports. More and better information is now presented than was available previously. However, many ports still have insufficient statistics, and co-ordination of container handling statistics for different ports at the national level is still unsatisfactory in many cases. At the international level, differences of definition and detail make comparisons very difficult and this should be taken into account when using the present statistical data.

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OECD Publications Center, 1750 Pennsylvania Avenue, NW, Washington, D.C., 20006, Repr PC: \$2.75

019390

**REUSABLE METAL SHIPPING CONTAINER (CONEX III)**

Pittsburgh University, Washington, D.C., Research Staff,

Washington, D.C.

AMC-TIR-33.8.7.8, Tech Rpt, Mar. 1968, 16pp

Contract DA-49-186-AMC-214(D)

The development of a reusable steel shipping container is described. The new container, mounted on skids, is 8 by 6.46 feet, with a volume of 350 cubic feet and a capacity of 13,000 pounds. Connecting devices on the containers make it possible to join the containers to form a single unit. Three of the containers connected together form a single unit 20 feet long, a standard recommended by the American Standards Association, for use in commercial rail, highway, and water shipping. The connected unit of three containers, with a gross weight of 44,800 pounds, can be lifted by a cable sling with a spreader. The double-door, all welded container is protected against rain and pilferage. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, AD-831121

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019452

#### MODULAR/INTERMODAL CONTAINER PARAMETRIC STUDY

Pusey, PS Wreghitt, K

Avco Systems Division, Wilmington, Massachusetts

AVSD-0513-69-CR, Final Rpt, Jan. 1970, 202pp

F33615-70-C-1013

The report presents the results of a parametric study of the effects of a range of design variables on modular/intermodal containers. A simple analysis is used to generate data showing the effects on module weight, usable volume, and cost of design parameters, various materials and methods of construction (steel, aluminum, fiberglass; homogeneous and sandwich) and handling requirements. The results of this analysis are presented in convenient graphical forms. More detailed calculations provide weight, usable volume and cost data for modules using certain specific materials and methods of construction. These results are tabulated for comparison with similar data on standard containers. The method of calculation is described, and illustrated by means of a sample problem. Graphs and tables are included to assist the computations. Four conceptual designs, believed to be capable of practical development are presented. Preliminary estimates based on these designs indicate that while cost is critically dependent on the design itself, weight and usable volume are insensitive to the design, and depend primarily on the handling features provided. Finally, consideration is given to reliability and maintainability aspects of modular containers and to the possible application of their component parts to uses other than cargo transport. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, AD-725099

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019559

#### TRENDS IN INTERMODAL REFRIGERATED CONTAINER SYSTEMS

Sabin, AB

Society of Naval Architects and Marine Engineers, 74 Trinity Place, New York, New York, 10006

Jan. 1970, 12pp, 8 Fig, 1 Tab

Paper presented at Northern California Section of the SNAME, Jan 1970

Foreign ship owners with their new fleets of plenum container-ships are providing a transport service superior to conventional practice in the U.S. The purpose of this paper is to acquaint U.S. shippers with the threat of overseas competition and the availability to meet it. Only shippers with improved equipment can hope to meet this competition and thus not only preserve but also expand our food-export industry.

#### ACKNOWLEDGEMENT

Society of Naval Architects and Marine Engineers

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019560

#### LOADING AND UNLOADING OF BULK MATERIALS ON THE GREAT LAKES

Whitehart, RE, McDowell Wellman Engineering Company

Society of Naval Architects and Marine Engineers, 74 Trinity Place, New York, New York, 10006

Jan. 1970, 36pp, 8 Fig, 1 Tab, 23 Pho

Presented at Great Lakes Section of the SNAME, Jan 1970

Recent construction of several new rail-water terminals, as well as the start of construction of two new self-unloaders, assures the continuation of advancing technology in Great Lakes bulk trade. Noteworthy among the new terminal developments are ore loading terminals at upper lakes ports and coal loading terminals at lower lakes ports. This paper presents a review of some of the new terminals as well as a few historical notes and some comments on future possibilities. Presented first is a historical review of tonnages and port locations; then a description of older ore and coal handling facilities together with a description of some of the latest terminals; and finally, some projections for the future.

#### ACKNOWLEDGEMENT

Society of Naval Architects and Marine Engineers

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024832

#### IRON ORE TERMINALS

Mills, HR Giedroyc, MJH

Institution of Civil Engineers, 1-7 Great George Street, London SW1, England

Nov. 1969, pp59-65, 2 Ref

A short historical review of the development of facilities for loading and unloading vessels carrying iron ore is followed by a discussion of the modern trends which influence the choice and design of such facilities, in particular the increase in ship size, the specialization in ship design, and the increase in output of both mines and steelworks. The equipment suitable for loading and discharge at the required rates is described and illustrated by reference to the most recent installations at a number of the more important ore ports.

#### ACKNOWLEDGEMENT

Engineering Index, EI 71 58784

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**024852**  
**STUDY OF CONTAINER INTERCHANGE AND POOLING**  
**FACILITIES IN UNITED STATES EXPORT-IMPORT**  
**TRAFFIC**

Kearney (AT) and Company, Incorporated, New York, New York

May 1971, 144pp

Contract DOT-OS-00061

The study is concerned with determining whether container pooling and interchange facilities offer workable alternatives to existing methods of operation. One of the steps required to make this determination is to investigate and evaluate the present situation concerning containerized cargo. The study reviews the state of the art in container pooling; foreign pooling considerations, current pooling arrangements, domestic intermodality, consortiums, leasing considerations, existing repair facilities, etc. The study also evaluates the current container pooling system, projects containerizable tonnage, gives alternatives to current pooling practices, studies the process of implementing a pooling network, and presents conclusions and recommendations. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-203130

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 PB-203130

**028929**  
**MOBILE POWER FOR THE U.S. NAVY**

Cannady, JR

Gas Turbine International (80 Lincoln Avenue, Stamford, Connecticut, 06902)

Vol. 13, No. 1, Jan. 1972, pp20-22, 3 Pho

In the event that an emergency utilities support system is needed at a Navy shore establishment the Mobile Utilities Support Equipment (MUSE) Program is ready to supply power on short notice. The majority of power plants use diesel engines as prime movers, but recently an increasing number of gas turbine driven power plants have been put into service. They are rated at 600 Kw, 750 Kw, and 2,000 Kw, and they all generate at 2400/4160 volts. They are designed for transportation by road, rail, or air. The advantages of using gas turbine models are less weight per Kw, minimal installation time, ability to "light off" and accept full load in 60 seconds, extreme responsibility to load fluctuation, and ability to accomplish engine overhaul on an exchange basis. The Navy relies mainly on industry to provide trained operators for the units. Although uneconomical for permanent installation, the gas turbine units are very effective for short term use.

**ACKNOWLEDGEMENT**

United States Merchant Marine Academy, N-278

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 Gas Turbine Publications, Incorporated, 80 Lincoln Avenue,  
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**034780**  
**CONTAINERIZATION AND ITS IMPACT ON PORT**

Tozzoli, A, Port of New York Authority

ASCE Journal of Waterways, Harbors & Coast Eng Div  
 (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. WW3, Aug. 1972, pp 333-342

Order paper number 9126.

The changes that containerization has brought to ocean transportation are also influencing changes in other modes of surface transportation. These dramatic changes in cargo handling are reviewed over the postwar years, with trends in vessel construction, the theory of containerization, and a review of problems leading towards true intermodal system of transportation. The interface and the ground on which it takes place, the port, are fully explained and are based on experience at the Elizabeth-Port Authority Marine Terminal. Criteria for the port complex are fully reviewed with area requirements and operational characteristics. As an interesting side light to container terminal construction, the water surcharge method of land reclamation is fully detailed.

**ACKNOWLEDGEMENT**

American Society of Civil Engineers

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 American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017, Repr PC: \$0.50

**037156**  
**AUTOMATIC CONTROL OF FREIGHT**  
**TRANSPORTATION ON THE DUTCH RAILWAYS 212**  
**AUTOMATISCHE PROCESBEHEERSING NS-**  
**GOEDERENVERVOER**

Pouw, GA

Ingenieur, Netherlands (NVA Oosthoek's Uitg-Mij, Domstrat 11-13, Utrecht, Netherlands)

Vol. 82, No. 6, Feb. 1970, pp V1-6

The problems encountered in setting up an adequate collection of data, and the system and apparatus selected for control are discussed. Questions of day-by-day control and control at higher levels are dealt with and future developments indicated.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 04882

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**037166**  
**DETERMINING PRACTICAL TONNAGE LIMITS AND**  
**SPEEDS IN GRADE OPERATIONS**

Blaine, DG, Westinghouse Air Brake Company

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

Paper '69-WA/RR-6, 9pp

ASME Meeting, November 16-20, 1969.

It is emphasized that in considering the design, control, and management of railroads, thinking must be oriented to horsepower, not only tractive but also braking. The author analyzes the effect and distribution of braking horsepower, listing parameters useful in modern railroading. Provided are graphical methods for determining practical tonnages per car and train for safe operation down grades.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 21726

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**037167**  
**GRASP-GENERALIZED RAILROAD ACTIVITY**  
**SIMULATION PROGRAM**

Gluck, R, Decision Systems, Incorporated

Hawaii Int Conference on Systems Sciences (2nd), Honolulu, Hawaii

Proceeding, Feb. 1969, pp505-8

Proceedings of the 2nd Hawaii International Conference on System Sciences, Honolulu, January 22-24, 1969.

Railroad is described in terms of its physical and logical structure; physical attributes are tracks and trains; logical attributes include signal system, timetables and operating strategy; track layout is described by nodal representation; interlockings are nodes; straight tracks are links; simulator determines priority based on time of day and direction of travel of each train, local/express status of trains, and passenger transfers.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 17860

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**037197**

**MANAGEMENT CONTROLS FOR OVER ONE HUNDRED CAR REPAIR FACILITIES THROUGH CENTRALIZED COMPUTER APPLICATIONS**

Robinson, VG

American Institute of Industrial Engineers, 345 East 47th Street, New York, New York, 10017

AIIE Tech Pap, Proc, 1969, pp465-75

American Institute of Industrial Engineers 20th Institute Conference and Convention, Houston, Texas, May 14-17, 1969.

A system to account for the repair of freight cars, including—billing for repairs made to the railroad's cars and other railroads' cars, records on repairs and reweighs, production and performance, and integration with accounting and transportation needs.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 42703

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**039795**

**PC UNVEILS "MOST EFFICIENT" M/W SHOPS**

Dove, RE

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 67, No. 6, June 1971, pp 18-21

Conversion of a former steam locomotive back shop into a shop for handling the complete overhaul of equipment by Penn Central at Canton, Ohio. In new facility work areas are reserved for particular machines, units are scheduled for repair on a priority basis, operations are based on the unit-changeout system, and a computer keeps tabs on repair costs.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 49876

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**039799**

**MINICOMPUTER CONTROLS UP YARD**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

N2, No. 12, Dec. 1971, pp 15-18

At a 16-track classification yard in East Los Angeles, Calif., the Union Pacific has applied a minicomputer for control purposes. The system described provides automatic car routing, car retarder operation and data generation on cars handled in the yard. Average traffic handled is 400 to 500 cars daily, and humping is carried out at about 4 cars/min. The minicomputer is a high speed, 16-bit process control computer. It is mounted on slides for easy access to all printed circuit boards.

**ACKNOWLEDGEMENT**

Engineering Index, EI 72 48977

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**039821**

**COST AND UTILIZATION CONTROL OF FREIGHT CAR EQUIPMENT PROVISION**

Whitten (Herbert O) and Associates, Annandale, Virginia

Final Rpt, Mar. 1971, 80p\*

Contract DOT-PR-10174

The report reviews the freight car utilization problem and discusses the impact of the rate of utilization on freight car costs and profits. Improved utilization is suggested by maintaining a detailed cost accounting system which could associate freight car costs with functional and geographic responsibility centers. The report discusses deficiencies in existing railroad cost accounting systems, and outlines a proposed system which could associate freight car costs with functional and geographic responsibility centers. Adoption of such an accounting system is recommended in the report.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204884

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**040611**

**THE IMPACT OF MARITIME CONTAINERIZATION ON THE UNITED STATES TRANSPORTATION SYSTEM. VOLUME 2. MAIN BODY**

Manalytics, Incorporated, San Francisco, California

Final Rpt, Feb. 1972, 339p

Contract C-1-35494

See also Volume 1, COM-72-10405.

The report represents the second phase of an earlier study entitled 'The Impact of Containerization on the U.S. Economy' (N.T.I.S. numbers COM-71-00050 and COM-71-00051). The main body report describes various affects that containerization has had to date and might have in the future. The topics covered include: FORECASTS OF CONTAINER FLEETS, CONTAINER TRADE, AND CONTAINER PORT CAPACITIES; A DESCRIPTION OF A COMPUTER ANALYSIS MODEL; AND A PROJECTION OF TRENDS IN CONTAINERIZATION. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-721040

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COM-721040

040612

**THE IMPACT OF MARITIME CONTAINERIZATION ON THE UNITED STATES TRANSPORTATION SYSTEM. VOLUME 1. EXECUTIVE SUMMARY**

Manalytics, Incorporated, San Francisco, California

Final Rpt, Feb. 1972, 43p

Contract C-1-35494

See also Volume 2, COM-72-10406.

The report represents the second phase of an earlier study entitled 'The Impact of Containerization on the U.S. Economy' (N.T.I.S. numbers COM-71-00050 and COM-71-00051). The executive summary gives synopsis of the main body report which describes various affects that containerization has had to date and might have in the future. The topics covered include: forecasts of container fleets, container trade, and container port capacities; a description of a computer analysis model; and a projection of trends in containerization. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-721040

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COM-721040

040980

**IMPROVING RAILROAD FREIGHT-CAR SERVICE**

Department of Transportation, Washington, D.C., 20590

Nov. 1971, 72 pp

Contract DOT-OS-00035/10

The National Academy of Sciences was requested to convene a conference to examine the problem of railroad freight-car shortages. A two-day conference was held during the spring of 1971 to which representatives from governmental agencies, shipping and carrier companies, and academic and professional consulting organizations were invited to discuss ways of improving freight-car service and to identify issues that might warrant further study. The conference opened with position statements from the U.S. Department of Transportation and the Interstate Commerce Commission and remarks from the staff of the Senate Commerce Committee. Written statements were also invited from the participants. The conference was then divided into four workshop groups to discuss (a) increasing the number of freight cars, (b) increasing the utilization of the existing freight cars, (c) making freight-car service more responsive to shipper needs, and (d) changing public policy and governmental regulation to increase investment in and use of freight cars. This report contains the proceedings of the conference.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205980

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PB-205980

041020

**IC PROVIDES ON-LINE, REAL TIME CONTROL TO PIGGYBACK TERMINAL**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 1, Jan. 1972, pp 15-17, 1 Fig, 2 Phot

Illinois Central has provided on-line, real-time control for their intermodal exchange (IMX) piggyback facility. Control is obtained by a digital computer fed by five Automatic Car Identification scanners. Two ACI scanners check trains in and out, and three scanners

are located at gates on the road entrance/exit points to check tractors and trailers. Teleprinters and cathode ray tubes provide for input/output. The control system controls twelve basic functions: trailer and flat car inventory, inbound shuttle and pickup, delivery, trailer reservation, patron release and pickup, inbound gate, parking, programming trailer loading on flat cars, cartage, trailer repair and credit reclaim, detention and yard storage, and performance measurements. Conventional automatic parking lot gates are used to control entry/exit of vehicles by road. About 300 trailers per day are handled through IMX. The control system has been a big aid to keeping out-bound piggyback trains on time.

**ACKNOWLEDGEMENT**

Railway System Controls

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041110

**DEVELOPMENT OF ELECTRO DYNAMIC CAR RETARDER**

Tusboi, M Itakura, E

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

Vol. 13, No. 1, Mar. 1972, pp 46-50, 14 Fig

A study was aimed at the practical development of the electro dynamic car retarder. The eddy current retarding force was analyzed and an approximate equation was derived. Validity of the equations was confirmed by experiments on a 1/5 scale model. Development of the device for practical use was performed on the basis of the analyses and experiments within merely two years. Installation of the initial device was carried out at Takasaki yard in October 1970.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
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041121

**LINEAR TRAIN DIAGRAM RECORDER**

Yamamoto, I Tsuchiya, K Ushiyama, C

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

Vol. 13, No. 2, June 1972, pp 99-103, 10 Fig

The train diagram recorder is one of the most useful apparatus for the train traffic dispatcher a versatile recording system using a X-Y plotter and a minicomputer has been developed. In this paper, various problems of this recording system, X-Y plotter, driving mechanism, recording paper, programing and so on, are described. The field test of this system was carried out on the Uno line of Okayama region.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Railway Technical Research Institute, Kunitachi, Box 9, Tokyo, Japan, Repr PC: Req Price

041124

**STATISTICAL ANALYSIS OF RENEWAL DATA IN ROLLING STOCK MAINTENANCE**

Abe, S

Railway Technical Research Institute (Japanese National



Railways, Kunitachi, Box 9, Tokyo, Japan)

Vol. 13, No. 2, June 1972, pp 112-115, 1 Fig, 1 Tab

A sequence of replacements of like units treated as a whole is called a self renewing aggregate. A new method has been developed of estimating type by type failure characteristics of units from short interval observations of the renewal processes. The number of failures in the interval is a random variable and is correlated with the life-times of the units observed in the interval for each renewal process. These statistics are applied to analyze field data in rolling stock maintenance.

#### ACKNOWLEDGEMENT

Railway Technical Research Institute

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041146

#### UNIT OIL TRAINS HELP REDUCE POLLUTION

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 12, Dec. 1972, p 12, 1 Phot

Unit trains are used to move crude oil, imported from the Middle East, from deepwater to an electric generating station. After an extensive search for a non-polluting alternative to coal, the low sulfur crude oil was selected, but it was not feasible to deliver the oil by water to the generating station. The unit train movement involves three 26 car trains operating 70 miles across the state and providing a daily delivery of about 600,000 gallons of crude oil. A total of eighty of the 23,150 gallon tank cars are used. An additional generating unit will go on-line in 1974, which will increase the daily train to 36 cars.

#### ACKNOWLEDGEMENT

Railway Age

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041155

#### FIELD MANUAL OF THE INTERCHANGE RULES

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

1973 Edit, Jan. 1973

Notice of this manual was given in Volume 146, No. 11 of "Railway Locomotives and Cars", dated December 1972.

The updated version of this pocket-sized manual become effective Jan. 1, 1973, and contains all rules dealing with care, repair, responsibility for, disposition of and settlement for freight and passenger cars.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

AAR, Repr PC: \$3.00

041158

#### READING'S SIMPLIFIED SANDING UTILIZES AIRSLIDE CONCEPT

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 9, Oct. 1972, p 23, 2 Phot

The Reading claims a sharp reduction in locomotive sanding time due to the use of low velocity air produced by blowers rather than high-velocity air produced by a compressor. The new Module installation at Lebanon, Pa., has the major advantages of reduced line wear and economy produced by using a low-cost air supply system. The conveying of sand with the low pressure system is fast and smooth because the Module valve automatically adjusts the sand flow to the flow of air. This smooth flow of sand also minimizes noise and dust pollution.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041229

#### "MOST MODERN CLASS YARD" BEGINS TO TAKE SHAPE IN CALIFORNIA

Dove, RE

Railway Age (Simmons-Boardman Publishing Corporation, New York, New York, 10013)

Vol. 173, No. 9, Nov. 1972, 3 pp, 4 Phot

This article describes the new, innovative features of Southern Pacific's new yard at Colton, California. Master, intermediate, and group retarders perform a spacing function only. Tangent point retarders control coupling speeds. This separation of retarder functions is to make possible higher humping rates of six cars per minute or more. Eight classification tracks are combined into a 'key unit' with departure tracks. The layout of the yard provides an organized and rapid movement of cars with a minimum of conflicting or restriction points. The data-control systems uses two separate computer systems: the crest control computers (CCC) which is located at Colton and handles the switching and retardation of cars; and the terminal control computer (TCC) which is located at San Francisco and handles management information functions. The availability of real-time inventory and of a trains-due file permits advance planning on a detailed basis. Also available is computer-assisted assignment of resources, classification tracks, and departure tracks. Cost saving techniques used in construction of the yard include: distribution of cross ties by a tie-placer machine, prefabrication of turnouts, and welding of rail into long strings at a yard site.

#### ACKNOWLEDGEMENT

Railway Age

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.6

041298

#### SPECIFICATIONS FOR INTERNATIONAL FREIGHT CONTAINERS

American National Standards Institute, 1430 Broadway, New York, New York, 10018

This book was prepared by the American National Standards Institute and announced in Railway Locomotives and Cars, V146, N8, September 1972.

Recommendations of the International Organization for Standardization (ISO) on container specifications have now been made an American National Standard. Carriers, lessors, repair facilities and others involved with international containers will find the dimensions, ratings, specifications for testing, corner fittings, marking and terminology all valuable.

#### ACKNOWLEDGEMENT

Railway Locomotives and Cars

#### TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

American National Standards Institute, 1430 Broadway, New York, New York, 10018, Repr PC: \$6.50

**041303**  
**RULES OF INTERCHANGE FOR RAILROAD CARS**

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

Jan. 1972

This manual was announced in *Railway Locomotives and Cars*, V146, N3, March 1972. For copies write care of J.H. Bean, Mechanical Division.

New editions of the Field Manual and the Office Manual became effective Jan. 1, 1972. The Field Manual deals with the care and repair, responsibility for, disposition of, and interchange of freight and passenger cars. The Office Manual contains rules covering all aspects of pricing and billing for car repairs, requirements for new and rebuilt cars, and methods of settling disputes.

**ACKNOWLEDGEMENT**  
Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
AAR, Repr PC: \$3.00, Orig HC: \$5.00

**041628**  
**INTEGRAL TRAIN SYSTEMS**

Kneiling, JG

Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233

1969, 216 pp

This book is the first to deal with integral train technology. It therefore necessarily includes material covering a wide range of topics. The book presents the basics and some illustrations that can help managers, engineers, regulators, and traffic men to use the new technology and the services of men skilled in its application. This book assumes some familiarity with transportation, particularly rail transportation. This book is divided into four parts: (1) Concepts, (2) Technology, (3) Money, and (4) Commercial Exploitation. Integral train technology starts with some obvious but ordinarily neglected concepts. They amount to a strictly commercial plan to run each train as if it were intended solely to produce low-cost transportation. The train needs accessories to load and unload, service, fuel, and maintain, it. The entire system is an integral train system. It also follows that an integral train system will use and pay directly for only those railroad plant and facility components that it needs. It will also contribute to "overhead and profit," and this money can be used in any way that management chooses. Engineering decisions derive from commercial ideas. Engineering design consists of selecting, for each function, the tool and method associated with lowest total cost. It does make a difference how the work is done. A first commercial choice is usually a single-purpose facility or device. Few existing transportation systems and accessories survive such analysis. Each bit of business must meet at least its own incremental costs. Budgeting is an important part of the planning process because costs enter into all design decisions and commercial considerations. Integral train systems have the incidental but useful characteristic of enabling most of their costs to be isolated and hence identified. It is also characteristic of integral train systems that their management can be largely isolated from the management of the rest of the railroad. Therefore advances in technology and operational science need not wait for the rest of the industry. The savings from such advances can be realized and identified at once. The two appendices concern: (a) Some projections that will help anticipate next-generation equipment. (b) A glossary of terms which have special definitions in integral train technology.

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Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233, Orig PC: \$18.9

**041640**  
**BN CARS COME CLEANER FASTER IN NEW WASHER FACILITY**

Railway Locomotives and Cars (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 146, No. 3, Mar. 1972, pp 14-16

Features of an automatic box car washing machine designed jointly by Burlington Northern's engineers and Whiting Corp. This automatic machine, which operates in conjunction with a car progression system also built by Whiting, helps keep car interior cleaning costs to about \$1 per car. The car cleaning facility can handle up to 56 cars a day on two tracks. The washing apparatus itself moves into the car through the door opening, and the washing arms themselves then extend to the far reaches of the car.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 72 066677

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

**041655**  
**TOFC/COFC HITS ITS STRIDE AGAIN**

Welty, G

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 172, No. 10, May 1972, pp 27-29

Developments and improvement at key points and over key events of TOFC/COFC (piggyback) service are reviewed. Features of crane-equipped facility at Houston, Tex. opened recently by Santa Fe and Southern Pacific.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 017706

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**043512**  
**CONSIDERATION OF DIRECT TRANSIT AND WAGON TRANSFER IN FREIGHT TRAFFIC**

Miyata, H

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

Vol. 13, No. 4, Dec. 1972, pp 198-201, 5 Fig

The patterns of freight car transit system such as a direct transit between origin and destination yards without stopping at any yard en route, a local transit between two adjacent yards and an intermediate transit form derived from these two extreme forms are investigated as applied to the traffic networks established mainly for the link of principal yards in Honshu from the standpoint of railway management and the nation-wide economics, in terms of cost of the section of line, yard expenditure, temporal cost (for example: handling time of freight car at yards and its load, waiting time of freight cars to be transferred to another train), etc. (Author)

**ACKNOWLEDGEMENT**  
Railway Technical Research Institute

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan

043514

**THE MOST OPTIMAL ARRANGEMENT OF MARSHALLING YARD ON THE JNR NETWORK FOR MODERNIZATION OF FREIGHT TRANSPORT SERVICE**

Harada, M

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

Vol. 13, No. 4, Dec. 1972, pp 208-212, 11 Fig, 1 Tab

The most optimal number and the arrangement of yard on the network can be obtained by the transport matrix and tree. Generally the whole yards are not arranged on the network at the same time, but one by one. However, it is necessary to reappraise the former one and apply it to the long term project to keep pace with the times. The most optimal number and the arrangement of yard on the JNR network are described in this paper.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan

043519

**AIR BAG TYPE CAR HOLDER FOR TRAIN FERRY**

Izumi, M

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

Vol. 13, No. 4, Dec. 1972, pp 231-234, 6 Fig

In order to mechanize the fixing work of rolling stock carried on a train ferry, a remote-controlled air bag type car holder, which works at a time, has been developed together with its particular controlling device, hoping to take place of the conventional turn-buckle type car lashing apparatus. This report presents the experimental results obtained with respect to the fundamental problems such as the compressibility of air bags, the effect of air bag type car holder upon the side structure of a freight car and a synthetic review on the problems arising from the realistic installation plan and the particular controlling device. (Author)

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan,  
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043537

**WHERE HAVE ALL THE RAILCARS GONE?**

American Plywood Association, 1119 A Street, Tacoma, Washington, 98401

Spec Rpt, Mar. 1973, 4 pp, 4 Phot

The current boxcar shortage is now reaching the intensity of the 1966 crisis, the worst in history. The problem is particularly acute in the West, but it is also being felt throughout the South. It is aggravating the wood products price-supply spiral that was already in effect. The cause is plain: not enough boxcars to go around in a booming economy. The large movement of Russian Grain is the most immediate reason for the car shortage, but the roots of the problem go much deeper. Boxcar ownership has declined from 720,000 cars in 1956 to 550,000 today. Improved carrying capacity and improved railroad performance cannot keep up with the demand, though, because the GNP continues to increase. The plywood industry depends too much on railroad transportation, and alternatives must be sought. Broader utilization of water and motor carrier transportation should be sought, although this will involve extra loading costs. Repeal of the Jones Act would permit intercoastal water transportation of plywood in low rated foreign vessels. The plywood industry itself can

help, positive measures include: order only the cars actually needed, load and unload cars quickly as possible, route shipments over the most direct route. Long term relief measures include a bill to be introduced to create a Government Load Fund for rolling stock purchases, and a solution to the Northeastern railroad problem.

**ACKNOWLEDGEMENT**

American Plywood Association

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American Plywood Association, 1119 A Street, Tacoma,  
Washington, 98401, Repr PC: Req Price

043779

**BRAIN TRAIN CAN BOOST TERMINAL THROUGHPUT**

ICHCA Monthly Journal (International Cargo Handling Coordination Assn, Drummond House, 203-9 North Grove Street, London NW1, England)

Aug. 1971, 3pp

A driverless, self-routing transport system, capable of moving containers rapidly round docks and terminals to cut throughput times and increase efficiency is described. This principle of automatic track selection offers routing flexibility comparable to road transport and can be also applied to monorails and steered vehicles. A detailed analysis of the system and a flow diagram for port application are included.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 021833

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043919

**CONTAINERIZATION: A PANDORA'S BOX IN REVERSE?**

Strom, HK

Transportation Journal (American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60606)

Vol. 12, No. 2, Dec. 1972, pp 46-57

The basic premise for the explosive growth of the containerization concept in the mid-1950's was an expected reduction of costs resulting from reduced damage, reduced pilferage, less packaging, simplification in paper work, and simplification in the freight rate systems resulting from a demand-based to a cost-based pricing system. "Traditional" ills found in the field of transportation are present in this development: large capital investment requirements, lack of standardization, uncertainty in the legal sector involving questions of carrier liability, bill-of-lading provisions, and customs inspection, difficulties in the labor-management area due to opposition by labor to containerization, and customer indifference. The ultimate value of the new concept may be as a catalyst that will produce efficiently integrated transportation systems.

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American Society of Traffic and Transportation, 547 West  
Jackson Boulevard, Chicago, Illinois, 60606, Repr PC: Req  
Price

044017

**UNIT TRAINS: THE REASON FOR COAL'S COMEBACK**

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 2, Feb. 1971, 4 pp, 2 Fig, 5 Phot

Contrary to expectations, nuclear power has not displaced coal as the first choice for new power stations in the U.S. To a large extent this is because rail transport costs have been virtually halved by unit train operation, a development stimulated 10 years ago by the threat of coal-slurry pipeline competition. Latest and greatest are the 17,000-ton trains destined to feed Detroit's 3,200 NW Monroe power station with coal from Blacksville, West Virginia, 360 miles away.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044038**  
**FRENCH RAILWAYS REORGANISES ITS SMALLS TRAFFIC**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 3, Mar. 1971, pp 92-94

By transferring much of its less-than-wagon load freight to a subsidiary, the SNCF has developed an organisation capable of responding to changing market conditions. Although the new arrangements came fully into effect only in October, 1970, individual contracts so far negotiated represent a 10% increase in smalls traffic.

ACKNOWLEDGEMENT  
British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044039**  
**CUTTING THE COST OF CONTAINER TRANSFERS**

Hardie, C

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 9, Sept. 1972, pp 336-339

One of the most important lessons to emerge from nearly a decade of ISO container movement is the importance of matching the capital cost of the lifting plant at the transshipment point to the volume of traffic handled. Failure in this respect can create bottlenecks, or load each container movement with excessive costs which cannot be recovered from the shipper. The author reviews the wide range of container lifting and handling equipment now available, and explains the advantages of each method for particular applications.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044040**  
**TACKLING THE UNIT-LOAD PROBLEM**

Schultz, G V

IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England

Vol. 128, No. 9, Sept. 1972, pp 336-339

Internal dimensions of containers, pallets, railway freight wagons, lorries, ships and warehouses must all be related if full global use is to be made of the intermodal unit-load. But already heavy investment has been made in several conflicting standards. The author

outlines the work of the International Standards Organization in attempting to reconcile distribution systems with international standards dimensions.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044041**  
**CAN AUTOWAGON BEAT THE LORRY?**

Mellitt, B

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 9, Sept. 1972, PP 329-332

Trainload freight is fully competitive with road in Britain but wagonloads are not, mainly because of marshalling costs and delays. The author points out that these would be eliminated if selfpropelled-unmanned wagons moved direct between a large number of automated terminals, giving good penetration into the market for high-value manufactured goods now almost entirely moved by road.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044042**  
**FREIGHTLINERS IN PERSPECTIVE**

Gibb, G

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 9, Sept. 1971, pp 340-343

Too much was expected of Freightliners by their originators; in particular they failed to appreciate the large tonnage throughput needed to justify a fully-equipped container terminal. Nevertheless, carryings are expanding at a high rate—particularly maritime containers—and Freightliners Limited should be profitable in 1971.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England; Repr PC: R Price

**044043**  
**PIGGYBACK IN WESTERN EUROPE**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 9, Sept. 1971, pp 346-348

At first sight, carrying complete road vehicles by train looks inefficient compared with transcontainers. But many road haulers are small operators, jealous of their independence, who are not interested in becoming a cog in a ponderous transport machine. In Europe there is a growing demand for piggyback services that are marketed separately from—even in competition with—other rail business.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

044051

**ONE-MAN TRAIN CREWS IN THE NETHERLANDS**

Kaper, HP

Railway Gazette International (IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 11, Nov. 1972, pp 427-428

After several years' experience with freight trains manned only by the driver, NS is conducting experiments with one-man operation of passenger trains on the line between Gouda and Alphen.

**ACKNOWLEDGEMENT**

British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street, London SE1 9LU, England, Repr PC: R Price

044071

**RUN ANYWHERE, RUN FAST, RUNTHROUGH**

Welty, G

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 4, Feb. 1973, pp 16-19, 3 Phot

The runthrough maximizes the unity of railroads as a system and it minimizes the fragmenting of operations in a total system made up of multiple corporate structures and multiple managements. The advantages, problems and future of runthroughs are discussed and a case illustration is given.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

044073

**NORFOLK & WESTERN STRIVES FOR BETTER ON-TIME PERFORMANCE**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 4, Feb. 1973, pp 36-37, 2 Phot

Six years ago, Norfolk and Western established a "System Operations Center" at Roanoke. SOC's first assignment dealt with motive-power (1,554 units) control and distribution, but it rather soon got into system-wide control of train make-up and dispatch. Results, in terms of its on-time performance and equipment utilization, have been impressive. Statistics are included.

**ACKNOWLEDGEMENT**

Railway Age

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

044252

**A NEW ANALYSIS OF RAILROAD YARD OPERATIONS**Schweich, TA, Southern Pacific Transportation Company  
Brown, WB, Oregon University, Eugene

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp 12-27, 7 Ref

Although several models of railroad yard performance have been developed in the past twenty years, none of them are in active use in the daily conduct of railroad freight transportation. Three basic models are discussed. Another model is developed using an eight-week sample of daily performance data. Factor analysis is used as an analytic tool to discern the patterned relationships among the data. The final model developed by the authors is considerably different from previous models, and because of its strong base in empirical investigation it is believed that it is a more viable model than its predecessors. (Author)

**ACKNOWLEDGEMENT**

Railway Management Review

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Orig PC: \$7.50

044254

**MARITIME CONTAINER TRANSPORTATION TRENDS**

Schrier, E, Manalytics, Incorporated

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp A1-A20, 14 Fig

Containerization is the dominant means of carrying break-bulk commodities between all of the major industrialized countries. The problem facing the port is much the same as that facing the ocean carriers: how to attract sufficient cargo to achieve economic levels of utilization. The situation is just the reverse for rail and truck carriers. Less than one percent of all U.S. overland traffic, measured by revenue-miles or ton-miles, now moves in containers over any portion of its route. The problem for inland carriers, is how to develop regular, high-volume, low-cost container operations, without adversely affecting their much larger domestic business. There is enough rail and truck capacity to move import/export containers to inland origins/destinations in that manner. But until the quality of the inland container services matches that available on the ocean segment, the full benefits of containerization will not be available to all U.S. shippers. The container, The System Economics, Land Transportation Costs, Capacity/Demand Relationships, Land Bridge, U.S. Canadian Trade Diversion, and Institutional Considerations are the headings of subjects covered in this article.

**ACKNOWLEDGEMENT**

Railway Management Review

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044256

**MINIBRIDGE IN FOCUS**

Norris, JT, Jr, Department of Transportation

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp A39-A42

Minibrige refers to two or more modes working in tandem—fully coordinated and producing a planned through service usually on a through pricing basis. From the carrier point of view, it may expand the market of either, both, or all the carriers or other transport-oriented participants, which, of course, reflects the stimulus of carrier competition. From the aspect of the shipping public, the minibrige, like its kin, intermodalism, represents a new—and additional—transport option which, in the relatively few minibrige arrangements that exist to date, has proved, according to claims, a very effective technique in meeting some of the demands in transportation.

**ACKNOWLEDGEMENT**

## Railway Management Review

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Railway Systems and Management Association, 181 East Lake  
Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044257

**A LAND BRIDGE—THE MYTH AND THE REALITY**

Velez, RA, Seatrails Lines

Railway Management Review (Railway Systems and  
Management Association, 181 East Lake Shore Drive, Chicago,  
Illinois, 60611)

Vol. 72, No. 4, 1972, pp A43-A49

Stimulated by the successful railroad offer of TOFC services in the post World War II era, coupled with the ocean carriers conversion from break-bulk to container transportation, the land bridge became a "new" topic in 1966. But soon arguments against the idea were heard and in 1970 and 1971, the land bridge appeared to be on its way into limbo. The author believes the land bridge is a workable concept if developed according to market place realities and 1972 transportation economics. The markets, Conventional Pricing, Rail and Water Economics, Regulation, Through Bills of Lading, Implementation of the Land Bridge and The Reality and its future are topics discussed in this article.

## ACKNOWLEDGEMENT

Railway Management Review

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Railway Systems and Management Association, 181 East Lake  
Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044258

**MINI-BRIDGE FORUM**

Howard, FH, Halifax International Containers Limited  
Hennessey, WF, Atchison, Topeka and Santa Fe Railway  
Welter, LJ, Sea-Land Service, Incorporated  
Shimrak, G, Penn Central Transportation Company

Railway Management Review (Railway Systems and  
Management Association, 181 East Lake Shore Drive, Chicago,  
Illinois, 60611)

Vol. 72, No. 4, 1972, pp A50-A65

Halifax International Containers Limited is described: 95,000 twenty-foot boxes are moved per year in the terminal, ninety percent go directly to and from rail. The second paper has two parts: the first part involves some comments on land bridge economics, the size of the market, land bridge pricing and land bridge marketing; in the second part the author makes some general comments from his personal experience on why the minibridge got started. The economics of the minibridge and the land bridge are considered in the last two papers.

## ACKNOWLEDGEMENT

Railway Management Review

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Railway Systems and Management Association, 181 East Lake  
Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044259

**THE FUTURE OF TOFC AND COFC**

DeBoer, DJ, Federal Railroad Administration

Railway Management Review (Railway Systems and  
Management Association, 181 East Lake Shore Drive, Chicago,  
Illinois, 60611)

Vol. 72, No. 4, 1972, pp A66-A70

There is about 8 billion in merchandise and high rated traffic that is moving annually by long haul trucks. If nothing is done to improve railroad services, this traffic will continue to move on the highway. The first step to improve the situation is to develop a nationwide systems approach to improve railroad service, productivity and efficiency. An intermodal study is being conducted which will include an analysis of current operating and commercial TOFC/COFC practices and of current traffic flows. The next step will be to develop comparative line haul and terminal costs for motor and rail. The hard data gathered in the previous stages will be used to develop a modal split analysis and estimate revenues costs and profitability throughout the system.

## ACKNOWLEDGEMENT

Railway Management Review

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Railway Systems and Management Association, 181 East Lake  
Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044260

**THE SHIPPER'S VIEW OF CONTAINERIZATION**

Warner, DW, International Paper Company

Railway Management Review (Railway Systems and  
Management Association, 181 East Lake Shore Drive, Chicago,  
Illinois, 60611)

Vol. 72, No. 4, 1972, pp A71-A87, 9 Fig, 1 Tab

The purpose of this paper is to focus on the shipper's viewpoint of U.S. domestic containerization and develop a dialogue between shipper and carrier. The subjects covered are: 1) why containerization; 2) definitions; 3) the economics of containerization; and 4) future trends.

## ACKNOWLEDGEMENT

Railway Management Review

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Railway Systems and Management Association, 181 East Lake  
Shore Drive, Chicago, Illinois, 60611 Orig PC: \$7.50

044261

**DOMESTIC CONTAINERIZATION—WHY NOT NOW?**

Serenbetz, WL, Interpool Limited

Railway Management Review (Railway Systems and  
Management Association, 181 East Lake Shore Drive, Chicago,  
Illinois, 60611)

Vol. 72, No. 4, 1972, pp A88-A91, 2 Fig

The concept of containerization is widely used in Canada, the United Kingdom and throughout the countries in Europe but not yet in the United States. At this time, 1972, there are approximately 1400 ramp locations where TOFC can be handled and 125 locations where containers can be handled. It is virtually impossible to offer a shipper the opportunities of domestic containerization on any broad ground. Research is needed to determine the actual rail operating savings of COFC over TOFC, as well as the actual capital savings. Research is also needed to determine which locations need a million dollar crane installation, which a \$250,000 front end loader, side lifter or similar device and which locations can get by with a \$25,000 side transfer.

## ACKNOWLEDGEMENT

Railway Management Review

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Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044262

**CONTAINERS FOR DOMESTIC FREIGHT—WHAT DO THE CARRIERS THINK?**

Seguin, VC, Union Carbide Corporation

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp A92-A98, 3 Tab

The findings of a research effort, which was designed to collect opinion in such a manner that the factors inhibiting growth of domestic containerization could be set down in order of importance, are presented. Questionnaires were sent to freight users, freight carriers and container equipment suppliers. It was found that Economic Factors were of greater concern, followed by Labor Resistance, Coordinative Activities, Container Equipment Availability and lastly, Government Regulation and Influence. It appears that containerization is going to have to provide a greater economic incentive through more efficient intermodal transfers in overland movements than is currently provided by the Van Trailer/Piggyback before the practice really takes off on the domestic scene.

**ACKNOWLEDGEMENT**

Railway Management Review

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044263

**WHEN WILL DOMESTIC CONTAINERIZATION TAKE OFF?**

Lawless, RE, Canadian National Railways

Reebie, RS

Margolin, E, Interstate Commerce Commission

Ogle, PE, O-T-D Corporation

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, 23 pp, 1 Fig

Four reports are given by the authors. First, the present situation in Canada and the future trends of containerization and multimodal transportation are discussed. Second, three general comments about transportation: Predicting Economic Aspects—Marketing to Control Destiny—Balancing Capacity and Utilization with Sales—are presented, followed by an evaluation of the feasibility of a national intermodal transportation network. In the third report, the Interstate Commerce Commission's studies of TOFC costs and major investigation of the economics of containerization are discussed. The last report delineates O-T-D's approach to containerization.

**ACKNOWLEDGEMENT**

Railway Management Review

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

044266

**OPERATING RULES—OBSOLETE OR OTHERWISE**

American Association of Railroad Superintendents, 18154 Harwood Avenue, Homewood, Illinois, 60403

Proceeding, June 1971, pp 109-116

The 75th Annual Meeting of the American Association of Railroad Superintendents was held at Le Chateau Champlain, Montreal, Quebec Canada, June 15-17, 1971.

A recent DOT report placed the 'human factors' or 'negligence of employees' as the cause of 27.1 percent of the train accidents in 1968. All of these accidents were due to rules violations of one sort or another. A tough policy on rules compliance is badly needed in the industry. The need for improved rules training is chronic. Employees required to operate over foreign line tracks must be qualified on foreign line rules. There are advantages to adopting a common rule book for all railroads. A disadvantage would be the high cost of changing signals to meet a common requirement. Acceptance would be difficult, since each railroad believes its own rules are the best for it. The committee feels that the present rules are not obsolete, but that they need to be streamlined to reflect the changes in operations and technology. The need for common rules is clear. The report concluded with the results of a survey on operating rules. Discussion of the committee report is presented on pages 60-75.

**ACKNOWLEDGEMENT**

American Association of Railroad Superintendents

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Association of Railroad Superintendents, 18154 Harwood Avenue, Homewood, Illinois, 604 Repr PC: Req Price

044268

**FREIGHT CAR DISTRIBUTION—A TOTAL SYSTEM**

American Association of Railroad Superintendents, 18154 Harwood Avenue, Homewood, Illinois, 60403

Proceeding, June 1971, pp 99-108

The 75th Annual Meeting of the American Association of Railroad Superintendents was held at Le Chateau Champlain, Montreal, Quebec Canada, June 15-17, 1971.

Effective distribution and utilization of the national freight car fleet is one of the most vital requirements for the survival of the railroad industry. Effective freight car distribution must definitely be a total system. One aspect of car utilization is optimum use of available empties. Due to rising costs, freight cars are becoming too capital intensive, and, even though new cars earn more revenue, they are not returning their investment as quickly as they formerly did. To increase the number of loads each car handles per year, improvement must be made in these areas: (1) transit time for loads and empties, (2) loading and unloading time, (3) time waiting for or undergoing repairs, (4) time for cleaning cars (5) distribution procedures to improve availability and avoid idle car days. The report then lists attributes of a desirable car distribution system and comments on freight car distribution among railroads. Discussion of the committee report is presented on pages 54-58.

**ACKNOWLEDGEMENT**

American Association of Railroad Superintendents

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Association of Railroad Superintendents, 18154 Harwood Avenue, Homewood, Illinois, 604 Repr PC: Req Price

044504

**RETARDING FORCE OF ELECTRODYNAMIC CAR RETARDER**

Itakura, E, Japanese National Railways

Electrical Engineering In Japan (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 91, No. 4, July 1971, pp 135-143, 9 Ref

This paper describes a method of calculating the electromagnetic retarding force produced by the eddy current induced in rolling freight car wheels. Using a simplified model representing the effect of

the eddy current, an approximated calculation formula for the retarding force is derived. Experiments conducted on a small-scale and actual car retarders show good agreement between the calculated and measured result.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 021480

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014643

**A NEW PALLET SYSTEM INCREASES THE EFFECTIVENESS OF CONTAINER TRANSPORT AND PERMITS THE USE OF STANDARDIZED PACKAGES**

Schubert, J · Delmelt, R

Seewirtschaft (Berlin, East Germany)

Vol. 2, No. 4, German, Apr. 1970, pp333-336

The authors studied the means for improving the utilization of loading areas in transcontainers by employing pallets dimensioned in an appropriate manner, and the use of standardized packages facilitating the implementation of the results of these studies. Both approaches, viz., (a) changing the container dimensions to permit accommodation to the pallet size of 800 by 1200 mm, and (b) use of pallets or other loading facilities with sizes conforming to the existing container dimensions, were explored. It was shown that the introduction of two additional pallet sizes would materially contribute to the effective utilization of the container transport facilities and of standardized packages.

**ACKNOWLEDGEMENT**

Joint Publications Research Service

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Library of Congress, Photoduplication Service, Washington, D.C., 20540, Repr PC: Req. Price

032670

**TRANSPORT OF CITRUS FRUIT UNDERGOES EXHAUSTIVE TESTS**

Felice, M

Container News (150 East 52nd Street, New York, New York, 10022)

Vol. 7, Mar. 1972, pp10-12

A unique experiment is currently taking place at a citrus packing house in southern Israel. It involves the containerization of citrus fruit for overseas transport using 40 foot refrigerated containers. Among those particularly concerned with the results are the U.S. Department of Agriculture and the U.S. Quarantine Division. In fact, parts of the experiment are being conducted solely upon the request and for the benefit of U.S. Quarantine. The tests are a joint undertaking of the Israel Citrus Marketing Board, Zim Israel Navigation Company, and two U.S. manufacturers of refrigeration machinery: Frigitemp and Thermo King. Their overall aim is to ascertain how different container refrigeration systems affect the condition of the fruit and how containers within these different refrigeration systems should be handled. There are two stages to this experiment—The first stage is a stationary test, with the task to check primarily: the rate of cooling down within the container, in order to bring the temperature to the desired level; the actual temperature in different parts of the container and the degree of temperature fluctuations; different stacking patterns of container loads; the flow of air within the container and how it is affected by the different stacking patterns, as well as by the introduction of a new type of carton accommodating 40 pounds of fruit; the condition of the fruit during the experiments which last between eight to twelve days, and the out-turn after their conclusion. The second stage, which is scheduled to begin only after the satisfactory completion of the stationary tests, will involve experimental shipments of various lengths and to different destinations. In both systems being tested, the air movement inside the container is vertical. This made it possible to use "solid bloc" stowage which gives maximum stability, good air movement throughout the unit and equally good temperature distribution. One of the crucial factors to the apparent success of the experiment was the design of the already mentioned special carton. It is perforated on all sides, as well as on top and bottom, thus forcing the air to circulate through each carton and not only around it, resulting in nearly equal temperature distribution. The tests were conducted under outside ambient temperatures of 70 to 75 degrees Fahrenheit during the day, to 35 degrees and

sometimes even below the freezing point during the night.

**ACKNOWLEDGEMENT**

Container News Incorporated

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Container News Incorporated, 150 East 52nd Street, New York, New York, 10022, Repr PC: Req Pric

039850

**AN ECONOMIC MODEL OF CARGO LOSS: A METHOD FOR EVALUATING CARGO LOSS REDUCTION PROGRAMS**

Braddock, Dunn and McDonald, Incorporated, McLean, Virginia

May 1972, 86p

Contract DOT-OS-20011

The study developed a method for defining the causes and sources of cargo loss to enable the development of effective counter-measures and remedial actions.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210223

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$4.85, Microfiche: \$0.95  
PB-210223

039878

**INCREASED PROFITS THROUGH FREIGHT CLAIM REDUCTION**

Boulay, PF

Mind Three Communications Group, 1821 Michael Faraday Drive, Reston, Virginia

June 1972, 39p\*

A technique of managing Cargo Loss Reduction Programs, stressing the profit motivation is presented. The key feature of the technique is periodic review and evaluation by comparing results (profits) to stated goals. The technique requires only financial and freight claims data available within most companies. Although the examples chosen are for trucking companies, the methodology is applicable to any transportation company.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211915

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039888

**TRANSPORTATION FACILITATION EDUCATION PROGRAM, PARTS 1 AND 2**

Oregon University, Transport and Logistics Research Center, Eugene, Oregon

Final Rpt, Mar. 1971, 155p

Contract DOT-OS-00063

See also Part 3, AD-742 322.

The purpose of this study is the development of educational material aimed at the transportation community including manufacturers, exporters and would-be exporters, carriers, freight forwarders, and other facilitating middlemen such as customhouse brokers. More specifically, the objective is the development of a set of guidelines with appropriate consideration given to teaching aids as both may be

used by lecturers and speakers in preparation and presentation of future workshops or seminars. A part of this objective is creation of a handbook or manual covering various subjects pertinent to transportation, the exact contents of which is determined by relevant information gathered during the study. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-742321

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95

AD-742321

**039889**

**TRANSPORTATION FACILITATION EDUCATION PROGRAM, PART 3**

Oregon University, Transport and Logistics Research Center, Eugene, Oregon

Final Rpt, Mar. 1971, 401p

Contract DOT-OS-00063

See also Parts 1 and 2, AD-742 321.

The handbook accents the nature of transportation and related domestic and international business activities. Its objective is to provide basic information for the 'newcomer' to the field. It contains such topics as mechanics of exporting and importing; role of physical distribution; services and assistance provided by various United States government agencies; regulatory bodies and regulation; financing; insurance; documentation; packing; marking and packaging; warehousing and storage; containerization; carriers; ports and airports; and services of international specialists. The handbook is intended for use completely independent of the educational program discussed in Part One, but it could very easily be used in conjunction with that program. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-742322

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95

AD-742322

**040967**

**BIN HOPPER ENGINEERING AND BULK MATERIALS FLOW: A STATE-OF-THE-ART REPORT ON EMPIRICAL AND THEORETICAL ANALYSES**

Pariseau, W Fowkes, R

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

IC 8562, 1972, 36 pp, 16 Fig

Notification of this information circular appeared in the the Bureau of Mines--New Publications, September 1972, Monthly List 689.

This Bureau of Mines report is an evaluation of the state of knowledge about gravity flow from bin hoppers the most commonly used method of handling bulk materials where the force of gravity is used. The requirements for flow to be initiated and to continue, formulas developed experimentally or mathematically from various assumptions to describe the materials flow, and the question of whether or not a material will flow over the entire cross sectional area of the bin hopper according to the flow regime developed are the primary areas discussed. The work of A.W. Jenike, whose pioneering investigations raised bin hopper design from the trial and error state, is examined in depth and its limitations and assumptions are pointed out. Bin hopper design depends heavily upon prior experience, and suggestions for further studies of bin hopper flow to include the effects of

feeders are made.

**ACKNOWLEDGEMENT**

Bureau of Mines

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Government Printing Office, Superintendent of Documents,

Washington, D.C., 20402, Repr PC: \$0.4

2402-01167

**040983**

**A \$75,000,000 PROBLEM--WHAT CAN BE DONE ABOUT IT?**

Southern Freight Association, 151 Ellis Street, Atlanta, Georgia, 30303

Brochure, 14 pp, 37 Phot

Announcement of this brochure appeared in Railway Age, Volume 172, Number 6, page 42.

Those who need and use rail freight service are being deprived of the use of thousands of freight cars every month and are paying higher freight rates because many shippers and receivers are needlessly damaging these cars. A little thought and care can save everyone--shippers, receivers and railroads--time and money. Elimination of this careless and needless damage to freight cars and the consequent need to remove them from service for repair can result in an almost-immediate increase in the supply of freight cars of all types.

**ACKNOWLEDGEMENT**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Southern Freight Association, 151 Ellis Street, Atlanta, Georgia,

30303, Repr PC: No Charge

**041307**

**LOADING RECOMMENDATIONS FOR FRESH FRUITS AND VEGETABLES IN REFRIGERATED TRAILERS AND CONTAINERS**

Association of American Railroads, 59 East Van Buren Street, Chicago, Illinois, 60605

This publication was prepared by AAR Freight Loading and Container Section and announced in Railway Locomotives and Cars, V145, N9, September 1971.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

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AAR, Repr PC: \$0.25

**041653**

**SURVEY OF THE TRANSPORTATION SHOCK AND VIBRATION IMPUT TO CARGO**

Ostrem, FE, General American Transportation Corporation

Shock and Vibration Bulletin (Naval Research Laboratory, Washington, D.C., 20390)

42,Pt1, Jan. 1972, pp137-151, 14 Ref

The shock and vibration environment encountered by cargo during transportation is reviewed. Available data describing the environment on trucks, railcars, ships and aircraft is summarized. The vibration environment is described in terms of probability of occurrence of peak accelerations as a function of frequency. Peak acceleration levels, 99.5%, 99%, 98%, and 90% probability levels are presented for particular vehicles covering a wide range of operating conditions. Curves are presented to show the effect of direction, load, location and speed on the environment. Shock spectra are presented for

typical events encountered during transportation.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 016221

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**043785**  
**REDUCING THE COST OF HANDLING FOR BRITISH RAILWAYS**

Cosgrove, JT, British Railways Board

Materials Handling and Management (Temple Press Limited, Stamford House, 65166 Turnmill Street, London EC1 M5RA, England)

Sept. 1971, 4 pp

Specialized equipment and methods expedite material flow and reduce labor. Unitized loads, train shipping concepts, a combined tractor and fork truck and parcel sorting machines are described.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 73 022657

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**043992**  
**GUIDELINES FOR THE PHYSICAL SECURITY OF CARGO**

Department of Transportation, 800 Independence Avenue, SW, Washington, D.C., 20590

May 1972, 65 pp

An analysis of cargo theft and pilferage on a national basis encompassing all modes of transportation shows that about 85 percent of goods and materials stolen go out the "front gates" on persons and vehicles authorized to be in loading and unloading areas of transportation facilities. Only some 5 percent involves the after-hours break-and-enter burglar. Although catastrophic and highly publicized, the armed hijack or grand larceny of a tractor-trailer or a complete container amounts to only some 10 percent of the total loss picture. The main text of this handbook develops the rationale for cargo security measures and provides the basis for establishing and maintaining a cargo security program. Appendix I, "Cargo Security Standards," is a quick-reference summary of the recommended physical and procedural matters essential to cargo security. Appendix II, "Cargo Security Checklist," provides a series of questions to be answered in surveying a facility to ensure comprehensive consideration of the many aspects of cargo security.

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**044086**  
**L&D PREVENTION: THE TREND IS RIGHT FOR RAILROADS—AND FOR THEIR CUSTOMERS**

Bartley, RD

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, pp 14-16, 6 Fig

Freight claim payout, which peaked at pretty close to \$235 million in 1971 may show a drop to around \$230 million when all the 1972 figures are in. The real cause for elation in L&D prevention offices across the nation would have to be the all-important ratio of L&D to revenues. At the end of the first nine months of 1972 that

ratio had dipped to 1.80 (\$1.80 paid out in claims for every \$100 of freight revenues. Behind this sudden turn of events is the fact that railroads and the shippers are now doing a lot of things right on behalf of L&D prevention: evidence of improvement in materials handling and carloading methods, more specially-equipped box cars, increased use of piggyback, improved designs of cars for hauling automobiles and parts, better and more car cushioning, more effective load-restraining devices and a host of other equipment innovations. The role of the Government and-of research are also discussed.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

**044087**  
**L&D PREVENTION: HOW SANTA FE WENT FROM WORSE TO BETTER TO VERY, VERY GOOD**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, pp 18-19

As recently as three years ago, Santa Fe's ratio of payout to revenue stood at 1.88. Dollar payout was at all-time high of \$13 million. Then in 1971 the ratio was pushed down to 1.68 and payout dropped by about a half-million dollars. In 1972, the ratio dipped to 1.53, lowest since the early 1960's and payout dropped by about \$200,000. In January 1973, the ratio dropped all the way down to 1.28. In short, Santa Fe seems to be well on its way to reaching the goal now set for L&D prevention, which is to slice the ratio all the way to an even 1.00 by mid-1976.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

**044088**  
**L&D PREVENTION: QUAKER OATS CAN POINT TO A RECORD SHOWING A 30% DROP IN DAMAGE**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 176, No. 6, Mar. 1973, pp 24-25, 1 Phot

Quaker Oats is one of the shippers that has decided to come to grips with the loss and damage problem, especially in the area of grocery products distribution. Aside from developing its own in-house damage prevention program, Quaker Oats' transportation division also participated in a survey of handling and transportation practices for packaged grain mill products completed recently under the guidance of the AAR. Ultimately, a national damage prevention program for these products will be undertaken, based on the survey results. Today, Quaker Oats can point to a record which shows about a 30 percent drop in damage to shipments moving in both plain and equipped box cars from processing plant to its 30 distribution warehouses located across the nation.

**ACKNOWLEDGEMENT**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

044502

**PACKAGING IN A CHANGING TRANSPORT AND DISTRIBUTION PATTERN**

Lamain, JI

ICHCA Monthly Journal (International Cargo Handling  
Coordination Assn, Drummond House, 203-9 North Grove  
Street, London NW1, England)

Dec. 1971, pp 3-6

Good packaging design, to prevent damage, must be geared to contend with new transport, distribution and automated loading and unloading methods. New packing materials, transport and handling techniques are described and recommendations made for optimized packaging.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 022179

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008821

**MASS TRANSPORTATION FOR THE 1967 WORLD EXHIBITION**

Heffernan, JJ

ASCE Journal of the Urban Plan and Develop Div (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 93, No. UP4, Proc Paper 5638, Paper, Dec. 1967, pp 97-117

An automated, 3-1/4-mile, steel wheel on steel rail rapid transit system, designed and built to serve visitors to the 1967 World Exhibition in Montreal, is described. Each of the eight trains consists of six 75-ft-long lightweight, Airconditioned cars. The double track line has five stations and a complete maintenance and yard facility. System capacity is 30,000 passengers per hr in each direction. An unusual method of supporting the continuous welded rail to dampen vibrations is described. The problem of attenuating noise is considered, and among the methods implemented are an acoustic fence and viscoelastic compound applied to car wheels.

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5638

019795

**SUBWAY ENVIRONMENTAL SURVEY, CHICAGO TRANSIT AUTHORITY SYSTEM**

Institute for Rapid Transit, Washington, D.C.

2045-04, May 1971, 105pp

Prepared in cooperation with DeLeuw, Cather and Co., Chicago, Illinois

The report has been prepared under the Institute For Rapid Transit (IRT) project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems,' and is one of many such reports leading to the final product—a 'Handbook for Subway Environmental Criteria, Analysis and Control'. The purpose of this particular report was to present all of the subway environmental information gathered in an extensive interview with the Chicago Transit Authority. The information represents the state-of-the-art under actual operating conditions, in the Chicago subway system of the various environmental areas included in the project—temperature, humidity, velocity, pressure, environmental equipment, noise and vibration.

(Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201875

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PB-201875

024858

**RAILWAY'S ROLE IN SPEED, SERVICE AND SAFETY**

Sillcox, LK

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 2, No. 1, Jan. 1968, pp 205-213

A new system of high-speed ground transportation cannot be introduced simply by purchasing new equipment, as in the case of jet planes. Any new services above 100 miles per hour will most certainly require vastly improved vibration-free rights-of-way, fitted with continuous welded rails and free from any level crossings, and above a speed of 160 mph, they will have to be located underground or in a tunnel to avoid objectionable turbulence and excessive noise effects.

In order to reduce the existing excessive operating labor costs, push-button control will be included and only sufficient personnel will accompany trains to preserve order and meet safety and emergency demands. The prospective cost of any super-high-speed ground transportation system for passengers will lean heavily on public money. In addition to the very high cost, there will be a need to have such a super-high-speed system which may run about 160 mph, physically segregated from existing railway operations for practical reasons of safety. In other words, under any such a program, the passenger operations alone would have to carry the entire cost. The only significant application of ultra-high-speed railway passenger service which could be finally justified at the present time is that being undertaken by the Department of Transportation in the Northeast Corridor between Boston and Washington.

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037106

**EVALUATION OF TRAVELER SERVICE PROBLEMS**

Resource Management Corporation, Incorporated, Bethesda, Maryland

RMC-UR-165A, Final Rpt, 7106-7205, May 1972, 121 pp

Grant DOT-OS-10212

See also PB-210 645.

A study is presented of traveler service problem areas encountered by the public in using domestic inter-city air, bus, and rail common carriers.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210644

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PB-210644

037108

**REGIONAL TRANSIT 1990. THE REVISED AND UPDATED REGIONAL PLAN AND PROGRAM**

Tri-State Regional Planning Commission, New York, New York HUD-N.Y. P-249

TSRPC-3027-3702-6M, Apr. 1972, 16 pp

The two transit planning goals for the Tri-State Region are: (1) to strengthen and maintain the economic viability of the Manhattan central business district and other dense centers; and (2) to provide a reasonable alternative to the automobile for travel outside the Manhattan central business district. These goals, in turn, lead to ten specific planning objectives, whose degree of attainment is measured by certain criteria. Target dates for attaining the objectives are specified; the current status is summarized; and a list of projects costing \$16.4 billion to achieve the objectives is presented. Major elements of the plan are geographically indicated on maps of the region.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210724

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PB-210724

037109

**EVALUATION OF TRAVELER SERVICE PROBLEMS**

Resource Management Corporation, 7910 Woodmont Avenue, Bethesda, Maryland

RMC-UR-165-B, Final Rpt, 7106-7205, May 1972, 24 pp

Grant DOT-OS-10212

See also PB-210 644.

The report documents a study of traveler service problem areas encountered by the public in using domestic inter-city air, bus, and rail common carriers. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210645

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PB-210645

**037114**

**SUBURBAN SERVICE ADJUSTMENT EXPERIMENT.  
HARLEM DIVISION— NEW YORK CENTRAL RAILROAD,  
WESTCHESTER AND PUTNAM COUNTIES**

Tri-State Transportation Commission, New York, New York

Final Rpt, 6407-6610, Nov. 1967, 75p

Sponsored in part by the Department of Housing and Urban Development, Washington, D.C.

The effectiveness of commuter rail line changes (faster scheduling, more frequent service, and expanded parking facilities) is analyzed for a mass transportation demonstration project in New York State.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210929

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**037117**

**PATH STATION MODIFICATION AND REHABILITATION  
TECHNICAL STUDY**

Port Authority Trans-Hudson Corporation, New York, New York INT-T9-15

Final Rpt, 1971, 89p

Contract DOT-UT-444

The study examines the PATH (Port Authority Trans-Hudson Corporation) System. It was determined that this study would be directed not only to the examination of the PATH stations as buildings, but would also concern itself with the urban areas around stations, and with the PATH system as a whole. The three levels analyzed were station level, urban level, and system level. Topics discussed in this report include background, general recommendations, station recommendations (10 stations), and the study processes. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210618

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**037158**

**RAPID TRANSIT TO THE 1970 CONFERENCE**

Generette, C

Industrial Engineering (American Institute of Industrial Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 2, No. 4, Apr. 1970, pp20-3

Description and analysis of planning, facilities rolling stock and passenger studies of 15 mi rapid transit system serving Cleveland airport and 14 stations along right of way.

**ACKNOWLEDGEMENT**

Engineering Index, EI 71 01236

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**037161**

**TIMETABLES FOR SUBURBAN RAIL TRANSIT SYSTEM**

Salzborn, FJM, Adelaide University

Transportation Science (Operations Research Society, GM Research Labs, 12 Mile and Mound Roads, Warren, Michigan, 48090)

Vol. 3, No. 4, Nov. 1969, pp297-316

A scientific method for the construction of timetables for a suburban railroad line without branches is developed. It is shown that such timetables are largely determined by stop-schedules. Two criteria for stop-schedules have been considered—the number of intermediate passenger stops and the number of carriage miles. A mathematical formulation is presented and it is shown that the problems of finding optimal stop-schedules can be solved with dynamic programming. Zone-stop-schedules have received special attention.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 48652

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**037188**

**TRANSPORTATION PLANNING IN MEGALOPOLIS**

Ellis, JB, Waterloo University, Canada  
Pearson, PM

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 3, No. 2, May 1969, pp230-7

It is the content of this paper that two main avenues of approach need to be opened up in the planning of transportation facilities in megalopolis, these being a coherent understanding of each megalopolis as a system and that of a coherent multimode system model of the complete transportation subsystem. Approaches discussed are a method for functional decomposition of megalopolis into subsystems and a system theory model for multimodal transportation networks.

**ACKNOWLEDGEMENT**

Engineering Index, EI 70 34148

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**037200**

**SUPPLEMENTAL STUDIES OF URBAN  
TRANSPORTATION SYSTEMS ANALYSIS**

Boys, JA, General Research Corporation  
Dodson, EN  
Hamilton, WF  
Sjovold, AR

High Speed Ground Transportation Journal (Box 4824, Duke Station, Durham, North Carolina, 27706)

Vol. 4, No. 2, May 1970, pp211-12

This volume reports on studies of alternative land uses and travel demand, extended rail rapid transit system in Boston and improved modal split formulations.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 71 04833

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**037373**

**SUBWAY ENVIRONMENTAL SURVEY, NEW YORK CITY TRANSIT AUTHORITY**

Institute for Rapid Transit, Washington, D.C.

UMTA-DC-MTD-7-72-1, Dec. 1971, 76 pp

The report has been prepared under the Institute for Rapid military services to perform numerous utility tasks. The Control in Subway Rapid Transit Systems', and is one of many such reports leading to the final product—a 'Subway Environmental Design Handbook'. The purpose of this particular report is to present all of the subway environmental information available on the New York City Transit Authority. The information represents the state-of-the-art under actual operating conditions in the New York subway system, of the various environmental areas included in the project—temperature, humidity, velocity, pressure, environmental equipment noise and vibration. (Author)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-211073

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PB-211073

**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 accommodated 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.

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-174307

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PB-174307

**039016**

**OPTIMUM ALLOCATION OF TRANSPORTATION TERMINALS IN URBAN AREAS 212 Research rept.**

Cramer, BE

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

RR66-60, Res Rpt, Nov. 1966, 63 pp

Contract C-85-65t

The report indicates a method of determining the location of a number of transportation terminals in an urban area in such a way that they were most accessible, and thus had the greatest utility from

a system customer's point of view. By equating demand distribution with population distribution, and making some straightforward assumptions about travel velocity and path, a simple circular model was constructed. Subsequent theoretical and numerical analyses using a computer program which was developed from the model suggested several important results. There seems good reason to believe that the model, which is based on very modest assumptions and requires vastly less effort to parametrize than the network approach, will generate solutions which compare favorably with more complex models. (Author)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-173684

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**039019**

**STUDIES IN TRAVEL DEMAND. VOLUME II**

Quandt, RE Baumol, WJ

Mathematica Incorporated, Princeton, New Jersey

Vol. 2, Sept. 1966, 231 pp

Contract C-187-66

See also VOLUME I-PB-173 499.

Contents: Estimation and testing in abstract mode models— The abstract mode model; theory and measurement; Tests of the abstract mode model; A non-linear model of passenger demand; A probabilistic abstract mode model; Some considerations on the choice among forecasting formulas; Alternative approaches and special problems— Some problems and prospects in collecting data on travel demand; A cross-sectional model of the demand for rail passenger service in the Northeast Corridor; Time patterns of traffic volume; An optimization model for Corridor transportation planning.

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-176114

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**039020**

**PRELIMINARY ENGINEERING REPORT ON POSSIBLE IMPROVEMENTS TO RAILROAD PASSENGER SERVICE BETWEEN NEW YORK AND BOSTON**

Klauder (Louis T) and Associates, Philadelphia, Pennsylvania

Nov. 1965, 191 pp

Rept. on US Dept. of Commerce Northeast Corridor Transportation Proj.

The purpose of this report is to set forth the changes and additions which might be made in order to reduce the travel time between New York and Boston to 2-1/2 hours, 2-3/4 hours, or 3 hours. In the study of 3-hour travel time top speeds of both 125 mph and 150 mph are considered. In studies of 2-3/4 hour travel time two possibilities are considered: first that the improvements to the right-of-way necessary to reduce the travel time to 2-3/4 hours might be made between New Haven and Providence where the costs are relatively modest, and, second, that these improvements might be made between New York and New Haven where the costs are considerably higher.

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-169907

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**039026**

**STUDIES IN TRAVEL DEMAND**

Mathematica Incorporated, Princeton, New Jersey

Sept. 1965, 188 pp

Contract C-247-65

Contents: Methodological problems—A survey of demand for travel studies, by Ronald E. Miller; Some problems in forecasting transportation demand, by Henry M. Peskin; Some perspectives of gravity models, by Richard E. Quandt. Modal studies—The demand for air travel, by Roger E. Alcala; The demand for bus travel, by John Kissin; The demand for rail travel, by Solita C. Monsod; The demand for automobile travel, by Frank Vannerson.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173499

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**039034**

**SURVEY OF TECHNOLOGY FOR HIGH SPEED GROUND TRANSPORT, PART I**

Massachusetts Institute of Technology, Cambridge, Massachusetts

P1, June 1965, 484 pp

Contract C-85-65t

This report presents the results of a research planning study initiated at MIT on September 16, 1964 in support of the Northeast Corridor Transportation Project of the United States Department of Commerce. The objective of the Northeast Corridor Transportation Project is to determine the facilities that will be needed to transport passengers and freight in the region extending roughly from Boston, Massachusetts to Washington, DC in the era of 1980 and thereafter. This includes study of both technological and nontechnological aspects of transportation; analysis of transportation needs and related demographic and economic forecasts for the region; and consideration of the interaction between transportation services and their impact on the development of the region as a whole and of its many urban centers. It includes studies of both existing and projected facilities for all modes of intercity transport, prospective technological improvements in each mode and alternative network configurations.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-168648

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PB-168648

**039038**

**THE RELATIONSHIP BETWEEN CARRIER CAPACITY AND MEAN PASSENGER WAITING TIME**

Groninger, KL

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R67-74, Res Rpt, Sept. 1967, 53p

Contract C-85-65t

The study is addressed to the problem of determining the relationship between carrier capacity and the expected waiting time of a random passenger at various demand levels. (Passenger arrivals per

time.) A passenger is assumed to be in a waiting state during the total time he is in his station of origin from the time he enters until he departs on a moving carrier. A mathematical model of the stochastic process resulting from a 'go-when-filled' carrier dispatching policy is formulated and analyzed. The model assumes that individual passenger arrivals to the station are Poisson and that a minimum headway must be enforced between successive carriers leaving the station. A carrier queuing situation of the form E sub K (absolute D)1 results which is solved for the mean waiting time in queue. A solution technique and computer program for obtaining the roots of a c (th) order, complex, transcendental equation (necessary for a numerical solution of the mean waiting time in queue) is also included. Numerical values of the mean waiting time for various carrier capacities and arrival rates are included to illustrate the relationships. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176919

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**039050**

**TRANSPORTATION SCHEDULING UNDER MULTI-DIMENSIONAL DEMANDS**

Devanney, JWIII

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

R67-72, Res Rpt, Dec. 1967, 73 pp

Contract C-85-65t

This report describes an algorithm for scheduling passenger transportation systems under the realization that travel demand will both vary with time of day and depend on the schedule. The control variables used are the number of departures per day on each link, the times of these departures, and the number of units dispatched at each departure. The algorithm uses a combination of dynamic programming and heuristic search to generate scheduling policies which attempt to balance the demand attracted and served against the costs of attracting and serving this demand in a manner consistent with the system's objective. The algorithm can accept a wide variety of demand models and objective functions and may be feasibly applied to networks containing several hundred links.

**ACKNOWLEDGEMENT**

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**039052**

**STUDIES IN TRAVEL DEMAND. VOLUME III**

Mathematica Incorporated, Princeton, New Jersey

Vol. 3, July 1967, 416 pp

Contract C-187-66

See also Volume 2, PB-176 114.

The document covers a mathematical means of estimating travel demand in New England and the Middle Atlantic states.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-177610

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PB-177610



**039054**  
**OPERATIONS ANALYSIS OF SYSTEM SPECIFICATIONS.**  
**PART I. PASSENGER SCHEDULING.**

Bisbee, EF    Devanney, JWIII    Bhatt, KU    Kuroda, S  
 Ward, DE

Massachusetts Institute of Technology, Department of Civil Engineering, Cambridge, Massachusetts

Pt 1, R-66-54, Res Rpt, Nov. 1966, 62 pp

Contract C-85-65t

In this report some service properties of a transport system that result from operating policies are formulated jointly with system costs. By varying major system design parameters such as vehicle size, allowable dispatching frequency, fleet size and so on, rather different operating practices are possible each of which yields a quantity of service at a given level and an associated cost. The model finds optimal operating policies with respect to a weighted function of system cost and traveller utility (service level). The resulting evaluations for each set of parameters can serve as a basis for comparison of competing systems which, though only a crude basis, contains generalizable components representing dominant measures of transport effectiveness, i.e., its cost and its apparent desirability. The fundamental assumption made is that all technological aspects of a possible system remain to be selected. The models developed here have further use after component choices are made. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-173635

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**039059**  
**POSSIBLE IMPROVEMENTS TO RAILROAD PASSENGER SERVICE BETWEEN NEW YORK AND WASHINGTON**

Klauder, LT

Klauder (Louis T) and Associates, Philadelphia, Pennsylvania

Prelim Rpt, June 1964, 135p

Contract Cc6238ct

Rept. on Washington-Boston Corridor Research Proj.

Studies are made of the possible service improvements on the Pennsylvania Railroad between Washington, D. C. and New York, N. Y. to provide in greater depth an analysis of the operational aspects of such service, the required alterations to existing facilities, and the equipment design features, as well as calculations of the cost of improvements and improved operations between these two cities.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-166879

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**039060**  
**POSSIBLE IMPROVEMENTS TO RAILROAD PASSENGER SERVICE BETWEEN NEW YORK AND WASHINGTON**

Klauder (Louis T) and Associates, Philadelphia, Pennsylvania

Supp Rpt, June 1964, 123 pp

Contract Cc6238ct

Rept. on Washington-Boston Corridor Research Proj.  
 Supplemental rept. to preliminary rept. dated 1 Jan 64.

The possibility and the cost of establishing two and one-half hour passenger service between New York and Washington was studied, using the tracks of the Pennsylvania Railroad. The results of that study were presented in a 'Preliminary Engineering Report on Possible Improvements to Railroad Passenger Service Between New York and Washington,' dated June 1, 1964 (PB-166 879). In this report the possibility and cost of establishing two and one-quarter and two-hour service between these same two cities are studied.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-166880

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**039061**  
**DEMAND FOR INTERCITY PASSENGER TRAVEL IN THE WASHINGTON-BOSTON CORRIDOR**

Systems Analysis and Research Corporation, Boston, Massachusetts

1963, 288 pp

The study has four main objectives: (1) identification and measurement of the principal factors influencing intercity passenger demand; (2) identification and measurement of the principal factors influencing the division of intercity passenger demand by mode; (3) projection of intercity passenger demand in the corridor through 1980, and (4) delineation of further study requirements.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-166884

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 PB-166884

**039063**  
**WASHINGTON-BOSTON TRANSPORTATION STUDY.**  
**PART B. FEASIBILITY AND COST OF IMPROVED RAILROAD SERVICE**

Arentz, AAJ    Sander, FW    Pages, RE

General American Transportation Corporation, Marketing Research Division, Niles, Illinois

Pt B, Final Rpt, Nov. 1963, 228 pp

Contract Cc6207ct

Conclusions: A large portion of the total intercity passenger market in 1980 in the Washington-Boston corridor can be effectively and economically served by improved railroad service. To serve the 1980 market, major improvement of existing rail systems does not appear to be economically feasible. The most promising long-range solution to the 1980 corridor problem is a new high-speed high-frequency railriding auto ferry. An immediate improvement of the present rail systems in the corridor should be made with the object of achieving efficient, dependable, and economical operations. This improvement should be in the lower improved-speed ranges contemplated in the study and should be compatible with the structures of the railroads as they already exist. It should also be predicted on new comfortable equipment that will be consonant with future local and commuter requirements.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-166886

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039082

**LITERATURE SURVEY OF PASSENGER COMFORT  
LIMITATIONS OF HIGH-SPEED GROUND TRANSPORTS**

Carstens, JP Kresge, D

United Aircraft Corporation, Research Laboratories, East  
Hartford, Connecticut

D-910353-1, July 1965, 60 pp

Research supported by Department of Commerce, Washington,  
DC.

A literature survey was made of passenger comfort criteria applicable to high-speed ground transports. Factors considered include acceleration vibration, pressure changes, atmospheric contamination, visual disturbances, and noise. Literature examined includes engineering data pertinent to the analysis of riding comfort in trains, automobiles, and airplanes, as well as aerospace medical and other medical sources. The results of the survey are presented in figures and tables. A summary of recommended values of the pertinent variables is also provided. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-168171

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039086

**BIBLIOGRAPHY OF HIGH SPEED GROUND TRANSPORT.  
PART IA**

Massachusetts Institute of Technology, Cambridge, Massachusetts

Pt1A, Oct. 1965, 86 pp

Contract C-85-65t

See also PB-168 648, -169 121.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-170581

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039087

**TRAIN AUTO FERRY OPERATIONS.—A SUMMARY OF  
PRESENT AND PROPOSED CONCEPTS AND  
RECOMMENDATIONS FOR A DEMONSTRATION  
PROJECT**

Whitten, HO

Whitten (Herbert O) and Associates, Washington, D.C.

Final Rpt, Apr. 1966, 158 pp

Availability: Original document in color until exhausted.

The idea of moving passengers and their automobiles by train from a point of origin to a common destination is examined. This report discusses past and present attempts to put this idea into practice; analyzes potential costs and prices for such service if operated in this country; and makes recommendations for a proposed demonstration project of such service.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-170798

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PB-170798

039116

**A FEASIBILITY ANALYSIS FOR AUTO-ON-TRAIN  
SERVICE BETWEEN WASHINGTON, D.C. AND  
JACKSONVILLE, FLORIDA**

Horton, G

Center for Advanced Administrative Research, Inc., Boca Raton,  
Florida

1967, 96 pp

The study examines the potential market for automobile-on-train passenger service between Washington, D. C. and Jacksonville, Florida. The methodology employed in gaining information is discussed in detail. Indications are that the number of those willing to pay \$100 or more per one-way trip between Washington, D. C. and Jacksonville, Florida, is about 14 times the capacity of a 10-car (78 autos) train making 2 round trips each 3 days.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-182122

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PB-182122

039117

**SYSTEM FOR SURVEYING REGIONAL TRAVEL.  
VOLUME I: PROPOSED METHOD FOR SELECTION OF  
SURVEY SITES FOR A COORDINATED AIR, AUTO, BUS  
AND RAIL TRAVELER SURVEY IN THE NORTHEAST  
CORRIDOR**

Peat, Marwick, Livingston and Company, Washington, D.C.

Vol. 1, June 1967, 58 pp

Contract DT-7-35215

See also Volume 2, PB-182 218.

The understanding of travel choices, investment opportunities, and community impact continues to be a distinctive challenge to planning research. A system for surveying regional travel could reasonably serve several objectives, some of which are: to provide statistical data; to establish travel preferences; to determine travel motives and patterns; to establish transportation needs or demand; to produce costs and other financial information; and to forecast future travel. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-182217

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PB-182217

039118

**SYSTEM FOR SURVEYING REGIONAL TRAVEL.  
VOLUME II: PROPOSED SAMPLE DESIGN AND SURVEY  
PROCEDURES FOR A COORDINATED AIR, AUTO, BUS  
AND RAIL TRAVELER SURVEY IN THE NORTHEAST  
CORRIDOR**ABT Associates, Incorporated, 55 Wheeler Street, Cambridge,  
Massachusetts

Vol. 2, Apr. 1968, 116 pp

Contract DT-T8-054

See also Volume 1, PB-182 217. Limited number of copies containing color other than black and white are available until stock is exhausted. Reproductions will be made in black and white only.

The survey plan covered in the document is complete with respect to presenting the methodology for accomplishing the stated objectives. It covers the mathematical design and definitions of the survey population; the survey procedures and reasons for their selection; the overall plan for implementation; and guidelines for controlling the fieldwork. Costs documentation, and control requirements necessary to implement a survey of this magnitude are also discussed. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-182218

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**039125****SIMULATION ANALYSIS OF A HIGH SPEED GROUND TRANSPORTATION SYSTEM**

Crane, MA

Massachusetts Institute of Technology, Department of Naval Architecture and Marine Engineering, Cambridge, Massachusetts

68-20, Thesis, Sept. 1968, 231 pp

Contract C-136-66

Sponsored in part by the National Science Foundation, Washington, D.C.

A ground transportation system is considered which includes as its proposed operating characteristics: real-time dispatching of trips according to passenger demand; travel from origin to destination without intermediate stops for the purpose of passenger exchange; travel through a network of links and nodes, with constant-speed travel on each link; minimum headway constraints for each link resulting in capacity limits and possible interference between trips; and the possible coupling of vehicles, for more efficient use of channel capacity and reduced propulsion costs. Quantitative measures of cost and utility are developed as criteria for a comparative analysis of operating policies and design parameters. Overall system utility is postulated as an approximate function of a worst-case level of passenger service and a partition-weighted mean measure of service level. Cost impacts are characterized in terms of vehicle size and a measure reflecting fleet size and vehicle-hours of operation. An event-ordered simulation model representing the transportation system is described in some detail. It is used together with the cost-utility relationships in determining policies and parameters such as vehicle size, fleet size, dispatching policy and vehicle coupling policy. Some consideration is given also to the design of train formation policies and vehicle inventory control policies. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183156

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**039136****RAIL PASSENGER STATISTICS IN THE NORTHEAST CORRIDOR**

Office of High Speed Ground Transportation, Washington, D.C.

Feb. 1969, 22 pp

Using the results of surveys taken on Penn Central trains between Washington, New York, and Boston, this report discusses passengers' origins, destinations, socio-economic characteristics, purposes of travel, frequency of travel, and attitudes toward the service.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-183365

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**039139****HIGH-SPEED RAIL: PROBLEMS AND PROSPECTS**

Ullman, KB

Office of High Speed Ground Transportation, Washington, D.C.

1968, 11 pp

Presented at conference on Transportation Engineering, Washington, D.C., 28-30 Oct 68.

A projection of demand for the current 'high-speed' mode-air-illustrates the importance of developing ground transportation systems of high capability. Presented in this context are the attributes both of the present generation of high speed rail (HSR) equipment and of future HSR systems. The potential of HSR embodies four distinct features: (1) Ability to compete with air transportation on a door-to-door travel time basis; (2) Greater passenger comfort, convenience, and safety; (3) Greater acceptability due to more efficient land use and less noise and air pollution; (4) Allows more rational use to be made of limited airport capacity and possesses very high limiting capacity. (Author)

**ACKNOWLEDGEMENT**

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**039150****RAIL SHUTTLE SERVICE BETWEEN WASHINGTON, D. C. AND BALTIMORE, MARYLAND VIA FRIENDSHIP INTERNATIONAL AIRPORT. AN ECONOMIC FEASIBILITY STUDY FOR 1972**

Eastman, SE

Economic Sciences Corporation, Incorporated, Washington, D.C.

ES1-0169, Mar. 1969, 55 pp

Contract DOT-3-0166

This is an economic feasibility study of a rail shuttle service between Penn Central Railroad (PCRR) Terminals in Washington and Baltimore making a single intermediate stop at Friendship International Airport (FIA). The time period of the study is 1972. Three rail transportation systems are considered. Budd Company RDC-2. United Aircraft Corporation Turbo Train, and a rail-bus car. All three transportation producing systems are found to be economically feasible if costs are lower than the 'high' estimate; for the systems to be feasible costs need not be as low as the 'low' estimate. Feasibility depends on load factor and headway (time between service). The rail-bus service is feasible at headways of 15 minutes, 30 minutes and 60 minutes; the RDC-2 at headways of 30 minutes and 60 minutes; and the Turbo Train at headways of 60 minutes. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184265

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PB-184265

**039179****NORTHEAST CORRIDOR TRANSPORTATION PROJECT REPORT**

Nelson, RA Shuldiner, PW Miller, M Winestone, RL

Office of High Speed Ground Transportation, Washington, D.C.  
NECTP-209, Apr. 1970, 242 pp

Limited number of copies containing color other than black and white are available until stock is exhausted. Reproductions will be made in black and white only.

The Northeast Corridor Transportation Project was charged to determine the inter-city transportation facility requirements of the Northeast Corridor through 1980. This report contains the following: A comparative analysis of the transportation alternatives as to their technical feasibility, economic costs and benefits and other impacts in the year 1975; A discussion of the actions required to implement the transportation alternatives; An examination of possible financing and management of new modes included in the alternatives; Advantages and disadvantages of various organizational alternatives; Population growth patterns and the Corridor transportation system; Methodology; Description of the alternative systems; and exploratory studies and sensitivity tests. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190929

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**039180**

**NORTHEAST CORRIDOR TRANSPORTATION:  
PROBLEMS AND PROSPECTS**

Peat, Marwick, Livingston and Company, Washington, D.C.

Dec. 1969, 109 pp

Contract DOT-FR-9-0017

Limited number of copies containing color other than black and white are available until stock is exhausted. Reproductions will be made in black and white only.

The report contains four parts, each based on a region within the Corridor. New York is examined first because of its impact on the remainder of the region. The other three regions covered are Delaware Valley, Baltimore-Washington and New England. Each region is examined on the basis of four central points: Historic growth patterns; Demand for transportation; Level of service; and Anticipated deficiencies and prospects.

**ACKNOWLEDGEMENT**

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**039181**

**STATUS OF THE TRANSPORTATION SYSTEM AND  
PLANS FOR IMPROVING INTERCITY TRANSPORTATION  
IN THE NORTHEAST CORRIDOR**

Peat, Marwick, Livingston and Company, Washington, D.C.

Dec. 1969, 189 pp

Contract DOT-FR-9-0017

Limited number of copies containing color other than black and white are available until stock is exhausted. Reproductions will be made in black and white only.

The report provides background information on the Northeast Corridor, its geographic and demographic characteristics in general, and the characteristics of its travelers, in particular. Also it describes the existing Corridor highway system, the rail passenger system, and the scheduled air transportation system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190931

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**039182**

**NORTHEAST CORRIDOR TRANSPORTATION FACTS AND  
STATISTICS**

Rothenberg, MJ

Peat, Marwick, Livingston and Company, Washington, D.C.

Dec. 1969, 15 pp

Contract FR-9-0017

The material presented in the document is meant to provide basic information on the intercity transportation system and other select regional characteristics of the Northeast Corridor. Primary attention is given to the status of the existing transportation system and the magnitude and characteristics of system usage. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190932

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**039183**

**HSGT MODE SERVICE ANALYSIS IN THE NORTHEAST  
CORRIDOR**

Vadeboncoeur, JR Smith, TW

TRW Systems Group, Washington Operations, Washington, D.C.

06818-W007-RO-00, Dec. 1969, 145 pp

Contract DOT-C-353-66

See also Rept. no. TRW-06818-W917-RO-00, PB-178-979.

The report describes the analysis of High Speed Ground Transportation service in the U. S. Northeast Corridor. In the analysis, three HSGT systems were established: a 150-mph High Speed Rail system (HSRA), a 200-mph High Speed Rail system (HSRC), and a Tracked Air Cushion Vehicle system (TACV). Each of these was analyzed in competition with auto, bus, conventional air (CTOL), short takeoff and landing (STOL), and vertical takeoff and landing (VTOL) modes. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190934

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**039184**

**TRANSOP MODEL METHODOLOGY**

Vadeboncoeur, JR Smith, TW Adamson, DS

TRW Systems Group, Washington Operations, Washington, D.C.

06818-W009-RO-00, Dec. 1969, 129 pp

Contract DOT-C-353-66

See also Rept. no. NECTP-214, PB-190 934 and Rept. no. TRW-06817-RO-00, PB-178 797.

The TRANSOP computer program was developed in order to assist in the determination of transportation equilibrium supply and demand levels for the Northeast Corridor Transportation Project. The program is built upon a proprietary optimization and simultaneous equation-solving algorithm (SLANG) developed by TRW Systems Group. Applications of the TRANSOP program have included investigation of the competitive position of ground modes such as high speed rail, tracked air cushion vehicles, and tube vehicle systems. The program has also been utilized to examine similar systems in other U. S. corridors. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190936

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PB-190936

**039201**

**HIGH SPEED RAIL SYSTEMS**

TRW Systems Group, Redondo Beach, California  
06818-6037-RO00, Feb. 1970, 608 pp

Contract DOT-C-353-66

Report on High-Speed Ground Transportation Systems Engineering Study.

The application of steel-wheel-on-steel rail trained vehicles to intercity passenger transportation at speeds of 200 to 300 mph is examined. The physical and human constraints, and the framework of ground-rules within which the study is constructed are described. Primary system elements are singled out and considered in the light of the higher speed requirements. The elements are the vehicle, propulsion and power, braking, suspension, guideway, control and communications and terminals. Present-day state-of-the-art operating systems are used as a point of departure. A baseline high-speed rail system is synthesized, and its performance and service characteristics are described parametrically, as a function of such independent variables as seating capacity and design cruise speed. Research and development, investment and operating costs are given. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-192506

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**039259**

**OBSERVATIONS ON THE COST, PRESENT AND ANTICIPATED, ASSOCIATED WITH HIGH SPEED RAIL TRANSPORTATION**

O'Sullivan, WB

Federal Railroad Administration, Washington, D.C.  
No. 9, FRA-RT-72-19, Final Rpt, Sept. 1970, 104p

Also pub. in Bull-629, Sep-Oct 70, of the American Railway Engineering Association and in AREA Proceedings, v72.

The report is a synthesis of data, published and otherwise, commenting on costs related primarily to the construction and maintenance of present high speed train routes or those envisioned for near and longer term future. Some of the social factors supporting the concept of high speed train service are explored. Results of recent model studies of a region's transportation demands for the next two decades are reviewed and the anticipated role of the rail mode described. (DOT abstract)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-202573

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**039274**

**STUDIES IN TRAVEL DEMAND. VOLUME V**

Pinton, MR

Mathematica Incorporated, Princeton, New Jersey  
Vol. 5, Mar. 1969, 288 pp

Contract DOT-3-0009

See also Volume 4, PB-185 003.

Contents: Estimation and testing in long-range demand models (An abstract model approach to the demand for travel, Relative shares model, Estimation of the behavioral model, Tests and comparisons on demand models); Time-series analysis (An empirical study of the fluctuations in passenger traffic, The time patterns of train passenger traffic in the Northeast Corridor, A regression analysis of hourly traffic patterns in the Northeast Corridor).

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-184995

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**039280**

**RAIL PASSENGER STATISTICS IN THE NORTHEAST CORRIDOR 1971**

Office of High Speed Ground Transportation, Northeast Corridor Transportation Project, Washington, D.C.

Annual Rpt, 7101-7112, Feb. 1972, 18 pp

See also report dated Feb 71, PB-209 505.

The report presents 1971 ridership and frequency data covering rail passenger traffic on the New York-Washington Metroliner Demonstration route and on the New York-Boston Turbo Demonstration route. Comparative traffic data for 1969 and 1970 are offered as background.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209506

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**039281**

**FULLY ALLOCATED COST OF RAIL PASSENGER SERVICE BETWEEN NEW YORK AND WASHINGTON. COMPARISON OF CONVENTIONAL AND METROLINER COSTS DURING THE FOURTH QUARTER OF 1968 AND THE FOURTH QUARTER OF 1970**

Peat, Marwick, Mitchell and Company, Philadelphia, Pennsylvania

Final Rpt, Nov. 1971, 17 pp

Contract DOT-FR-00025

See also PB-202 048, and PB-202 049.

The report presents a comparative analysis of the fully allocated cost of rail passenger service between New York, New York and Washington, D.C. for the fourth quarters of 1968 and 1970. The objective of this phase of the study was to collect, analyze and present in a comparative format the fully allocated cost of operating those passenger trains. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208773

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PB-208773

**039286**

**STATISTICAL ANALYSIS OF THE NEW YORK—WASHINGTON, D.C. RAIL PASSENGER SERVICE, 1970**

Office of High Speed Ground Transportation, Demonstrations Division, Washington, D.C.

Oct. 1971, 37 pp

The report displays and discusses the socioeconomic and attitudinal characteristics of Metroliner passengers. Analysis of socioeconomic data indicates that Metroliner patrons more nearly resemble Northeast Corridor air passengers than Corridor conventional rail passengers. In general Metroliner passengers are much more pleased with the Metroliner's equipment and services than conventional rail passengers are with conventional facilities; however, when rating older facilities shared by both groups, such as terminal facilities, Metroliner and conventional train passengers are in close agreement.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209503

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PB-209503

**039287**

**RAIL PASSENGER STATISTICS IN THE NORTHEAST CORRIDOR 1969**

Office of High Speed Ground Transportation, Northeast Corridor Transportation Project, Washington, D.C.

Annual Rpt, 6901-6912, Mar. 1970, 31 pp

See also report dated Feb 69, PB-183 365 and report dated Feb 71, PB-209 505.

The report displays 1969 rail passenger statistics for the New York-Boston and New York-Washington routes, with emphasis on a comparison of Metroliner and Turbotrain passengers with conventional train passengers. Statistics relative to passengers' origins and destinations, socio-economic characteristics, purposes of travels, frequency of travel, last-used mode of travel and opinions concerning the quality of train service are displayed. The socio-economic characteristics of Metroliner patrons and airline passengers within the Corridor are compared, with the results indicating that Metroliner riders are more similar to airline passengers than to users of conventional train service.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209504

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PB-209504

**039289**

**RAIL PASSENGER STATISTICS IN THE NORTHEAST CORRIDOR 1970**

Office of High Speed Ground Transportation, Northeast Corridor Transportation Project, Washington, D.C.

Annual Rpt, 7001-7012, Feb. 1971, 14 pp

See also report dated Mar 70, PB-209 504, and PB-209 506.

The report displays 1970 rail passenger traffic statistics for the New York-Boston and New York-Washington routes for both conventional rail service and the Metroliner and Turbotrain Demonstrations. Traffic volumes for each origin-destination link and each route segment within the Corridor are given. Monthly breakdowns are provided for traffic within the New York-Washington and New York-Boston corridors and for traffic between these cities as origin-destination pairs. Equivalent statistics for 1969 are offered as background information.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209505

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PB-209505

**039299**

**RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION. MAIN REPORT. VOLUME 2**

Miller, M Cheslow, M Ebersole, NT Gerba, J Igo, DJ

Department of Transportation, Office of Systems Analysis and Information, Washington, D.C.

Final Rpt, 7004-7109, Sept. 1971, 316 pp

See also Volume 1, PB-205 241 and Volume 3, PB-205 243.

Volume 2 includes discussions of the Northeast Corridor's population growth patterns and the region's transportation system, an evaluation methodology, descriptions of interim and long term alternative systems, and a comparative analysis of the alternatives as to their technological feasibility, economic costs and benefits and environmental impacts for the years 1975 and 1985.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205242

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PB-205242

**039300**

**RECOMMENDATIONS FOR NORTHEAST CORRIDOR TRANSPORTATION VOLUME 3. APPENDICES**

Miller, M Cheslow, M Ebersole, NT Gerba, J Igo, DJ

Department of Transportation, Office of Systems Analysis and Information, Washington, D.C.

Vol. 3, Final Rpt, 7004-7109, Sept. 1971, 217 pp

See also Volume 1, PB-205 241, and Volume 2, PB-205 242.

Volume 3 contains descriptions of methodology and detailed results of the Northeast Corridor's air and highway systems analysis and general environmental forecasts through 1985.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205243

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PB-205243

**039301**  
**RECOMMENDATIONS FOR NORTHEAST CORRIDOR**  
**TRANSPORTATION VOLUME I**

Miller, M Cheslow, M Ebersole, NT Gerba,  
J Igo, DJ

Office of Systems Analysis and Information, /Department of  
Transportation, Washington, D.C.

Vol. 1, Final Rpt, 7004-7109, Sept. 1971, 66 pp

See also Volume 2, PB-205 242.

The report contains recommendations and supplementary conclusions, and discusses in highly summarized form the background to the Corridor's transportation problems, the general study approach and the evaluation of alternative. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205241

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PB-205241

**039354**

**JOB ACCESSIBILITY FOR THE UNEMPLOYED: AN**  
**ANALYSIS OF PUBLIC TRANSPORTATION IN CHICAGO**

Mayor's Committee for Economic and Cultural Dev, Chicago,  
Illinois UMTA-ILL-T9-1

Final Rpt, Mar. 1972, 118 pp

Contract DOT-UT-103

The report presents the results of a study investigating the adequacy of public transit service linking high unemployment neighborhoods with employment areas in Chicago.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210969

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PB-210969

**039356**

**A TRANSIT SYSTEM IN CRISIS. A CASE STUDY OF D.**  
**C. TRANSIT**

Artabane, JA Nealon, FJ

Consortium of Universities, Urban Transportation Center,  
Washington, D.C.

UTC-3, Final Rpt, June 1972, 89 pp

Contract DOT-UT-53

The report analyzes the mass transit systems that serve the Washington metropolitan area. It presents a descriptive sketch of the bus systems in D. C. and the political and social impact of various forces operating in the District. It examines the role of the Federal Government as the area's largest employer and parking supplier as well as the effect that the independent jurisdictions of Virginia and Maryland have on transit policies for the metropolitan area.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210999

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**039361**

**INITIAL DATA ACQUISITION FROM VEHICLES IN**  
**CONFINED SPACES (VICS-120) FACILITY, AND FINAL**  
**RESULTS FROM VICS-70**

California Institute of Technology, Graduate Aeronautical  
Laboratories, Pasadena, California DOT-DC-MTD-7

Oct. 1971, 65p

Contract DOT-UT-290

Prepared in cooperation with the Institute for Rapid Transit,  
Washington, D.C.

The report has been prepared under the Institute for Rapid Transit (IRT) project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems,' and is one of many such reports leading to the final product—a 'Subway Environmental Design Handbook.' The report completes the Phase I effort at JPL. It contains data obtained during the initial and pressurized shutdown operational periods of the VICS-120 Facility and a detailed description of the JPL Computer Program for Analytical Model I. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211031

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**039365**

**SUBWAY ENVIRONMENTAL SURVEY, NEW YORK CITY**  
**TRANSIT AUTHORITY**

Institute for Rapid Transit, Washington, D.C. UMTA-DC-  
MTD-7

Dec. 1971, 76p

Contract DOT-UT-290

Prepared in cooperation with De Leuw, Cather and Company,  
Chicago, Ill.

The report has been prepared under the Institute for Rapid Transit (IRT) project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems', and is one of many such reports leading to the final product—a 'Subway Environmental Design Handbook'. The purpose of this particular report is to present all of the subway environmental information available on the New York City Transit Authority. The information represents the state-of-the-art under actual operating conditions in the New York subway system, of the various environmental areas included in the project—temperature, humidity, velocity, pressure, environmental equipment noise and vibration. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211073

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**039366**

**STUDY AND EVALUATION OF URBAN MASS**  
**TRANSPORTATION REGULATION AND REGULATORY**  
**BODIES. VOLUME I: SUMMARY AND MAIN REPORT**

Banks (RL) and Associates, Incorporated, Washington,  
D.C. UMTA-TRD-65

Vol. 1, Final Rpt, May 1972, 398 pp

Contract DOT-UT-00003

Prepared in cooperation with Stanford Research Inst., Menlo

Park, Calif., and Real Estate Research Corp., Washington, D.C., see also Volume 2, PB-211078.

Transit regulation is examined as a basic aspect of urban planning and decision-making. The regulatory function embraces not only franchising and operational specifications, but also the relationship between transit and general development of the surrounding community. The present transit decline is discussed with reference to current regulatory practices and seven case histories. Specific areas of regulatory neglect are identified along with such issues as the 'right' of mobility, congestion and pollution, and the emerging public role in transportation management. Financial and institutional options are discussed in detail. The report particularly emphasizes the importance of coordinated regulation and planning, and the utility of regulation as a planning tool. Various analytical techniques for transit improvement are also examined. Specific policy options for organization, financing, and review are outlined; alternative structural approaches are reviewed with reference to service consolidation, management, and organization. The report concludes with specific guidelines for constructive action. Data were collected in surveys of both public and private officials.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211077

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039367

#### STUDY AND EVALUATION OF URBAN MASS TRANSPORTATION REGULATION AND REGULATORY BODIES. VOLUME II: APPENDICES

Banks (RL) and Associates, Incorporated, Washington,  
D.C. UMTA-TRD-65

Final Rpt, May 1972, 215p

Contract DOT-UT-65

See also Volume 1, PB-211077. Prepared in cooperation with Stanford Research Inst., Menlo Park, Calif., and Real Estate Research Corp., Washington, D.C.

The report contains seven appendices to a study of transit regulation as a basic aspect of urban planning and decision-making. The appended material covers: (1) a bibliography of major data sources (including both public and private officials concerned with transit regulation who were interviewed), (2) the structure of transit regulation in selected metropolitan areas, (3) the legal basis for transit regulation, (4) innovations in urban transportation, (5) land development trends affecting transportation regulation, and (6) the contractor's statement of work completed under this project.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211078

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PB-211078

039391

#### BUS-TRANSIT FEASIBILITY STUDY, WESTPORT, CONNECTICUT

Harris (Frederic R) Incorporated, Stamford, Connecticut

Final Rpt, Mar. 1972, 68p

Contract DOT-UT-27

The report examines the feasibility of bus transit in Westport, Conn. Principal characteristics of this suburban community are summarized with reference to population, housing, income and employment, land use and zoning, and projected growth trends. The

authors note how a public bus system would provide major benefits to three potential user groups: youth, the elderly, and railroad commuters. It is recommended that a fleet of small buses be operated along routes designed to maximize service for these groups, and focused on the central business district and commuter railroad stations. Aspects of the recommended system are discussed, including design, service levels, route and fare structures, and estimated patronage, as well as vehicle selection and management operations.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-211263

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039805

#### THEORETICAL SCALING LAWS FOR SUBWAY MODELING

California Institute of Technology, Graduate Aeronautical  
Laboratories, Pasadena, California DOT-DC-MTD-7

Tech Rpt, Mar. 1971, 55p

Contract DOT-UT-290

The report, prepared under the Institute for Rapid Transit (IRT) project, is one of many such reports leading to a final product—a subway environmental design handbook. A study is presented of the laws which scale the aerodynamic and heat transfer effects for vehicles in tubes. Aerodynamic scaling laws are found, under which the scaling laws for heat transfer by forced convection, free convection, and thermal radiation are derived. A discussion about the possibilities of applying these laws for small scale models is given, along with a summary of scaling laws.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-206779

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039806

#### SUBWAY ENVIRONMENTAL SURVEY SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY

DeLeuw, Cather and Company, Chicago, Illinois DOT-DC-  
MTD-7

Tech Rpt, Aug. 1971, 91 pp

Contract DOT-UT-290

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc. and Kaiser Engineers.

The report, prepared under the Institute for Rapid Transit (IRT) project, is one of many such reports leading to a final product—a subway environmental design handbook. It presents information gathered in an extensive interview in southeastern Pennsylvania, including the actual operating conditions, of temperature, humidity, velocity, pressure, environmental equipment, noise, and vibration.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-206780

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039807

#### SUBWAY ENVIRONMENTAL SURVEY MASSACHUSETTS BAY TRANSPORTATION AUTHORITY



Deleuw, Cather and Company, Chicago, Illinois DOT-DC-  
MTD-7

Tech Rpt, Sept. 1971, 64 pp

Contract DOT-UT-290

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc. and Kaiser Engineers.

The report, prepared under the Institute for Rapid Transit (IRT) project, is one of many such reports leading to a final product—a subway environmental design handbook. It presents information gathered on actual operating conditions in the Boston subway system, including the various environmental areas of temperature, humidity, velocity, pressure, odor, environmental equipment, noise, and vibration.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206781

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**039808**

**SUBWAY ENVIRONMENTAL SURVEY MONTREAL  
URBAN COMMUNITY TRANSIT COMMISSION**

Deleuw, Cather and Company, Chicago, Illinois DOT-DC-  
MTD-7

Tech Rpt, Oct. 1971, 314 pp

Contract DOT-UT-290

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc. and Kaiser Engineers.

The report, prepared under the Institute for Rapid Transit (IRT) project, is one of many leading toward a subway environmental design handbook. It covers operating conditions in the Montreal subway system, including the various environmental areas of temperature, humidity, velocity, pressure, equipment noise, and vibration.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206782

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**039809**

**SUBWAY ENVIRONMENTAL SURVEY TORONTO  
TRANSIT COMMISSION**

Deleuw, Cather and Company, Chicago, Illinois DOT-  
DCMTD-7

Tech Rpt, July 1971, 335 pp

Contract DOT-UT-290

The purpose of the report is to present all of the subway environmental information gathered in an extensive interview with the Toronto Transit Commission. The information represents the state-of-the-art under actual operating conditions in the Toronto subway system, of the various environmental areas included in the project—temperature, humidity, velocity, pressure, environmental equipment noise and vibration. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206848

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**039810**

**SINGLE-TRACK SUBWAY ENVIRONMENTAL  
SIMULATION MODEL PHASE I**

Parsons, Brinckerhoff, Quade and Douglas, Inc, New York, New York DOT-DC MTD-7

Interm. Rpt, Aug. 1971, 175 pp

Contract DOT-UT-290

The report describes the Single-Track Subway Environment Simulation computer program which has been developed during the first year of the IRT project and includes sample preliminary input forms for the program as well as results from a test simulation of a sample subway system. This designer-oriented computer program will simulate multiple train operation and will provide continuous, peak, and average readings for the air velocity, temperature, and humidity throughout the stations, tunnels, and ventilation shafts of a single-track subway. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206895

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**039811**

**SUBWAY ENVIRONMENT DESIGN CRITERIA**

Kaiser Engineers, Oakland, California DOT-DC-MTD-7

Tech Rpt, Sept. 1971, 87p

Contract DOT-UT-290

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, Calif.

The report focuses on the development of human comfort criteria for subway systems. The psychological and physiological aspects of thermal comfort are reviewed. The common indices of comfort are evaluated and the effective temperature and a modification to the relative strain index are selected as the most suitable for use in developing criteria in a subway rapid transit system. The concept of relative comfort is introduced as a means of computing the temperature required to achieve the desired comfort level. Criteria for rapid pressure changes, high air velocities and air quality are also given. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206896

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**039812**

**SUBWAY ENVIRONMENTAL SURVEY PORT AUTHORITY  
TRANSIT CORPORATION**

De Leuw, Cather and Company, Chicago, Illinois DOT-  
DCMTD-7

Tech Rpt, Oct. 1971, 70p

Contract DOT-UT-290

The purpose of this report is to present all of the subway environmental information gathered in an extensive interview with the Port Authority Transit Corporation. The information represents the state-of-the-art under actual operating conditions in the PATCO subway system, of the various environmental areas included in the project—temperature, humidity, velocity, pressure, odor, environmental equipment noise and vibration. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206897

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PB-206897

**039813**

**SUBWAY ENVIRONMENTAL SURVEY CLEVELAND  
TRANSIT SYSTEM**

De Leuw, Cather and Company, Chicago, Illinois DOT-  
DCMTD-7

Tech Rpt, Oct. 1971, 56 pp

Contract DOT-UT-290

The purpose of the report is to present all of the subway environmental information gathered in an extensive interview with the Cleveland Transit System. The information represents the state-of-the-art under actual operating conditions in the Cleveland subway system, of the various environmental areas included in the project—temperature, humidity, velocity, pressure, environmental equipment noise and vibration. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-206898

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
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PB-206898

**039819**

**VENT AND STATION TEST (VST) FACILITY. VENT  
SHAFT TESTING**

Developmental Sciences, Incorporated, Aerospace Technology  
Division, City of Industry, California, 91744 DOT-DC-MTD-  
7

Aug. 1971, 123p

Contract DOT-UT-290

The report has been prepared under the Institute for Rapid Transit (IRT) project, one of many reports leading to a final product—the 'Subway Environmental Design Handbook'. The purpose of this particular report is to present, describe, and interpret the quantity of test data generated in the VST Facility for vent shafts. Junction coefficients for a wide range of vent shafts are presented and compared to theory. Recommendations are made.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207755

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PB-207755

**039820**

**VENT AND STATION TEST (VST) FACILITY—STATION  
TESTING**

Developmental Sciences, Incorporated, Aerospace Technology  
Division, City of Industry, California, 91744 DOT-DC-MTD-  
7

Oct. 1971, 56p

Contract DOT-UT-290

The purpose of this particular report is to present, describe, and interpret the mass of test data generated in the VST facility for stations. Pressure signatures for various stations with and without mezzanines, for various entry portals, vent shafts and platform configurations are presented and compared to theory. Recommendations are

made.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207756

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207756

**039823**

**RESEARCH REQUIREMENTS SURVEY OF THE RAPID  
RAIL INDUSTRY**

McGean, TJ

Mitre Corporation, McLean, Virginia TRD-90

Final Rpt, June 1971, 99 pp

The major problems existing today in the rapid transit industry have been assessed by interviewing all properties in the United States and Canada and surveying major suppliers of transit equipment. The results of these surveys have been used to identify fruitful research areas for the Urban Mass Transportation Administration's rapid rail research program. Emphasis is upon the Pueblo, Colorado test site where UMTA will build a ten mile test track and, in conjunction with the Federal Railroad Administration, the first wheel-rail dynamics laboratory in this country. The report includes complete survey results and rapid rail research recommendations. It also discusses the impact of present and planned UMTA research and development programs upon these problems.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204438

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-204438

**039828**

**METROLINER AUXILIARY POWER ELECTRICAL  
SYSTEM RELIABILITY STUDY**

Abbas, JD Watt, CWJ

Transportation Systems Center, 55 Broadway, Cambridge,  
Massachusetts, 02142

DOT-TSC-FRA-71-2, Intrm Rpt, June 1971, 87p

The reliability of the electrical system of any vehicle is greatly affected by the way the system is configured. The propulsion and braking systems of a train must be unaffected by failures occurring in the nonessential power areas. With these criteria in mind the so-called 'Auxiliary Power System' of the Metroliner car was analyzed. This auxiliary power system was found to be deficient in achieving these ends. Recommendations suggest methods of satisfying these criteria by segregating the essential from the nonessential elements, thereby enhancing the overall availability of the Metroliner car. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204795

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-204795

**039829**

**URBAN MASS TRANSPORTATION**

Willis, DE

Department of Transportation, Library Services Division,  
Washington, D.C.

Bibliographic List-6, Sept. 1971, 146 pp

The bibliography provides an annotated listing of selected references to bibliographies, conference proceedings, books, research reports and periodical articles on Urban Mass Transportation. Most of the references cover the period 1960 through June 1971 but some particularly valuable articles prior to 1960 are included. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-733773

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
AD-733773

**039835****AN INITIAL CHICAGO NORTH SUBURBAN TRANSIT IMPROVEMENT PROGRAM. 1971-1975. VOLUME II. TECHNICAL SUPPLEMENT**

Pratt, RH Bevis, HW

North Suburban Transportation Council, Chicago,  
Illinois UMTA-ILL-T9-2

Final Rpt, July 1971, 110p

Contract DOT-UT-85

See also Volume 1, PB-204 873.

The volume documents travel forecasting models and procedures, parking inventories, a Skokie Swift station site inventory, available bus service technology, short and long bus trip analyses, and the effects of employment growth on mass transit. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204874

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-204874

**039836****AN INITIAL CHICAGO NORTH SUBURBAN TRANSIT IMPROVEMENT PROGRAM. 1971-1975. VOLUME I. REPORT AND EXHIBITS**

Pratt, RH Bevis, HW

North Suburban Transportation Council, Chicago,  
Illinois UMTA-ILL-T9-2

Final Rpt, May 1971, 187p

Contract DOT-UT-85

See also Volume 2, PB-204 874.

The study undertakes to determine transportation planning objectives for the Chicago commuter-shed along the North Shore and the Skokie Valley, the northern portion of Cook County and the southern part of Lake County. Travel and population characteristics are reviewed. Travel analysis and projections are made. After existing rail service and parking facilities are reviewed, commuter parking needs and alternatives to the Skokie Swift are evaluated. A review of existing bus service, the development of a suburban bus service concept, and the evaluation of expanded suburban bus service follow the section on rail alternatives. Land use and mass transportation, the development of proposals and costs and an implementation program conclude the report. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204873

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-204873

**039838****TRIP: THE TRANSPORTATION ROUTING AND INTERMODAL PLANNING SYSTEM: AN AID FOR TODAY'S TRAVELER**

Kovatch, G Taub, J

Transportation Systems Center, 55 Broadway, Cambridge,  
Massachusetts, 02142

DOT-TSC-OST-71-3, Tech Rpt, Jan. 1971, 39 pp

The Transportation Routing and Intermodal Planning (TRIP) System was conceived as an aid to today's traveler. It assumes a traveler wishes to choose from all available modes of transportation generally air, automobile, rail, and bus. It is based on the utilization of current computer display technology. The TRIP System accepts information from the traveler in real time while the traveler sits at an input terminal. The information describes the individual travel needs and desires. The computer produces actual travel plans with comparative cost and time data for each mode. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204797

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-204797

**039841****PUBLISHED REPORTS BY THE OFFICE OF HIGH SPEED GROUND TRANSPORTATION**

Office of High Speed Ground Transportation, Washington, D.C.

Nov. 1971, 59 pp

The bibliography presents and abstracts 328 major research reports published by the Office of High Speed Ground Transportation in the Federal Railroad Administration, Department of Transportation. Also included are selected reports by the Office of Policy Planning, Federal Railroad Administration, and by the Northeast Corridor Transportation Project in the Office of the Assistant Secretary of Transportation for Policy and International Affairs. These reports represent results of contracted research and development, systems engineering, transportation surveys, and model development, along with intramural research reports and program summaries. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205937

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, NTIS Price: s: PC\$3.00, /MF\$0.95  
PB-205937

**039842****PHYSICAL AND GEOMETRICAL DATA FOR SUBWAY SYSTEM COMPONENTS**

Kaiser Engineers, Oakland, California DOT-D.C.-MTD-7

Tech Rpt, Sept. 1971, 164p

Contract DOT-UT-290

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc., and De Leuw, Cather and Company.

The report has been prepared under the Institute for Rapid Transit (IRT) project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems,' and is one of many such reports leading to the final product—a handbook on subway environmental criteria, analysis, and control. The report contains the physical and geometric data that characterize the aerodynamic and thermodynamic aspects of subway rapid transit systems. The range of values contained encompass the characteristics of existing and anticipated systems. The use of this data is intended to provide the IRT and its

research project with realistic ranges of parameters that must be included in their respective scale-model tests and basic theoretical developments. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205879

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-205879

**039844**

**BROAD AND COLUMBIA SUBWAY DEVELOPMENT STUDY**

Temple University, College of Engineering Technology,  
Philadelphia, Pennsylvania

Final Rpt, Aug. 1971, 222p

Contract DOT-OS-00054

The report was produced by an interdisciplinary team of university students demonstrating a constructive input into the planning and design of a transportation facility, the Broad and Columbia Subway Station. Subway station recommendations include provisions for the safety and security of the passenger, improved circulation and movement, physical rehabilitation of the station and connections to the activities and open courts adjacent to the station. Adjacent areas recommendations include improved land-use activities and arrangements and coordination and integration of these activities with the subway. Appendices include a bibliography related to psychological and physical effects of the subway environment. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205445

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-205445

**039848**

**SUBWAY ENVIRONMENTAL SURVEY PORT AUTHORITY TRANS-HUDSON CORPORATION**

Deleuw, Cather and Company, Chicago, Illinois UMTA-DC-MTD-7

Tech Rpt, Oct. 1971, 69 pp

Contract DOT-UT-290

Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc., and Kaiser Engineers.

The purpose of the report is to present all the subway environmental information gathered in an extensive interview with the Port Authority Trans-Hudson Corporation. The information represents the state-of-the-art under actual operating conditions in the PATH subway system, of the various environmental areas included in the project—temperature, humidity, velocity, pressure, environmental equipment noise and vibration.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210322

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-210322

**039849**

**PILOT SPECIFICATION FOR THE PROCUREMENT OF MULTIPLE-UNIT RAILWAY COMMUTER CARS**

Pullman Standard, 200 South Michigan Avenue, Chicago, Illinois,

60604

Final Rpt, Jan. 1972, 285p

The report was prepared by Pullman-Standard at no cost to the Federal government as an approach to the development of a guideline specification for urban rail commuter cars. This is a pilot specification written for the purpose of outlining the contractual procedures and performance requirements necessary for the procurement, construction, and utilization of passenger-carrying railway commuter cars. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210230

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-210230

**039851**

**PUBLIC INFORMATION SYSTEMS IN URBAN MASS TRANSIT**

Liff, SD Michaels, RM

Northwestern University, Transportation Center, Evanston,  
Illinois UMTA-III-URT-21(69)

Res Rpt, Aug. 1971, 98p

Contract DOT-UT-142

The report deals with the effects of improvements in the public information systems on mass transit ridership. The research in this study is designed to develop a methodology to identify the potential market, as well as to set a rationale for the expenditure of funds on public information. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209706

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-209706

**039852**

**COMPARATIVE EVALUATION, NEW TRANSPORTATION TECHNOLOGY MICHIGAN—BUREAU OF TRANSPORTATION, VOLUME II. APPENDICES**

TRW Systems Group, Washington Operations, McLean, Virginia

Sept. 1971, 151 pp

See also Volume I, PB-209 481.

Transit subsystems are discussed to provide a baseline for a comparative evaluation of the major alternatives for each, their performance capabilities, and explanatory material relative to their operating characteristics and applications. The major subsystems forming an automated rapid transit system that are discussed include controls, propulsion and power, brakes, and guideway/suspension. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209482

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-209482

**039853**

**COMPARATIVE EVALUATION, NEW TRANSPORTATION TECHNOLOGY MICHIGAN—BUREAU OF TRANSPORTATION. VOLUME I**

TRW Systems Group, Washington Operations, McLean, Virginia

Final Rpt, Sept. 1971, 169 pp

See also Volume 2, PB-209 482.

The study was made to conduct a comparative evaluation of new urban transportation systems which are either under construction or prototype testing and expected to be available for near term (2 to 3 years) construction. Principal objectives of the study: Investigate and evaluate specific technological problems which are in need to be improved before real-life application is possible; Identify time frame and cost requirements needed to bring upon the defined technological improvements; Determine capital and operational cost ranges for alternative hardware systems. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209481

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-209481

**039857**

**DATA ACQUISITION FOR VEHICLES IN CONFINED SPACES (VICS-70) FACILITY**

California Institute of Technology, Graduate Aeronautical Laboratories, Pasadena, California DOT-D.C. MTD-7

Tech Rpt, May 1971, 71p

Contract DOT-UT-290

Tests were conducted at the VICS-70 facility using scale models under a variety of simulated conditions. Model test data reduction procedures for steady-state tube vehicle aerodynamics are described. Sample calculations of equilibrium velocity, drag coefficients, tube pressure gradient, tube flow velocity ratio, effective tube length and effective friction factor in proximity to the model are included. Results of the test program are presented with reference to: velocity history; effects of model nose and tail perturbations on drag; drag as a function of blockage ratio, vehicle length, tunnel length, Reynolds number, and vehicle roughness, drag coefficient sensitivity to blockage ratio; and tube length and tube flow velocity ratio as a function of blockage ratio, vehicle length and test section length.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205878

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-205878

**039874**

**THE NORTHEAST CORRIDOR INTERCITY TRAVEL SURVEY: USAGE OF THE REVISED RAIL SURVEY TAPE**

Peat, Marwick, Mitchell and Company, Washington, D.C.

Final Rpt, Nov. 1971, 71p

Contract DOT-OS-10051

See also report dated Mar 71, PB-200 632.

The objectives of the study were to edit and reformat the rail component of the Northeast Corridor Intercity Travel Survey and to reformat the rail survey to make it compatible with the surveys of the automobile, bus, and air modes. All the information required to use the revised rail survey tape is presented in one chapter; the user is encouraged to review the section on use of the revised rail survey tape prior to undertaking any analyses.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211769

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-211769

**039876**

**HIGH SPEED GROUND TRANSPORTATION. DOCUMENTATION OF PRELIMINARY ENGINEERING, LOS ANGELES INTERNATIONAL AIRPORT AND THE SAN FERNANDO VALLEY**

Kaiser Engineers, Los Angeles, California

72-1-RE, Engr Doc, Apr. 1972, 175 pp

Contract DOT-UT-312

See also report dated Nov 70, PB-197 962.

The report documents work completed under Phase 3 of a project to construct a high speed ground rapid transit access facility between Los Angeles International Airport and the San Fernando Valley. Service in this corridor will be provided by tracked air-cushion vehicles running on a special guideway. Phase 3 of the project included preliminary engineering studies and continued development of the route and structures.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211833

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-211833

**039877**

**BUS AND RAIL ROLLING STOCK, EQUIPMENT IN METROPOLITAN CHICAGO**

Leonard, GB

Chicago Area Transportation Study, Chicago, Illinois UMTA-IL-09-0012

CATS-314-04, Final Rpt, Aug. 1972, 50p

Contract DOT-UT-587

Prepared in cooperation with Lake-Porter Co. Regional Transportation Planning Commission, Highland, Ind.

A computer-assisted inventory procedure was developed as a tool in formulating the rolling stock renewal component of the mass transit priority program in metropolitan Chicago. A computer tabulation of each unit was compiled, using standards provided by the individual carriers to estimate the functional economic life of vehicles in the existing transit fleet. Results of the rolling stock inventory are broken down among bus, suburban rail, and rapid transit modes with reference to fleet size, vehicle manufacturers, and various equipment conditions such as air conditioning. The author notes that annual updates of this report are anticipated.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211887

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-211887

**039883**

**INVESTIGATE ENVIRONMENTAL CONTROL IN UNDERGROUND RAPID TRANSIT SYSTEMS**

Parsons, Brinckerhoff, Quade and Douglas, Inc, New York, New York DOT-DC MTD-7

Final Rpt, Oct. 1971, 47 pp

Grant DOT-UT-290

The report has been prepared under the Institute for Rapid Transit (IRT) project, Ventilation and Environmental Control in Subway Rapid Transit Systems, and is one of many such reports leading to the final product—A 'Subway Environmental Design Handbook.' The report describes the various task assignments that were undertaken by all participating contractors during the first year of the IRT project. It includes highlights of these activities and identifies the major accomplishments. A list of the total of 37 interim and milestone technical reports prepared during the year is included. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205259

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, NTIS Price: s: PC\$3.00, MF\$0.95  
PB-205259

**39886**

**THE 'NORTHWEST PASSAGE' PROJECT. A MARKET ANALYSIS COVERING PERFORMANCE OF THE PEDESTRIAN INTERCHANGE, 1969-1971**

Harris (AC) Company, Chicago, Illinois UMTA-ILL-MTD-5  
Tech Rpt, Oct. 1971, 371 pp

Contract DOT-H-1015

The report includes data collected during a series of passenger surveys (unified, on-train, and platform) relating to the provision of a passageway linking a commuter railroad and a rapid transit station in Chicago, Illinois. The purpose of the surveys was to determine whether or not there had been an increase in passengers who used both the Chicago and North Western Railway and the Chicago Transit Authority rapid transit system, and, if so, to what extent the increase in combination ridership is due to the provision of the passageway called the Northwest Passage. The answers to the survey questions are tabulated and analyzed in the report.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210240

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-210240

**039890**

**NEW DESIGNS FOR HIGH SPEED RAIL TRANSPORTS  
212 NOVYE KONSTRUKSTII VYSOKOSKOROSTNOGO  
RELISOVOGO TRANSPORTA**

Rodovskii, AB

Army Foreign Science and Technology Center, Charlottesville,  
Virginia FSTC-T7023012301

FSTC-HT-23-1438-71, Feb. 1972, 12 pp

Trans. of Zhelezodorozhnyi Transport (USSR) n12 pp79-82,  
1969.

A review is presented of Soviet and foreign research in the area of the design of high speed rail equipment. Designs are illustrated, developed from research conducted in the United States, England and Japan.

**ACKNOWLEDGEMENT**

National Technical Information Service, AD-741726

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
AD-741726

**039896**

**A METHODOLOGY FOR DEVELOPING SECURITY  
DESIGN CRITERIA FOR SUBWAYS**

Harris, OLJ

Carnegie-Mellon University, Transportation Research Institute,  
Pittsburgh, Pennsylvania UMTA-URT-5(70)

CMUTRI-TP-71-04, Res Rpt, Oct. 1971, 122 pp

Contract DOT-UT-237

The report addresses itself to the problems of crime and harassment in subway stations and trains. Its major content consists of discussions of how the incidence of various types of criminal acts occurring in subway stations and trains relate to the physical and non-physical environment of these facilities. A new approach and framework for reducing the occurrence of these acts is presented. This methodology, entitled Security Design Criteria, is oriented towards assisting planners in choosing the optimal combination of physical and non-physical design factors in the construction or renovation of subway environments. The goal of such an approach is to achieve the greatest reduction in crime with the available funds. The methodology is dynamic in character as it involves constant citizen participation in forming the Security Design Criteria. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204953

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-204953

**039897**

**RESEARCH BIBLIOGRAPHY VENTILATION AND  
ENVIRONMENTAL CONTROL IN SUBWAY RAPID  
TRANSIT SYSTEMS. PHASE I**

Kaiser Engineers, Oakland, California UMTA-DC-MTD-7

71-56-R, Tech Rpt, Aug. 1971, 28 pp

Contract DOT-UT-290

The following subject areas are covered in the bibliography on rapid transit ventilation and environmental engineering: Passenger comfort, subway environment, high speed ground transportation, and aerodynamics of vehicles in tubes.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-205996

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$4.75, Microfiche: \$0.95  
PB-205996

**039899**

**USSR BUILDS BIG, CLEAN RAIL TRANSIT SYSTEMS**

Demore, HW

Modern Railroads (Cahners Publishing Company, Incorporated, 5  
South Wabash Avenue, Chicago, Illinois, 60603)

Vol. 27, No. 7, July 1972, 3 pp, 5 Phot

Rail transit is prospering in the Soviet Union. Five major cities have modern subways, and planners expect to double this number by the year 2000. A total of 26,000 streetcars are in use on streets of 110 cities. About 3 billion passengers ride long distance trains each year, and another 2.7 billion ride commuter trains. The 87 mile Moscow subway, and the four in other cities, are much alike. Most stations are at least 100 feet below the street. Although this eliminates utility relocation, it requires high speed escalators. Station platforms are wide and well lighted. The fare on the subway is about six cents in U.S. money. All subway systems use five foot gage, use 825 volt direct current, and have an underrunning third rail. Moscow subway carries

5 million passengers on a weekday, and has 86 stations. Even smaller cities have subways, Kiev has only 1.5 million population. The subways prosper because the Soviet government has chosen not to emphasize automobiles. The Russians are continuing to develop streetcar technology.

**ACKNOWLEDGEMENT**  
Modern Railroads

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Cahners Publishing Company, Incorporated, 5 South Wabash Avenue, Chicago, Illinois, 60603, Repr Req Price

**040607**  
**METROPOLITAN TRANSPORTATION PLANNING SEMINARS: SUMMARY REPORT**

Frye, FF

American Institute of Planners, Washington, D.C.

Final Rpt, Dec. 1971, 53p

Contract DOT-OS-00056

See also PB-208 701, PB-208 702, PB-208 703, PB-208 704, PB-208 705 and PB-208 706.

The report summarizes a series of seminars designed to secure a variety of local opinions on the transportation planning process. The individual city volumes summarize the seminars formal papers, workshop sessions, and discussion periods held during November and December, 1970, and January, 1971, in six metropolitan areas. Each was intended to evaluate the transportation planning process and to develop positive proposals to improve that process. The Summary Report abstracts the discussions, recommendations and findings of the six city seminars: Cleveland, Ohio; Indianapolis, Indiana; Denver, Colorado; San Jose, California; Hartford, Connecticut; and Miami, Florida. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208700

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-208700

**040610**  
**PRELIMINARY WAVE ANALYSIS OF UNSTEADY SUBWAY VEHICLE AERODYNAMICS**

California Institute of Technology, Graduate Aeronautical Laboratories, Pasadena, California DOT-DC-MTD-7

Tech Rpt, Oct. 1971, 56p

DOT-UT-29

The report was prepared under the Institute for Rapid Transit (IRT) project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems,' and is one of many such reports leading to the final product—a 'Subway Environmental Design Handbook.' Trains moving in tubes experience drag forces which are orders of magnitude higher than when in free air. The report studies such forces and their dependent parameters to determine the tube optimal ventilation design as well as the moving and braking powers. The solutions obtained in this work are to be considered only as a first approximation to the unsteady confined vehicle problem. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208248

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-208248

**040621**

**REPORT TO THE CONGRESS OF THE UNITED STATES ON URBAN TRANSPORTATION POLICIES AND ACTIVITIES.**

Department of Transportation, Washington, D.C.

Final Rpt, June 1972, 45 pp

The document, as called for in Section 4(g) of the Department of Transportation Act of 1966, reports on legislation, policy and actions which are either in effect or are being jointly developed by DOT and HUD to further contribute to the national commitment to improve urban transportation and the quality of urban life.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211475

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
NTIS, Repr PC: \$3.75, Microfiche: \$0.95  
PB-211475

**040623**

**VENT AND STATION TEST (VST) FACILITY CHICAGO TRANSIT AUTHORITY SCALE MODEL VENT SHAFT TESTING**

Developmental Sciences, Incorporated, Aerospace Technology Division, City of Industry, California UMTA-DC-MTD-7

Intrm Rpt, Jan. 1972, 29p

Contract DOT-SC-72-200

The purpose of this report is to present, describe, and interpret experimental data generated in the Vent and Station Test (VST) facility for a 1:16 scale model vent shaft typical of the Chicago Transit Authority (Kennedy Branch) subway system. Data obtained from the model testing were compared to calculations using semi-empirical formulations of vent shaft performance. This research was conducted under the Institute for Rapid Transit project, 'Ventilation and Environmental Control in Subway Rapid Transit Systems,' and is one of many such reports leading to the final product, a 'Subway Environmental Design Handbook.' The report describes both 'straight-through' and 'in-situ' tests; complete statistical data are appended. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212335

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-212335

**040978**

**WHAT DO THESE TWO TRAINS HAVE IN COMMON?**

Kneiling, J

Trains (Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233)

Vol. 33, No. 3, Jan. 1973, pp 22-25, 6 Fig

Two companies are providing a service the public will buy in the form of railroad passenger service. Both companies have brought new equity capital to their railroad passenger business, and both companies are run by people who are outsiders to the railroad industry. Auto Train runs a tourist train service between Lorton, Virginia and Sanford, Florida, and will haul the family automobile on the same train with the family. Scenic Railways operates two tourist lines: one at Lake Tahoe, California, and one in the Colorado-New Mexico area. Auto Train uses reconditioned passenger cars, and the Colorado-New Mexico line uses boxcars from the turn of the century. Auto Train contracts with two railroads to operate its trains, but all contact with the public is by Auto Train personnel. Scenic Railways hires all its own staff. Each operation is small enough to be managed,

and neither has labor or institutional burdens. Each operation sells what the customer wants to buy, not what the railroad wants to provide.

#### ACKNOWLEDGEMENT

Trains

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041117

#### VENTILATION OF AN UNDERGROUND RAILWAY WITH SINGLETRACKED SHIELD TUNNELS

Nagahama, M

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

Vol. 13, No. 2, June 1972, pp 85-92, 11 Fig, 1 Tab

To work out countermeasures for the expected annual increase of air temperature in the station and tunnel spaces of underground extensions, Shinagawa-Ryogoku, of Tokaido and Sobu Lines, the existing underground railway lines have been surveyed; and to realize a ventilation system of longitudinal stream type, theoretical and experimental studies have been made. The present paper gives a generalized statement of the results of research. Ventilation of a longitudinal stream type is recommended as appropriate for the underground railway with single-tracked shield tunnels. Capacity for the ventilator to be employed, special conditions calling for attention in the construction, new idea in the air conditioning of station space are made clear with design examples cited. The paper also refers to the pollution of the external air to be used for ventilation and to the background noise of ventilator installations.

#### ACKNOWLEDGEMENT

Railway Technical Research Institute

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041125

#### UNIT LOAD SYSTEM FOR BAGGAGES

Nakajima, I Maeda, K

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

Vol. 13, No. 2, June 1972, pp 115-116, 3 Fig

Unit Load System for baggage transportation using a Box Pallet as a unit container is evaluated by simulation technics measuring such quantities as pallet load coefficient and average baggage transfer times. The baggage depot system examined is in the Tohoku area. Expected numbers of baggages at 19 depots are transported by one of several patterns of reciprocating unit load transportations. Several cases of baggage accumulations are quantitatively compared.

#### ACKNOWLEDGEMENT

Railway Technical Research Institute

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041144

#### WHAT DOES LINDENWOLD PROVE?

Asher, J

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 11, Dec. 1972, pp 24-25, 3 Phot

The Delaware River Port Authority's Lindenwold transit line is 14.5 miles long, has 12 stations and 75 cars, and serves the New Jersey suburbs of Philadelphia. Ridership has climbed to better than 42,000 daily. Plans are to obtain more cars and construct one additional station. An arrangement has been concluded for feeder bus service. Parking spaces at stations have been doubled from 4,500 to 9,000. The PATCO Lindenwold Line has proved that people will leave their automobiles to ride trains, that present-day technology can meet the competition of other modes, that automation can get operating costs down to where they are manageable, and that modern rail transit can be good looking.

#### ACKNOWLEDGEMENT

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: \$0.7

041228

#### BART'S HARDWARE--FROM BOLTS TO COMPUTERS

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Oct. 1972, pp 60-72

The multidisciplinary technologies that comprise this very complex mass-transit system are examined: design, construction, electrical and electronic systems, test track, rolling stock, and train control system.

#### ACKNOWLEDGEMENT

IEEE Spectrum

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10 Repr PC: Req Price

041230

#### CONSTRUCTION HISTORY OF UNION STATION, WASHINGTON, D.C.

Olszewski, G

National Park Service, Division of History, Washington, D.C.

FNP-HH-71-41, Feb. 1970, 317 pp

The report includes two parts. In Part I, the major portion of the study, the author has documented as many factors as was possible of the original structure. A copy of the original construction report of the Chief Engineer of the project was found. The author has drawn heavily on this authoritative narrative of the station's construction. This information will be of great value to architects, engineers, and interpretive personnel. Part II details the history of the years of work involved in obtaining approval by Congress of the legislation establishing the National Visitor Center. By this action preservation of Union Station was assured and the facilities provided in the nation's capital for handling the millions of American and foreign visitors who come to Washington to study at first hand and to see democracy in action. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-200493

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041319

#### NEW EQUIPMENT FOR AMTRAK: HOW MUCH? HOW SOON?

Railway Age (Simmons-Boardman Publishing Corporation, 350



Broadway, New York, New York, 10013)  
Vol. 174, No. 1, Jan. 1973, pp. 20-22, 5 Fig

Amtrak is leasing, with an option to buy, two five-car turbine powered trainsets from a French manufacturer. Amtrak is also buying two four-car Turbo trains built for Canadian National by United Aircraft. Earlier, Amtrak ordered forty 3,000 hp diesel electric locomotives for delivery by summer 1973. Seventy percent of Amtrak boardings come from seven percent of its routes. A specification is being drawn for a replacement passenger car. As of December 1972, about 595 Amtrak cars had been through the shops, and by July 1973, another 400 cars will have been shipped.

ACKNOWLEDGEMENT  
Railway Age

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**041608**  
**THE LINDENWOLD HI-SPEED TRANSIT LINE**

Vigrass, JW

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 2, 52 pp

PATCO's Lindenwold Line has proven that transit can attract motorists in an area of low population density and high automobile ownership. The transit cars are fully climate controlled, and so are the six new suburban stations, which have plenty of parking. The line was built without any Federal aid. Trains are operated by a one man crew, and stations are entirely unattended. Normal running speed is 75 mph. By the early 1950's, there were two underutilized facilities: the Camden High Speed Bridge Line and the PRSL suburban railroad network. The Lindenwold Line uses the old railroad right of way, the bridge line, and city subway. The philosophy was to select the best of the state-of-the-art hardware. Innovation for its own sake was not sought. The line is a high speed suburban electric railway providing transit-type service. A complete break with past organization was made, but past facilities have been preserved and improved. The line has 50 cars in married-pairs, and 25 single cars. Trains are from one to six cars. The automatic fare collection system has completely unattended stations. Exact change is not required. Closed-circuit TV monitors are used. The ticket is a plastic card with magnetic encoding material. Automatic Train Operation provides fast operation.

ACKNOWLEDGEMENT  
Railway Management Review

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Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Repr PC: Req Price

**041613**  
**AMTRAK, THE ATTEMPT TO RENEW U.S. RAIL SERVICE**

Panella, J, California University, Berkeley.

Transportation Planning and Technology (Gordon and Breach Science Publishers, Incorporated, 150 Fifth Avenue, New York, New York, 10011)

Vol. 1, No. 3, 1973, pp 195-204, 2 Fig, 1 Tab, 55 Ref

The decline of railway passenger train patronage and the deterioration of service in the United States have led the U.S. Government to assume control over the operation of trains via a quasi-federal corporation called "Amtrak," but some basic causes of the decline remain and new problems will arise as a result of this action. Two

results of the neglect to assess external costs against the various transport modes is an unbalance in favor of those with the higher external costs and the continued, seemingly fundamental, unprofitability of railway passenger service, which exists even for equipment that operates at capacity. Some way of collecting external costs will have to be found, and the problems created by the new intrusion of the U.S. Government into transport will have to be faced.

ACKNOWLEDGEMENT  
Transportation Planning and Technology

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**041620**  
**A PRESCRIPTION FOR BART**

Friedlander, GD

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017

Vol. 10, No. 4, Apr. 1973, pp 40-44

As the result of a sequence of mishaps and incidents occurring in the automated operation of the Bay Area Rapid Transit (BART) system since partial revenue service was inaugurated last September 11, considerable skepticism has been expressed by many sources as to the safety of this ultrasophisticated mass-transit system. These critical evaluations led to the empaneling of a select three-man committee to report on the safety of the BART ATC system. In brief, the panel did not find the system's present mode of operation unsafe, but said the present system would not provide adequate passenger safety under full-scale operation, and recommended modifications and redesign to correct the deficiencies.

ACKNOWLEDGEMENT  
IEEE Spectrum

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Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017 Repr PC: \$1.50

**041621**  
**THE BART CHRONICLE: THE GRAND SCHEME**

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 9, No. 9, Sept. 1972, pp 35-42

This article is the first of a series on BART. Refer to RRIS #041625 Section 23 for a note on special availability.

The Bay Area Rapid Transit system was conceived and is being constructed on a scale too imposing for piecemeal consideration of any single engineering discipline. San Francisco has 770,000 people in a 50 square mile area. Living space is available in the East Bay 'bedroom' counties, or to the north or south. Sixty percent of all job opportunities in the Bay Area exist in San Francisco, Oakland, and Berkeley. The state legislature created a special commission, which recommended a five county BART. Use of tolls from the Bay Bridge was authorized. Early plans called for routes in the five counties, 52 stations, and the three level Market Street Subway with trackless trolley coaches at street level, street cars below on a second level, and BART trains at the lowest third level. Aerial structures were to be different from any previously constructed. Two counties withdrew, and a court suit challenged the construction of the system. The two most difficult engineering projects were the Berkeley Hills tunnels and the Trans Bay Tube. The Diablo Test Track was placed in use in 1965 to aid in selection of rolling stock and subsystems. Construction costs began to exceed estimates. Additional sources of funding were necessary, including taxes and DOT grants. A section of subway and

stations were redesigned to minimize the excess of cost over the estimate. Inflation was a big factor. The Trans Bay Tube is binocular in cross section, and the vertical profile follows the contour of the bay bottom to minimize trenching costs. The Market Street Subway has been under construction for six years by cut and cover techniques. Berkeley voted an extra \$20.5 million to place tracks and two stations underground. A new Embarcadero Station required funding. Stanford Research Institute Recommended the 5 ft 6 in. gage of the track, for stability and smoother ride. The Westinghouse automated train control equipment has been beset by de-bugging problems. Plans are to extend BART to San Francisco International Airport. BART will use 250 light weight cars. Public reaction is divided into two camps: those who view BART as the most advanced transit system, and those who view it as a catastrophe. BART will increase land values in San Francisco, spur building in suburban counties, and ease vehicular traffic in San Francisco, Oakland, and Berkeley. There is no master plan for extension of the system, even though numerous studies have been completed or are underway.

**ACKNOWLEDGEMENT**  
IEEE Spectrum

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**041622**

**THE BART CHRONICLE: DRY RUNS BY COMPUTER**

Harsch, AF, Westinghouse Tele-Computer Systems Corporation

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 9, No. 9, X72-092, Sept. 1972, pp 43-46

This article is the second of a series on BART. Refer to RRIS #041625 Section 23 for a note on special availability.

The advent of control and computing hardware that permits reliable and economic simulation of discrete systems has made possible simulation of rapid transit systems. Simulation is used to: test the control logic on the main computer, train personnel in the operation of the system, and allow for further development and testing of operating decisions. The control system will be used to: (1) adjust station dwell time for trains, (2) revise dispatching schedules, (3) distribute the intervals between trains, and (4) control the sequence of trains over a single track when the other track is out of service. Control logic includes train strategies and, for abnormal situations, decision tables. The program comprises four parts: (1) setting up the model, (2) initializing the model, (3) sequence of events, and (4) computerized control logic. The simulator for the standby computer can be used to: (1) test centralized supervisory monitoring, (2) simplify the problem of evaluating changes, (3) determine the effects of changes that might otherwise never be tried, and (4) train the train console operator.

**ACKNOWLEDGEMENT**  
IEEE Spectrum

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**041623**

**BART'S HARDWARE—FROM BOLTS TO COMPUTERS**

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 9, No. 10, Oct. 1972, pp 60-72, 18 Fig

This article is the third of a series on BART. Refer to RRIS #041625 Section 23 for a note on special availability.

In 1965 BART began the Mt. Diablo Test Track. Three laboratory cars were built and used to test new technology. The testing program included reduction of sound and vibration, propulsion equipment and power supply, transit vehicle trucks, automatic train operation, rails and rail support, and aerial structures, tubes, and tunnels. Five propulsion systems were tested, and dc chopper control was selected. The Rohr built transit cars, 250 of them, feature cantilever seat construction, noise suppression, air conditioning, and glare free lighting. The car trucks are equipped with derail detectors connected into the automatic train operation system. On aerial structures and in tunnels, rail is fastened directly to the concrete slab or tunnel invert. For the Berkeley Hills tunnel, which crosses the Hayward Fault, rails were mounted on timber ties to permit speedy realignment. The Trans Bay Tube contains both horizontal and vertical curvature. Fifty-seven prefabricated sections were floated into position, then sunk. The Trans Bay Tube terminates in a ventilation building at each end. Cathodic protection is used. Welded rail was used, and the second pour technique for concrete. BART purchases power at 34.5 kvac. This power system has seven sections. An I section steel third rail provides strength and the top running surface for overrunning pickup shoes. Aluminum inserts carry the current. A J shaped cover protects against accidental contact. Automatic train operation handles speed regulation, programmed station stops, and train door operation. Line supervision provides best possible service schedules. Train protection maintains the safety of the operation.

**ACKNOWLEDGEMENT**  
IEEE Spectrum

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**041624**

**MORE BART HARDWARE**

Friedlander, GD

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 9, No. 11, Nov. 1972, pp 41, 6 Fig

This article is the fourth of a series on BART. Refer to RRIS #041625 Section 23 for a note on special availability.

BART's central control at Lake Merritt is the nerve center for its communications network. More than 300 discrete channels and four radio channels are used. Wireline carrier uses a double sideband suppressed carrier AM modem that can carry 24 channels over two pairs of wires. BART uses a PBX dial system leased from the telephone company. However, for wayside maintenance use, there is a separate maintenance telephone throughout the entire BART system. Emergency phones are located along the route. BART has a fully automatic fare collection system. A ticket console produces a magnetic card ticket with the amount the passenger wishes to purchase. Upon entering a station, a ticket console encodes entry data. Upon departure from the passenger's final station, the gate console deducts the proper amount and recodes the balance. For exact fare remaining, the console captures the ticket. For insufficient fare, the ticket is rejected and a lighted display directs the passenger to the Addfare machine. Subway construction near Civic Center required working well below the water table. A wall was constructed down to an impervious layer of soil by a special technique. Land beneath aerial structures has been made into Linear Parks.

**ACKNOWLEDGEMENT**  
IEEE Spectrum

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**041625**

**BART SETS THE PACE**

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

pp 45-54, 12 Fig

This article is the fifth and last of a series on BART. Through October 1973 a combined reprint of the series of articles will be available at \$4.50 for the first copy and \$1.50 each for additional copies. Request No. X72-113 from IEEE, 345 East 47th Street, New York, New York 10017, Attention SPSU.

BART is serving as a model for other metropolitan areas, but Toronto and Montreal led the way in building less complex systems. Toronto opened subway lines in 1954, 1963, and 1966, and the lines are now being extended. The Toronto lines spurred building booms. Montreal's Metro was opened in time for Expo '67. Montreal's Metro uses rubber tired wheels, which increase adhesion and reduce noise level; but cost more to build, generate more friction, and cost more for power. BART was envisioned to avoid conventional urban sprawl. So far, only San Francisco has really had a building boom, other parts of the Bay Area have a 'wait and see' attitude. Metropolitan Atlanta Rapid Transit Authority is producing an impact study encompassing: socio-historic factors, economic factors, esthetic factors, ecologic factors, acoustic factors, air quality, and water resources. The economic return is estimated at 2.79 to 1. Construction is well underway for the Washington Metropolitan Area Transit Authority. This 158 km system will serve 86 stations. Rohr will build 300 Metro cars. The automatic fare collection system will be similar to that of BART. Washington Metro will use padded rails and floating slabs to reduce noise and vibration. Special tunnel ventilation will be used.

#### ACKNOWLEDGEMENT

IEEE Spectrum

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041644

#### NOVEL FEATURES ON LINDENWOLD LINE

Pinkham, RE, Port Authority Transit Corporation

ASCE Journal of Transportation Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 98, No. TE2, Paper 8892, May 1972, pp 367-385

The new Lindenwold high speed rapid transit line between Philadelphia, Pa and suburban Lindenwold, N.J. covers 14.5 miles and owns 75 new, high speed, automated cars. Parking facilities for over 8,600 autos are provided at suburban stations. All stations are unmanned, but are protected by closed circuit television. Tickets are sold by vendors and collected by electronic turnstiles. The right-of-way is fully grade separated, either on conventional fill or on reinforced concrete elevated structures. Running rails are 132 lb and are fully welded.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 000016

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041657

#### THERMAL MODEL FOR THE EVALUATION OF SUBWAY VENTILATION AND AIR CONDITIONING

Lassow, W, New York City Transit Authority  
Lustenader, EL  
Schoch, KF

IEEE Transactions on Industry & Genl Applications (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New

York, New York, 10017)

Vol. IA-8, No: 4, July 1972, pp504-513

A thermal model of an existing subway station and 1/2 mi of adjacent tunnels are described. The model, developed to evaluate a number of car-cooling and air-conditioning concepts for improved passenger comfort, was programmed for a digital computer to account for transient effects due to train and passenger flow, outdoor temperature, humidity conditions, and heat storage in tunnel walls and surrounding soil.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 001075

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041660

#### PITTSBURGH TRANSIT SYSTEM TO EMPLOY THREE MODES

Seedlock, RF, Port Authority of Allegheny County

Civil Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 42, No. 5, May 1972, pp41-43

Features a novel combination of three types of transit rubber-tired transit vehicles on guideway, buses on exclusive roadway, and upgraded streetcars in Pittsburgh's Allegheny County. An innovative project encompassing 38 miles of public transit lines.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 000207

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041681

#### JAPAN'S "ROMANCE TRAIN"

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

71-WA/RT-7, 1971

This paper was presented at the ASME Winter Annual Meeting, November 28-December 2, 1971. The notification of this paper appeared in Mechanical Engineering.

Japan's "Romance Train" operates on a short 50-mile run between Tokyo and Hakone, Japan, on the Odakyu Electric Railways line. The train runs at conventional speeds; the passengers enjoy the comfort of human-engineered seats, soft indirect lighting, and background music. Extra passenger services include hostesses who serve snacks, light meals, drinks and also distribute hot towels.

#### ACKNOWLEDGEMENT

Mechanical Engineering

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041759

#### TRANSPORTATION 1985

Brennan, PJ Drucker, EB Tong, KM

Syracuse University Research Corporation, Syracuse, New York  
Appendix, May 1964, pp 393-402

In: Appendix to Science and Technology in the 1985 Era.

The current dominant modes of transportation will remain dominant in 1985. These modes are: inter- and intra-city travel by private automobiles, transcontinental and intercontinental travel by airlines, overland freight by rails and overseas freight by surface vessels. With improvements, these modes can carry the greatly expanded cargo and passenger traffic in 1985 with other forms of transportation playing supplementary and complementary roles. The emergence of new transportation systems or revolutionary improvement of the existing systems are not preconditioned upon the development of technology which is and will remain far ahead of utilization. Economic, sociological, legal and regulatory factors are more important in determining what developments will or will not occur. A major deterrent to rapid advance in transportation systems is the slow rate of writeoff of capital equipment in comparison with its technical obsolescence.

#### ACKNOWLEDGEMENT

Air Pollution Technical Information Center, 05195

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Syracuse University Research Corporation, Syracuse, New York,  
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#### 041866

#### URBAN MASS TRANSPORTATION ADMINISTRATION (U.M.T.A.) TRANSPORTATION PLANNING SYSTEM— NETWORK DEVELOPMENT MANUAL

Urban Mass Transportation Administration, Washington, D.C.

UMTA-RDD-72-2, Sept. 1972, 79p

See also PB-212 473.

The UMTA Transportation Planning System (UTPS) is a set of computer programs for use in planning multi-modal transportation systems. The basic UTPS software is aimed at the mid-level of analysis—ie, specific routes and corridors as have been used for typical areawide transportation planning studies. One critical element of these analyses is the ability to accurately represent existing and planned transportation systems. This manual provides an overview of the UTPS network analysis computer programs which are designed to simulate such urban transportation systems. Specific topics covered in this report include: network functions and components, the actual transit planning programs, preparation of network data and maps, problem situations and solutions, and a discussion of specialized networks. Parameters for the various programs are covered in the appendices. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-212474

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PB-212474

#### 041870

#### URBAN MASS TRANSPORTATION ADMINISTRATION (U.M.T.A.) TRANSPORTATION PLANNING SYSTEM— REFERENCE MANUAL

Urban Mass Transportation Administration, Washington, D.C.

UMTA-RDD-72-1, Sept. 1972, 253p

See also PB-212 474.

The UMTA Transportation Planning System (UTPS) is a collection of IBM System/360 computer programs for use in planning multimodal transportation systems. The objective of UTPS is to provide readily available, easy-to-use and fully tested planning tools for transportation planners attempting to solve a wide variety of problems. UTPS presently consists of 14 separate computer programs designed for use in the IBM 360 operating system. This document, the

reference manual, summarizes information pertaining to the operation of the UTPS programs. It is intended to be used as a concise reference for persons already familiar with the usage of the programs. Specific sections include: statements of system controls; subject program controls, program writeup organization, software system description, catalogued procedures, and actual program writeups. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-212473

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#### 041872

#### STATE OF INDIANA TRANSPORTATION NEEDS STUDY, 1972

Department of Housing and Urban Development, Washington,  
D.C. HUD-IND P-131

Sumry Rpt, 1971, 35p

The report was concerned with trying to completely catalog transportation needs and capital improvement plans for all modes of transportation in Indiana. The work is a part of a larger national transportation plan process involving many elements of both the state and federal government. The report covers the level of federal expenditures and source of funds needed to finance a transportation program for Indiana until 1990. It presents studies on highway needs, urban highway related needs, urban transit needs and airport needs. It is concluded with figures showing capital improvement for highway, airports, intercity terminals and urban transit systems. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-212597

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#### 041878

#### SAN FRANCISCO AIRPORT ACCESS PROJECT

Parsons, Brinckerhoff-Tudor-Bechtel, San Francisco, California

Summr Rpt, May 1972, 40p

Contract DOT-UT-262

Prepared in cooperation with Wilbur Smith and Associates, and Kirker, Chapman, Consultants.

The report summarizes an earlier study of the feasibility of extending the Bay Area Rapid Transit (BART) system to serve San Francisco International Airport. This summary was prepared to answer several basic questions about the proposed BART extensions: (1) How can such transit help. (2) How soon is it needed. (3) What will it be like. (4) How might the cost be shared. (5) Will it be built. A proposed route description and various financing alternatives are discussed.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-212456

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#### 043236

#### COMMUTER PARKING. FEASIBILITY AND LOCATION STUDY

Rhode Island Statewide Planning Program, Providence, Rhode

Island

R15PP-SS-71-7, Final Rpt, Mar. 1971, 88 pp

The purpose of the study was to investigate the feasibility of the fringe parking concept and to locate fringe parking sites. It includes the criteria established and used to evaluate the concept, how the data was collected and used. It also describes the establishing of a demonstration project to test the feasibility of commuter parking.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212954

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PB-212954

**043242****TRANSIT NOW FOR TOMORROW. A DECADE OF TRANSIT PROGRESS FOR DADE COUNTY**

Simpson and Curtin, Philadelphia, Pennsylvania UMTA-FL-09-0001

SIMCUR-768-F, Oct. 1972, 31 pp

Contract DOT-UT-74

The report describes the proposed rapid transit plan for Dade County, Florida. This project, which expanded upon recommendations of the Miami Urban Area Transportation Study (MUATS), recommended a comprehensive and coordinated transportation system consisting of four major elements. These include: an initial 44.7 mile rail rapid transit system serving 48 stations throughout the metropolitan area; a system of trunk line bus routes operating on expressways and arterial streets in areas not served by rapid transit; a network of feeder bus routes to rapid transit stations; and 'mini-systems' at selected terminal locations to improve circulation and to link traffic generators with transit facilities. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212800

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PB-212800

**043243****BALTIMORE REGION RAPID TRANSIT SYSTEM. PHASE I. VOLUME I, METROPOLITAN TRANSIT AUTHORITY**

Daniel, Mann, Johnson and Mendenall/Kaiser Engs, Baltimore, Maryland UMTA-MD-09-0003

Final Rpt, June 1971, 164 pp

Contract DOT-UT-278

The report documents work completed under Phase I of a program to design a rail rapid transit system for Baltimore. Of the six proposed corridors, attention is focused on two in which revenue service is slated to begin by 1978. Principal objectives of this study were to refine and adjust earlier planning and design in accordance with current policies and to continue the preliminary system engineering. The technical discussion examines route alignments; stations; vehicle selection; program schedule; capital cost estimates; forecasts of patronage, operating costs, and revenues; operating systems such as vehicles, electrification, ventilation and heating, control and communications, fare collection, surveillance, etc.; and work conducted by other consultants to the project.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212815 /

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**043244****RHODE ISLAND TRANSPORTATION NEEDS STUDY, 1970-1990**

Rhode Island Statewide Planning Program, Providence, Rhode Island'

Final Rpt, Nov. 1971, 117 pp

Contract DOT-03-10116

The paper presents Rhode Island's transportation needs estimates prepared for the 1972 National Transportation Needs Study. These estimates are a consolidation of the highway, airport, and transit needs developed for the National Highway Functional Classification Needs Study, the State Airport System Plan Study, the State Guide Plan for the development of urban transit facilities, and needs specifically developed in support of the study. These needs estimates are listed by priority as of 1970 to 1990.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212836

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**043245****URBAN RAPID RAIL VEHICLE AND SYSTEMS PROGRAM**

Boeing Company, Vertol Division, Philadelphia, Pennsylvania INT-06-0026

D174-10008-1, Annual Rpt, July 1972, 54 pp

Contract DOT-UT-10007

The report reviews efforts of the Urban Rapid Rail Vehicle and Systems Program, whose objective is to enhance the attractiveness of rail rapid transportation to the urban traveler by providing him with transit vehicles that are as comfortable, reliable, safe and economical as possible. BART technical areas were reviewed. The State-of-the-Art Car (SOAC) was designed and is nearing completion. A full-scale SOAC mockup was completed and displayed at TRANSP0 '72. Four subcontractors are performing parallel Advanced Concept Train (ACT-1) design and specification development efforts. Under the program management task, provisions were made for the effective program integration, management and control of all program elements. The development of SOAC cost estimates was undertaken. Also, two-thirds of the human factors subtasks were completed and memoranda were issued on the results. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212848

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**043246****THE TRANSPORTATION NEEDS OF INTERNATIONAL VISITORS TO THE DISTRICT OF COLUMBIA IN THE BICENTENNIAL ERA**

Kerr, O Palfrey, RBJ

Consortium of Universities, Urban Transportation Center, Washington, D.C. UMTA-DC-URT-3

Final Rpt, June 1972, 59 pp

Contract DOT-UT-394

The 1976 National Bicentennial celebration is expected to attract some 100,000 daily visitors to Washington, D.C. This report examines the transportation needs of international tourists and develops

appropriate recommendations. Existing public transportation is discussed in detail and the authors note three reasons which limit the utility of transit for foreign visitors. The report forecasts increased international tourism in the United States and evaluates the tourist facilities in Washington for meeting the projected demands of Bicentennial visitors. The report makes 20 specific recommendations to improve public transit for the foreign visitor, including information sources, upgraded bus and rapid transit service, promotion of pedestrian and bicycle circulation, and stronger regulation of parking.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212899

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**043248****U.M.T.A. TRANSPORTATION PLANNING SYSTEM--  
NETWORK DEVELOPMENT MANUAL**

Urban Mass Transportation Administration, 400 7th Street, SW,  
Washington, D.C., 20590

UMTA-RDD-72-3, Sept. 1972, 97 pp

Supersedes PB-212 474.

The UMTA Transportation Planning System (UTPS) is a set of computer programs for use in planning multi-modal transportation systems. The basic UTPS software is aimed at the mid-level of analysis--i.e. specific routes and corridors as have been used for typical areawide transportation planning studies. One critical element of these analyses is the ability to accurately represent existing and planned transportation systems. Specific topics covered in this report include: network functions and components, the actual transit planning programs, preparation of network data and maps, problem situations and solutions, and a discussion of specialized networks. Parameters for the various programs are covered in the appendices.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212930

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**043265****LOGAN AIRPORT TRAVEL STUDY**

Coverdale and Colpitts, New York, New York DOT-MASS-  
T9-7

Final Rpt, Oct. 1972, 124 pp

Contract DOT-UT-207

Sponsored in part by Bureau of Transportation Planning and  
Development, Massachusetts Department of Public Works,  
Boston.

An origin-destination survey was conducted among air travelers, visitors, and employees at Boston's Logan International Airport. The study focused on the air travel market in various geographic areas, the principal modes used for ground travel between these areas and Logan Airport, and the current volume of ground travel by each principal mode used for airport access. Emphasis is placed on the relative attractiveness of rapid transit for ground travel to and from the airport. The data reveal principal concentrations of trip generators, modal split, major travel corridors, and other conclusions.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212814

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**043513****SIMULATION OF PASSENGER FLOW IN A STATION**

Ibaragi, Y Uehara, T Todoriki, M

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

Vol. 13, No. 4, Dec. 1972, pp 202-207, 8 Fig, 1 Tab

A simulation model of passenger flow in a station is worked out to make clear the congestion at the ticket inspection gate and thereby determine the adequate number of automatic ticket inspection gates to be installed. Based on this model, a GPSS program is formulated for application to four stations expected to be opened on Musashino Line. To account for the results of calculations, a simplified theoretical model is conceived for comparison and discussion.

**ACKNOWLEDGEMENT**

Railway Technical Research Institute

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Japanese National Railways, Kunitachi, Box 9, Tokyo, Japan

**043529****TO HELL IN A DAY COACH: AN EXASPERATED LOOK  
AT AMERICAN RAILROADS**

Lyon, P

Lippincott (JB) Company, East Washington Square, Philadelphia,  
Pennsylvania, 19105

1968, 324 pp

This book traces the development of American railroads with particular emphasis on service to the public, the financing of the industry, and the behavior of top industry figures. The book traces railroads through the Vanderbilt and Drew Era, through the building of the first transcontinental railroad, and into the Granger Era and time of Gould and Morgan. The book then proceeds through the Progressive Era, into World War I, into the Great Depression, through World War II, and into the post war period. The book concludes with a look at improved freight service, deteriorating passenger service, the future of passenger service, and the problems of commuter service. The tone of the book is generally critical of the management of the railroad industry.

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Lippincott (JB) Company, East Washington Square, Philadelphia,  
Pennsylvania, 19105, Orig PC: Re Price

**043598****PLANNING THE COORDINATION OF GROUND  
TRANSPORT**

Gibson, JE, Oakland University

IEEE Spectrum (Institute of Electrical and Electronics Engineers,  
345 East 47th Street, New York, New York, 10017)

Vol. 7, No. 10, Oct. 1970, pp 79-86, 3 Tab

Proper coordination in the design of a transportation system requires consideration of general land use in the area served, and indeed of the entire sociological and ecological fabric of society. Moreover, the designer must help weave this fabric while it is being used. A possible starting place for a transportation study, and some would argue the only starting place, is an overall regional plan. More and more it is being clearly recognized that a transportation link not only satisfies established needs in a region but also develops and anticipates others.

**ACKNOWLEDGEMENT**

IEEE Spectrum

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Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10 Repr PC: Req Price

**043599**

**TODAY'S NEED FOR BALANCED URBAN TRANSIT SYSTEMS**

Micheals, EL, Houston University

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 7, No. 10, Oct. 1970, pp 87-91, 8 Fig

Cities must have freeway systems in order to facilitate the movement of traffic. After a city reaches a certain size, however, it soon becomes apparent that freeways alone cannot solve the transportation problem. The only solution to this problem is to provide a system of balanced transit. Thus every large city that has expanded very rapidly—Los Angeles, Houston, Atlanta, and many others—should be planning or building a balanced transit system, with railroad rapid transit (including suburban railroad service) as the core, augmented by freeways for buses and private automobiles.

**ACKNOWLEDGEMENT**

IEEE Spectrum

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10 Repr PC: Req Price

**043623**

**SUBWAY AERODYNAMIC AND THERMODYNAMIC TEST (SAT) FACILITY— SINGLE-TRACK AERODYNAMICS**

Institute for Rapid Transit, 1612 K Street, NW, Washington, D.C., 20006 UMTA-DC-MTD-7

Aug. 1972, 165 pp

Prepared in cooperation with Developmental Sciences, Inc., City of Industry, Calif. Aerospace Technology Div.

The report on ventilation and environmental control in subway rapid transit systems is one of many reports leading toward the production of a subway environmental design handbook. The purpose of the report is to describe and interpret test data generated in the SAT facility for 9 trains of several blockage ratios for steady and unsteady runs, including entry transients. Comparison is made with theoretical work as well.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213158

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**043626**

**LIGHT RAIL TRANSIT SYSTEMS. A DEFINITION AND EVALUATION**

Vuchic, VR

Towne School of Civil and Mechanical Engineering, Philadelphia, Pennsylvania

Final Rpt, Oct. 1972, 127 pp

Contract DOT-TSC-310

Rail transit represents a family of modes ranging from light rail to regional rapid transit systems and it can be utilized in a number of different cities and types of applications. Many European cities of medium size employ very successfully light rail mode for gradual upgrading of transit service into partially or fully separated high speed, reliable transit systems. Analysis of these cities show that with

population densities and auto ownership are very similar to those in the United States cities, their transit systems offer a superior service and have much better usage than our cities. Many modern features of light rail technology are not known in this country. Wider use of different rail systems, greatly increased transit financing, introduction of more qualified personnel into transit industry and improved transit planning and implementation procedures are recommended to close the gap in urban transportation between some more progressive European cities and their counterparts in this country. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213447

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**043627**

**SAN FRANCISCO AIRPORT ACCESS PROJECT**

Parsons, Brinckerhoff-Tudor-Bechtel, 814 Mission Street, San Francisco, California, 94103 UMTA-CA-09-0012  
Smith (Wilbur) and Associates

Final Rpt, Oct. 1972, 327 pp

Contract DOT-UT-262

Prepared in cooperation with Kirker, Chapman and Associates.

The project developed recommendations for an extension of the Bay Area Rapid Transit (BART) system to provide rapid transit access at San Francisco International Airport. Project background and the need for improved airport access are discussed. The report gives particular attention to the proposed route location which will follow the Market St. Railway corridor through Daly City and Colma. Relevant aspects of the route profile and proposed service are described. System planning aspects are examined with reference to operations, service schedules, rolling stock, train control and communications, power distribution, fare collection, support facilities, and baggage handling. Estimates of patronage and revenues are considered along with specific preliminary features for the stations and guideways. The report also contains detailed cost estimates, impact analyses, and an overall evaluation of the project in terms of urban development objectives. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213411

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**043789**

**CHANNEL TUNNEL: VEHICULAR MOVEMENTS IN PROPOSED FERRY TRAINS**

Ellson, PB Layfield, RE

Transport and Road Research Laboratory, Crowthorne, England

TRRL-LR-435, 1972, 86 pp

Proposals for the construction of a rail Channel Tunnel, under consideration by the British and French governments, include provisions for a service of roll-on roll-off ferry trains to carry accompanied motor vehicles and their loads between terminals near the tunnel portals. The Laboratory was asked to investigate train loading and unloading operations by means of full-scale experiments. A preliminary series of experiments was carried out to find the effects of different sizes of railway wagons and platforms and of various parking procedures in the trains on the rates of flow of various classes of motor vehicles and trailers. Having established these figures, a further series of experiments was carried out to assess driver and pedestrian behaviour in the closed environment of realistically simulated trains. The Report describes all the experiments concerned with vehicular

movements and gives the conclusions drawn from them.  
**ACKNOWLEDGEMENT**  
 National Technical Information Service, PB-214191/9

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**043790**

**CHANNEL TUNNEL: PEDESTRIAN MOVEMENTS IN PROPOSED FERRY TRAINS**

Cundill, MA

Transport and Road Research Laboratory, Crowthorne, England  
 TRRL-LR-436, 1972, 36 pp

The Laboratory was asked to undertake an investigation of the loading of road vehicles onto ferry trains and to determine some of the factors affecting the choice of the tunnel diameter and the area of land required for the terminals, for a proposed Channel Tunnel. The report describes the experiments conducted to assess pedestrian mobility in the trains. The aim was to consider the practicability of pedestrian movement to toilet and possible vending facilities and movements in emergency situations. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-214192/7

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 PB-214192/7

**043910**

**HISTORICAL OVERVIEW OF THE DECLINE OF THE TRANSIT INDUSTRY**

Saltzman, A, North Carolina Agricultural and Technical State U  
 Solomon, RJ, Solomon and Schwartz and Associates

Highway Research Record (Highway Research Board, 2101  
 Constitution Avenue, NW, Washington, D.C., 20418)

No. 417, ISBN 0-309-02089-1, 1972, pp 1-11, 2 Fig, 22 Ref

Sponsored by Committee on Passenger and Freight  
 Transportation Characteristics. Library of Congress Catalog  
 No. 72-12128.

The developmental history of the U.S. public transportation industry has had much to do with shaping the declining role that mass transit plays in urban transportation today. This paper deals with the trends that have structured the industry, beginning with a discussion of the forces of decline. Many theories about the actual mechanism of this decline have been held by urban planners. Our hypothesis takes into account the possibility that inadequate understanding of the interacting mechanisms within the formerly private transit infrastructures by the various local and national governments eventually placed the operating companies on such poor financial footing as to make essential the current efforts of governments toward direct subsidy in order to rectify their previous mistakes. We have emphasized the financial and regulatory problems that have hampered the transit industry. It is recognized, however, that transit ridership has, for the past 50 years, slowly and predictably declined after leveling off during the immediate post-World War I years—well before the automobile had its major impact on suburbanization. However, any attempts by the industry to reverse its declining fortunes during the critical years of rapid urban change were hampered by the effects of the governments' antitrust actions against elements of the transit industry. Not all of the blame for the problems facing the transit industry can be placed on state and federal governments. It is our opinion that the industry's inability to respond to changing public needs within reasonable periods of time and its lag in adopting new technology, save as stopgap measures, have exacerbated declining ridership trends and accelerated change in the mobility habits of the public.

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 Washington, D.C., 20418, Repr PC: \$2.20

**043911**

**ANALYSIS AND EVALUATION OF THE RAPID TRANSIT EXTENSION TO CLEVELAND'S AIRPORT**

Wohl, M, Urban Institute

Highway Research Record (Highway Research Board, 2101  
 Constitution Avenue, NW, Washington, D.C., 20418)

No. 417, ISBN 0-309-02089-1, 1972, pp 12-24, 2 Fig, 3 Tab, 12 Ref

Sponsored by Committee on Passenger and Freight  
 Transportation Characteristics and Committee on Transportation  
 Programming, Planning and Evaluation. Library of Congress  
 Catalog Card No. 72-12128.

During the late 1960s, one of Cleveland's two rapid transit lines was extended by slightly more than 4 miles to the airport. Two of the three new stations (including one at airport) were opened on November 15, 1968, and the third one (Brookpark) was opened on April 20, 1969. The three stations, including the connecting trackage, rights-of-way, and transit cars, were added to the system at a total capital outlay of about \$18.4 million. The rolling stock for extension service accounts for \$3.4 million of the total. Federal funds covered two-thirds of the total capital costs; the remainder was paid out of city and county funds. Now, based on 3 full years of actual operating experience, what can be said about the impact of the line on the general public and on users? Also, what inferences can be made about similar proposals in other cities? It should be emphasized that the analyses, findings, and conclusions of this report are based on limited experience, on sample survey data, and on data collected during years of some rather extraordinary change. As a consequence, they are somewhat tentative, though as complete, accurate, and reasonable as possible.

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**043912**

**DESIGNING URBAN TRANSIT SYSTEMS: AN APPROACH TO THE ROUTE-TECHNOLOGY SELECTION PROBLEM**

Rea, JC, Pennsylvania State University

Highway Research Record (Highway Research Board, 2101  
 Constitution Avenue, NW, Washington, D.C., 20418)

No. 417, ISBN 0-309-02089-1, 1972, pp 48-59, 14 Fig, 1 Tab, 6 Ref

Sponsored by Committee on Transportation Systems Design.  
 Library of Congress Catalog Card No. 72-12128.

The service specification model is a tool for generating and screening public transportation systems during the initial planning stages. It is based on the concept of a service specification or supply function that integrates hardware system attributes and operating policy. A service specification is an integrated set of statements that defines which hardware-headway combination is to be used for any level of flow across a link. Walk mode may be included in the specification. The model defines a transit system within a network which includes all potential and existing transit links. The current model assumes that transit demand is known. The mechanism of the model is an iterative assignment procedure that is similar to the capacity restraint model. The template network is started at the "best" hardware-headway service level. Link service levels are iteratively adjusted to correspond to link flow level as specified by the service specification. The iterative process ends when no further changes in link



service level are required. Empirical tests show that the model is sensitive to the policy decisions and hardware mix incorporated in the service specification and to the size and orientation of the transit demand. The attainment of an equilibrium flow distribution appears to be influenced by the form of the service specification, the percentage of nonplanar links, and the presence of fixed transit-time links in the template network. The model appears to be a useful tool for generating alternative transport system configurations based on different technology mixes and operating policies in any transportation context for which a service specification can be formulated.

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043920

**ENERGY STUDY OF UNDERGROUND RAPID TRANSIT**

Chaddock, JB Sud, I

High Speed Ground Transportation Journal (Box 4824, Duke  
Station, Durham, North Carolina, 27706)

Vol. 6, No. 3, Sept. 1972, pp 391-407

Underground rapid transit systems can generate enough heat from their operations to raise tunnel and station temperatures as much as 15 or 20 deg above outdoor temperatures. The purpose of this study was to develop a preliminary analytical model for evaluating these energy transfers. Results obtained for the simplified thermal model of an underground rapid transit system permit drawing three major conclusions: The proper design of the ventilating and air conditioning system for this transit mode will require a detailed energy budget study; thermal modeling of the underground system must be true to the physical conditions imposed; and tunnel air temperature is a complex function of all the factors influencing the energy transfer mechanisms in the tunnel.

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044022

**THE DB'S S-BAHN PROGRAMME**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 7, July 1972, 3 pp, 4 Fig

By developing its existing suburban lines, the DB has been able to offer the basis of a rapid transit network in six major urban areas without the need to create new infrastructure. Because an S-bahn can be developed at less cost and more quickly than a new metro, yet have the same effect on relieving congestion in cities, both national and local finance has been made available. Plans for five more S-bahn networks are now being considered.

ACKNOWLEDGEMENT  
British Railways Board

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London SE1 9LU, England, Repr PC: R Price

044031

**NORTH TYNE STUDY FAVOURS LIGHT RAPID TRANSIT**

Howard, DF

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 10, Oct. 1971, pp 393-396

The recent decision of the Tyneside Passenger Transport Authority to ask the government to help finance a duorail rapid transit system was based on a study of several different modes carried out by Alan M. Voorhees & Associates.

ACKNOWLEDGEMENT  
British Railways Board

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IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

044048

**BUILDING A NEW INTER-CITY NETWORK**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 10, Oct. 1972, pp 375-377

Japan's civil engineers face the unique problem of constructing within the next 20 years a completely new 7000 km. standard gauge network, suitable for top speeds of 260 km/h. Geological structure and the high degree of urban development along the routes selected makes the task difficult: some lines will be underground for over half their length.

ACKNOWLEDGEMENT  
British Railways Board

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044064

**APT-E TAKES TO THE RAILS**

Wickens, AH

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 5, May 1972, pp 185-188

Features of the British Railways experimental Advanced Passenger Train, that is reported to offer the prospect of 250 km/hr on existing tracks and possibly 400 km/hr on new lines and to extend greatly the range of conventional steel-rail track by virtue of a suspension which combines a high critical speed and passage through curves without flange contact, are given.

ACKNOWLEDGEMENT  
Engineering Index, EI 73 017703

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044065

**PUBLIC TRANSPORTATION TO AIRPORTS**

Highway Research Record (Highway Research Board, 2101  
Constitution Avenue, NW, Washington, D.C., 20418)

No. 330, 1970, 32 pp

This publication consists of 7 related reports.

With the forecast limitations on highway access and parking facilities, an alternative for handling congestion and increasing demand is the use of public transit systems. The Highway Research Board's Committee on Passenger Transportation Economics and Special Committee on International Cooperative Activities held a day-long symposium during the 49th Annual Meeting of the Highway Research Board to examine the potentials of public transportation to airports. Seven speakers from different parts of the world were asked to address the symposium regarding their current plans for public transportation to airports. The presentations and informal notes of

several of the speakers are included in this RECORD. The conferees discussed current transit facilities at airports in the United States, Europe, and Asia. In Tokyo there is a separate monorail facility running from downtown Tokyo to Tokyo International Airport. In Cleveland, Boston, and London and at a number of airports throughout the world there are existing subway and railroad links connecting the airport to the rest of the transit and railroad systems. For a number of airports, there are downtown check-in terminals, and buses are used on existing streets and arterials to get to the airport; and for several airports, consideration is being given to separate bus rights-of-way between the central business district and the airport.

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Washington, D.C., 20418, Repr PC: \$1.60

**044181**  
**PARK AND RIDE RAIL SERVICE-JERSEY AVENUE**  
**STATION, NEW BRUNSWICK, N.J.**

Tri-State Transportation Commission, 100 Church Street, New  
York, New York, 10007 Int-mtd-1

May 1967

A mass transportation demonstration project at New Brunswick, N.J. was designed to test whether a new railroad station at the outskirts of a developed suburban community, would attract new patrons to an existing carrier and, at the same time, divert passengers from the suburban city center station, thereby relieving local vehicular traffic congestion. Results of the experiment revealed that an outlying station with ample parking space will attract new patrons to rail service, but its attraction will be limited by the availability of direct, convenient auto access routes from surrounding residential areas. The extent to which an outlying station, even with free parking, will attract passengers away from the suburban city center station is conditioned by the frequency of train service at the outlying station as contrasted with the center station.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044182**  
**TRACK-SHARING FOR URBAN TRANSPORTATION**

Institute of Public Administration, 1619 Massachusetts Avenue,  
NW, Washington, D.C., 20036 Ny-mtd-13

Jan. 1970

The potential use of railway tracks is discussed for passenger movements to the center city. Examination is made of the implications of instituting such service either by dual-mode railbus or by conventional rail equipment. The substantial vehicle development in railbuses is also reviewed. A simple inexpensive raiiling system, adaptable to any standard bus without major modification of the vehicle, can be installed in the shop of the bus company. The railbus concept is drawing increased attention from both national and international transportation planners.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044183**  
**THE BALANCED AND ORDERLY DEVELOPMENT OF**  
**THE SITE IN CLOSE PROXIMITY TO A METRO**  
**STATION AS A CONTRIBUTOR TO A MORE HEALTHY**  
**AND ECONOMICALLY VIABLE URBAN ENVIRONMENT**  
**IN THE WASHINGTON METROPOLITAN AREA**

Langfield, SC

Consortium of Universities, Urban Transportation Center,  
Washington, D.C., 20036 Urt-37

June 1971

The relationship between construction of rapid mass transportation and surrounding land use and property valuation is traced. The fundamental conclusion drawn from this analysis is that increased accessibility (provided by transit) shifts human activities to the most accessible locations, promoting more intensive land use and subsequently greater land values. Data collected from the San Francisco and Toronto examples are discussed in support of this contention. Photographs showing the changes in land use before and after transit construction are provided. In San Francisco, the method employed was incentive zoning of land adjacent to the proposed BART (Bay Area Rapid Transit) system. Zoning regulations were carefully planned to stimulate desired patterns of land use and construction, enforced by law. In Toronto, less formal control were established under which the municipality acquired wide strips of land in which transit rights-of-way were to be located. Surplus land was then parceled out by the municipality for private development on a long-term lease basis, pending approval of a regional planning body. A comprehensive description is provided of the North Bethesda, Md., site, with reference to existing land use, assessed valuation, and zoning. Potential growth and development are examined.

**ACKNOWLEDGEMENT**

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**044184**  
**PROTOTYPE SUBURBAN TRANSPORTATION CENTERS**

Northeastern Illinois Planning Commission, 400 West Madison  
Street, Chicago, Illinois, 60606 Ill-t9-2

Mar. 1971

The purpose was to develop criteria for prototype commuter transportation centers at which the interchange of rail passengers to automobile, bus or other rail modes would be facilitated with maximum convenience. Criteria for designing the prototype transportation centers was developed with reference to: (1) the enclosed structure; (2) pedestrian circulation; (3) provision of commercial and other public facilities; (4) parking; (5) loading operations; and (6) landscaping. Each functional aspect of the efficient rail station is described briefly along with such general planning requirements as the estimated volume of commuter passengers and vehicles. Particular emphasis is focused upon convenience for the transit user as the transit environment may be a principal factor in attracting new ridership. Consequently, such variables as walking distances, pedestrian access, passenger amenities, and functional design are emphasized in the analysis. Three prototype transportation center designs were developed for application in different types of urban and suburban locations. Estimated cost factors for each prototype design are provided. The possible impact of new transit technology on future station configurations is discussed. A final section details implementation procedures for commuter transportation centers. Different sources of financing are examined with reference to local contributions, parking fees, commercial leases or land sales, and participation in relevant federal assistance programs.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044185  
EVALUATION OF STATION FARE COLLECTION SYSTEM  
IN USE AT KEW GARDENS AND FOREST HILLS  
STATIONS OF THE LONG ISLAND RAILROAD**

De Leuw, Cather and Company, Chicago, Illinois, 60601 Int-  
mtd-2

Sept. 1965

The Kew Gardens-Forest Hills experiment was based upon an automatic fare collection system using a variety of tickets (single fares, ten-rides, monthly commutation, etc.) between two fixed locations. To each a practical level of completeness, exit as well as entrance equipment was necessary, and was one of several elements which made possible the elimination of on-train ticket checking and thus made possible the first step in reducing cost of operation. The equipment records the station of entry on prepaid station-to-station magnetically coded tickets, and erases the correct increment of fare at the station of exit. On single-ride tickets, or on multiple-ride tickets which are used up, the exit equipment also captures the ticket. The most encouraging anti-vandalism factor regarding the automatic fare collection gates is that the reading and gate-actuating equipment contains nothing of value to the vandal; collection of money will take place in vending machines which can be built into solid walls and which will provide a greater degree of security than is possible in turnstiles or passenger gates. Questionnaires and telephone and personal interview forms used in public response surveys, comments by passengers, passenger count analysis, a report to technical evaluation committee, and brochures of June and December 1964, concerning the station fare collection equipment, are included in an appendix to the report.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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**044186  
A TRAFFIC DEMAND ANALYSIS FOR THE PROPOSED  
VISITOR CENTER (TRANSPORTATION CENTER) ARENA  
COMPLEX UNION STATION SITE WASHINGTON, D.C.**

Genis, TP

Consortium of Universities, Urban Transportation Center,  
Washington, D.C., 20036 Urt-37

June 1971

Various problems cited are: (1) non-existent connections between line haul modes; (2) an inefficient ground transportation system; (3) limited interfaces to regional highway systems for buses, mail, and truck operations; (4) parking facilities for visitors in the areas of the proposed centers; (5) the need for transportation to and from Friendship and Dulles airports. Maps, diagrams, tables and charts are used to specify in which areas construction or land use changes are needed and also to predict the volume of people using these facilities for the next fifteen years.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-203782

**044191  
SEPACT III: FINAL REPORT—OPERATIONAL READING**

Southeastern Pennsylvania Transportation Authority, 2028 PSFS

Building, Philadelphia, Pennsylvania, 19101 Pa-mtd-5  
June 1971

The project was designed to develop and test techniques for the restructuring commuter railroad service in the Philadelphia metropolitan area. Each phase of the experiment tested the relationship between various levels of service, fare structures, and ridership. In some cases off-peak service was increased, in others the total number of trains was reduced. These fluctuations were accompanied by variations in fares, the provision of special passes, and heavy promotional campaigns. Comprehensive surveys were conducted to measure ridership preferences, trip characteristics, and volume. Four general conclusions were yielded by the analysis: (1) Increased service and higher fares were more effective in reducing operating deficits than decreased service and lower fares. (2) Where service was substantially improved, new ridership was attracted and paid higher fares as well. (3) Greater equipment efficiency resulted in significant reductions in operating cost, thus recommending greater emphasis on capital improvement. (4) The general market for rail service, including commuters, varied substantially over time. It is concluded that rail commuter service was demonstrated to be a viable and integral part of urban transportation, and that, further, levels of service and passenger fares could be provided to ensure a profitable operation.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-204065

**044192  
SEPACT II FINAL REPORT: A STUDY OF THE 1975  
COMMUTER RAILROAD SYSTEM IN THE  
SOUTHEASTERN PENNSYLVANIA METROPOLITAN  
REGION**

Southeastern Pennsylvania Transportation Authority, 2028 PSFS  
Building, Philadelphia, Pennsylvania, 19101

Jan. 1971

Present commuter railroad lines are operated by the Penn Central Company and the Reading Company under agreements with the Southeastern Pennsylvania Transportation Authority. The general terms of the agreements between Septa and each railroad cover: (1) fare structure, (2) on-time performance, (3) equipment availability and utilization, (4) car cleanliness, (5) station maintenance and cleanliness, (6) parking facility maintenance, (7) management computer operations, and (8) advertising and public relations. An action program is developed to maximize rail patronage, principally by increasing the attractions of commuter rail travel compared to automobile travel and thereby increasing the absolute number and the proportion of trips made by rail. To the extent that the number of peak period trains permits, zone scheduling is recommended. This concept involves division of a particular line into zones or groups of consecutive stations, with each train serving substantially only one zone. Direct service between downtown Philadelphia and each zone would thus be provided.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-200133

**044193  
COMMUTER RAILROAD SERVICE IMPROVEMENTS FOR  
A METROPOLITAN AREA—SEPACT I**

Southeastern Pennsylvania Transportation Authority, 2028 PSFS  
Building, Philadelphia, Pennsylvania, 19101 Pa-mtd-1

Apr. 1969

The objectives were to: (1) produce transportation findings applicable to other metropolitan areas faced with similar problems; (2) demonstrate the effectiveness of improved service and reduced fares in reversing the ridership decline on commuter railroads; (3) relieve traffic congestion on parts of the regions' highway network; (4) demonstrate the efficiency of a regional approach to common problems. Sepsact I encompassed a combined program of improved service and reduced fares on the Reading Company's North Penn-Hatboro lines and that portion to and from Levittown, of the Pennsylvania Railroad's Philadelphia-New York mainline. The program ran for three years and cost approximately 4.7 million dollars. The program included increased service, fare reductions, new equipment, parking improvements, bus-train transfers, and promotion, publicity and information. The project planning and implementation point out the allocation of responsibilities and special problems affecting the demonstration project. The demonstration helped the southeastern Pennsylvania region retain and improve service on a significant portion of its vital commuter rail network, and brought tangible benefits to commuters in a large portion of the Philadelphia market area.

#### ACKNOWLEDGEMENT

Urban Mass Transportation Administration

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PB-197346

#### 044195

#### TRANSIT ACCESS TO OAKLAND INTERNATIONAL AIRPORT

Kaiser Engineers, 900 17th Street, NW, Washington, D.C.,  
20006 Cal-t9-9

Oct. 1970

This is a comprehensive technical study of transit feasibility in the corridor between a proposed Bay Area Rapid Transit (BART) station and the Oakland International Airport. A review of potential transit service concepts revealed two alternatives for the corridor and four vehicle concepts. A detailed transit impact analysis was conducted to determine four routing options. One route would serve existing commercial and industrial development centers while another would serve the areas where future development is anticipated. A third route would serve the airport exclusively by providing nonstop service. The fourth route, with two branches, could serve all existing and future activity centers. Various combinations of service concepts, vehicle designs, and routes were evaluated to yield an optimal configuration for the corridor. A connector alternative was found to provide more frequent and lower cost service than a BART extension. The use of modified BART vehicles in the connector system was deemed necessary to make the system compatible with the BART mainline. The feasibility study also determined that a routing network designed to serve future industrial and airport developments would be optimal. The total connector route will span approximately 3.8 miles. An in-depth feasibility analysis concluded that operation of the connector system could prove economically beneficial both in terms of farebox revenues and the relief of regional traffic congestion. Appended material includes urban design criteria, results of a regional transit survey, a historical review of present airport transit links, methodology for patronage forecasting, criteria for development of the connector system, and interim program ridership data.

#### ACKNOWLEDGEMENT

Urban Mass Transportation Administration

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PB-197837

#### 044196

#### A PRELIMINARY REPORT ON THE CLEVELAND BEFORE AND AFTER STUDY

Wiggers, GF

Regional Planning Commission, 415 The Arcade, Cleveland,  
Ohio, 44114 Trd-36

May 1969

An extensive survey was conducted as part of the before phase of a study at Cleveland's Hopkins Airport during the week of September 8-14, 1968; in all, 33,126 air passengers, 1,866 airport employees; and 541 casual visitors responded. A data tape was developed from these responses of the air passenger and employee groups, and all analysis has been conducted regarding trip purpose, local origin and destinations, and baggage checked. Within the limited amount of data available at this stage of the study, it has been estimated that: (1) 71-80% of the people boarding the CTS Rapid at the airport are air passengers; (2) more than 65% of the air passengers going between the airport and some suburban Cleveland areas appear to be using the rapid rail; (3) a large number of air passengers are willing to ride two transit systems, the CTS and the Shaker Rapid, making as many as 25 local stops and one transfer on their trips to and from the airport; (4) a relatively small percentage (10.3%) of the air passengers originating or terminating in the Cleveland area begin or end their trips in the Cleveland central business district; (5) because of the current number of air passengers using Hopkins Airport, the impact of the rapid highway congestion at the airport is only marginal.

#### ACKNOWLEDGEMENT

Urban Mass Transportation Administration

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PB-184060

#### 044205

#### CLEVELAND-HOPKINS AIRPORT ACCESS STUDY: SURVEY RESULTS

Regional Planning Commission, Cuyohoga City, Ohio Trd-36

June 1970

The impact of providing rapid rail transit service between the Cleveland central business district and Hopkins Airport is assessed with reference to modal split and ridership characteristics. Two separate surveys of airport users were correlated, representing characteristic ridership profiles by mode both before and after the transit link became operational. The report outlines data collected concerning: overall airport activity and transit ridership; characteristics of air passengers, air trips, and ground trips to the airport; passenger-related visitors; airport employees; and casual visitors. Findings include: (1) Nearly 58% of all transit riders were air passengers, and only 1/4 of this group began their trips in the Cleveland central business district. (2) Approximately 14.5% of all air passengers at Hopkins Airport used the rapid transit for airport access. More significantly, at least 25% of all air passengers with origin or destination in the rapid transit service area used the system. (3) All modes of travel indicated some ridership diverted to the rapid transit. (4) Transit use rose to more than 30% among air passengers traveling to or from terminals of the rapid transit system. (5) Ridership among airport employees rose from 8% to 18%. (6) Transit was also used by small percentages of passenger-related and casual airport visitors.

#### ACKNOWLEDGEMENT

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PB-195045

#### 044206

#### CLEVELAND-HOPKINS AIRPORT ACCESS STUDY: SURVEY PROCEDURES

Regional Planning Commission, Cuyohoga City, Ohio Trd-36

May 1970

The purpose was to assess a new rail rapid transit extension between the Cleveland central business district and Hopkins Airport with reference to its impact on modal split and ridership. Data was collected by questionnaire before and after the commencement of transit operations. Design methodology, data collection, and control information sample questionnaires are reproduced in their original forms. Areas are outlined for each of four categories of origin and destination surveys (air passengers, passenger-related visitors, casual visitors, and airport employees). Although it was possible to poll air travelers accurately aboard their planes, special procedures were necessary to survey the airport visitors. A ground surveillance survey was designed to estimate airport use by people in these categories through sample counts of persons at selected portals, vehicles at certain locations, parking demand, and other guidelines. Appended material locates survey centers on airport maps and details instructions for project managers and participants.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-195046

**044207**

**CLEVELAND-HOPKINS AIRPORT ACCESS STUDY: DATA FILE EDITING AND PRELIMINARY ANALYSIS; DATA FILE FORMATS AND CODE DESCRIPTIONS; SELECTED TABULATIONS, AIR PASSENGER STUDY**

Regional Planning Commission, Cuyohoga City, Ohio Trd-36  
May 1970

The purpose was to assess a new rail rapid transit extension between the Cleveland central business district and Hopkins Airport with reference to its impact on modal split and ridership. Statistical data on airport access by air passengers, passenger-related visitors, casual visitors, and airport employees were collected in two surveys taken before and after the commencement of transit operations. The "data file editing" report mathematically expands the survey sample data into reliable estimates about the entire population of airport users. Coding process, data editing procedures, survey response rate, and subsequent expansions of the sample are detailed. Some preliminary analysis of the data is provided through comparison of air passenger survey results with rapid transit interviews. The "data file formats" report documents actual programming procedures used to analyze the data. Appended material includes airport maps showing the survey locations and sample questionnaires. The "Selected tabulations" report reproduces actual computer printouts of significant survey data. The tabulations break down to general areas of major interest to the project sponsors: (1) mode of travel by local origin or destination and selected characteristics of the air passenger and his trip; and (2) transit station by residence of air passenger and direction of travel for selected characteristics of the air passenger and his trip. Appended material includes traffic centers and census tracts in the survey area, rapid transit stations, and sample questionnaires.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-195047

**044208**

**COMMUTER RAILROAD SERVICE IN THE NATIONAL CAPITAL REGION**

Smith, AJ

Consortium of Universities, Urban Transportation Center,  
Washington, D.C., 20036 Urt-11

Aug. 1970

The experiences of four cities (Chicago, Boston, Philadelphia, and New York) in which rail is still a principal commuter mode are discussed. Ridership decline has become a national phenomenon. The basic problems are (1) public preference for the private transportation mode; (2) unbalanced public assistance to transportation programs which emphasize highway construction; (3) decentralization of the metropolitan core; (4) difficulty of adjusting rail services in response to changing patterns of urban growth; (5) peaking of ridership demand, which creates uneconomical utilization of equipment and manpower; (6) fare structures which do not adequately reflect costs; (7) unreasonable rules for union labor, which inflate operating costs; (8) deterioration of existing equipment; and (9) insufficient private capital for investment in service improvement programs. The history of a commuter rail operations in Washington is one of steady erosion. At present, fewer than 20 trains continue to serve the nation's capital, carrying only approximately 1,100 riders daily. In addition, these few remaining services are threatened by rising fees at Union Station, restrictive labor work rules, terminal location, and aging rolling stock. An analysis of existing plans for regional rail service notes that during the 1960's area planning agencies envisioned a combination of regular commuter trains and rapid transit. Under the current planning arrangements, three railroad commuter systems would be coordinated with various segments of metro. However, management, labor, and financing problems may threaten realization of these plans, and all railroad commuter service may be abandoned before completion of the rapid transit. A viable rail system is possible and desirable, given sufficient support by government agencies and potential customers.

**ACKNOWLEDGEMENT**

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**044209**

**A METRO PARK-RIDE FARE COLLECTION SYSTEM**

Studholme, ED

Consortium of Universities, Urban Transportation Center,  
Washington, D.C., 20036 Urt-11

1970

The adopted regional rail transit system for the Washington, D.C., metropolitan area comprises 86 stations located on 98 route miles. It is anticipated that about 30,000 parking spaces will be provided at these stations. It is suggested here that transit station parking facilities be coordinated with the automatic fare collection system, which employs magnetically coded fare cards and machines that are capable of performing logical functions in response to directives from the cards. The control exercised over the "paid area" of the station can be extended to the parking facility through automatic issuance of a transfer, presentation of which to the automatic parking gate control unit will allow the driver to enter the "free area" of the street. Functional design alternatives are considered, and a baseline system is proposed which is then made the subject of a cost analysis that includes comparison with a manual system. At a parking-space allowance of 350 square feet, the annual operating cost of the manual system would be about \$45, while that for the proposed system would be about \$7.

**ACKNOWLEDGEMENT**

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**044210**

**THE EVOLUTION OF METRO**

Murin, WJ

Consortium of Universities, Urban Transportation Center,  
Washington, D.C., 20036 Urt-11

1970

This research, part of a large effort, examines the evolution of the Washington, D.C., area subway system (Metro) from early legislation in the 1950's through adoption late in 1969. The specific purpose of the narrative is to provide a common framework of understanding for the larger effort and to present the incremental nature of the decision-making process relevant to the system's planning. The entire effort, titled transportation planning and politics in the national capital, will examine the policy implications of the values of the various participants in the metro planning process. The perspective will be that of an inner-city resident and his service needs to work, shopping, medical services, etc.

**ACKNOWLEDGEMENT**

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**044211**

**ST. LOUIS METROPOLITAN AREA RAPID TRANSIT  
FEASIBILITY STUDY/PHASE 2: ALTERNATIVE TRANSIT  
SYSTEMS**

Parsons, Brinckerhoff-Tudor-Bechtel, 814 Mission Street, San  
Francisco, California, 94103 Int-t9-4

May 1969

The schemes developed during this phase were buses using existing streets, highways, or freeways; grade-separated rapid transit systems of various forms; and commuter railroad service. Existing railroad rights-of-way and trackage within the planning area were examined with respect to their adaptability for commuter or rapid transit facilities; express bus operation on both existing and planned freeways, with and without CBD distribution facilities was evaluated; routings of rapid transit systems operating on exclusive rights-of-way were made; and combinations of these systems were studied. The major considerations were determination of the relationship that transportation systems have had on the development of the St. Louis metropolitan area; formulation of regional development objectives, insofar as public transportation matters are concerned; determination of the long-range transportation requirements for the metropolitan area, and delineation of the likely corridors that would be used for public transportation; and development of alternative, long-range, multimode transportation system schemes. It is recommended that testing be conducted of the present bus system expanded to an assumed 1990 highway network, and that the system be used as a plane of reference. It would also be advisable to test a fully grade-separated, exclusive right-of-way system whose operating characteristics are reliably known.

**ACKNOWLEDGEMENT**

Urban Mass Transportation Administration

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PB-187997

**044212**

**WASHINGTON METROPOLITAN AREA RAIL  
COMMUTER FEASIBILITY STUDY**

Englund (CR) (Transportation Consultant)

May 1971

A restructured commuter rail service, embracing three important routes in the Washington metropolitan area, could be operated on weekdays under conditions requiring only a very modest level of

support payments after service is well underway. The estimated expenses of operation, annualized would be on the order of \$2.74 million while revenues are estimated at \$2.37 million. The acquisition of rehabilitated main line rail equipment would set the capital needs at approximately nine million dollars. A new concept for operation is suggested which, from an experimental standpoint, would be a first in the nation. Commuter trains and crews running on the B&O Brunswick line and the RF&P Quantico line would be "interlined." They would proceed from their terminal at one end of the two-route commuter zone to the other and then turn back. This mode of operation would substantially reduce capital outlays for equipment, and at the same time, provide excellent cross-metropolitan area schedules for an expanded rider base by linking Washington's central business district and the southwest employment centers with such suburban employment complexes as Crystal City, Virginia and Rockville, Maryland. The Baltimore area rider origins, which represent about half of the total ridership, should be consolidated into an improved Penn Central Baltimore-Washington service. The First Street tunnel should be electrified in order to provide a through service link for Penn Central. Operation of electrified trains by Penn Central would be less expensive than the use of diesel or turbine propelled trains.

**ACKNOWLEDGEMENT**

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PB-200103

**044213**

**ST. LOUIS METROPOLITAN AREA RAPID TRANSIT  
FEASIBILITY STUDY LONG-RANGE PROGRAM-  
SUPPLEMENTAL REPORT**

Parsons, Brinckerhoff-Tudor-Bechtel, 814 Mission Street, San  
Francisco, California, 94103 Int-t9-4

Aug. 1971

Proposed criteria, vehicle design specifications, station configuration, construction methods, operating characteristics, route descriptions, and cost estimates are presented for a steel-wheel/steel-rail transit system for the St. Louis metropolitan area. The suggested long-range transit program envisions a system consisting of a grade-separated transit system on an exclusive right-of-way utilizing new construction for at-grade, aerial, and subway structures. In addition, a comprehensive bus system would be integrated into the system as an essential element to be used both for feeder-distributor service and for travel demands not conveniently served by the rail transit routes. The proposed rail system consists of eight lines (five in Missouri, two in Illinois, and one connecting the two states). An additional line, the Kirkwood line, is suggested as a possible addition to the long-range transit program, provided that the right-of-way and trackage can be provided at low cost. Three basic types of construction were considered for the project: subway, aerial, and at-grade. With subway construction, community disruption and dislocation of people and businesses would be minimal. Stations can be mined out, further reducing disruption at the surface. Because of these advantages, and because the estimated cost of tunneling in the rock formation is competitive with the cost of aerial structure plus right-of-way, it is planned to construct more than 67 miles of the rapid transit system underground. The total patronage estimated for the long-range transit program was 600,000 daily trips.

**ACKNOWLEDGEMENT**

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**044214**

**ST. LOUIS METROPOLITAN AREA-RAPID TRANSIT  
FEASIBILITY STUDY LONG-RANGE PROGRAM**

Parsons, Brinckerhoff-Tudor-Bechtel, 814 Mission Street, San

Francisco, California, 94103 Int-t9-4

Aug. 1971

The purposes of this study were to determine the type of mass transit system or systems most appropriate for St. Louis in the future; to evaluate alternative system configurations and routings; and to provide the community's decision-makers with sufficient information concerning costs, benefits, and related factors to permit selection and early implementation of a plan to guide the development of the area's transit system. The study consisted of three broad phases. Phase I was concerned with data gathering, Phase II was concerned with the anticipated future growth of the area and changes in its socio-economic characteristics that are likely to affect transit requirements; development of public transport system policies; and an evaluation of conventional and alternative future transit systems. The two alternative systems selected for Phase II analysis were: (1) a system of buses using the existing and proposed future highway network with improvements that could be achieved at modest cost, and (2) a train (rail-like) system operating on grade-separated exclusive right-of-way. The early portion of Phase III consisted of an analysis and presentation of the advantages and disadvantages of each of the systems. The decision was then made to proceed with an order-of-magnitude planning approach for an area-wide train system supplemented by a complementary surface bus system. As a result of the investigations and analyses carried out during the course of the study the following conclusions were reached: 1) Revenues from the new transportation system will be adequate to cover operating costs, including contingency and depreciation on vehicles. 2) If rapid transit is to be implemented in the St. Louis area, it should utilize steel-wheel/steel-rail, air-conditioned vehicles operating in automatically controlled trains with minimum headways of 90 seconds. (3) The forecast growth of the study area from a population of about 2,300,000 in 1965 to almost 3,200,000 by 1990, accompanied by a corresponding growth in employment opportunities and changes in the socioeconomic characteristics of the inhabitants, will result in 60-percent more trips being made on a typical weekday in 1990 than were recorded on a typical weekday in 1965.

#### ACKNOWLEDGEMENT

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PB-204060

044272

#### DYNAMIC VEHICLE DISPATCHING IN A TRANSPORTATION SYSTEM

Sadaaki, K

Japan Society of Civil Engineering Proceedings (Japan Society of Civil Engineering, Yotsuga 1-chome, Shinjuku-ku, Tokyo, Japan)

No. 199, Mar. 1972, pp 125-140, 8 Ref

The study described is an operational research approach towards the effective design of advanced ground transportation systems. A stochastic model was constructed over a network with M stations connected arbitrarily by routes and the relationships between parameters were simulated by the model. The dynamic dispatching policy was examined and the probability density function of vehicle departure interval, average passenger waiting time, and average vehicle loading factor were derived.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 015600

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044273

#### SUBWAY STATION AIR CONDITIONING FOR THE WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

Soloman, IM, De Leuw, Cather and Company

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

Paper 73-RT-7, Jan. 1973, 8 pp, 8 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the IEEE-ASME Joint Railroad Conference, St. Louis, Mo., April 11-12, 1973.

This paper describes the problems and solutions related to excessive heat expected in the Washington, D.C., subway system passenger stations. The heat sources are identified justifying the need for air conditioning. The method of calculating the cooling loads and controlling the air movement are explained. Costs and benefits of passenger station air conditioning are stated.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044292

#### ENGINEERING FOR BART

Hammond, DG, Bay Area Rapid Transit

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

Paper 72-WA/RT-1, Nov. 1972, 9 pp, 7 Fig

Contributed by the Rail Transportation Division of ASME for presentation at the Winter Annual Meeting, New York, New York, November 26-30, 1972.

The design and construction of a dual rail rapid transit system for the San Francisco Bay Area involved the engineer in an expanded role in his efforts to construct an entirely innovative mass transit system. The engineers working on BART were part of a versatile, multi-disciplined design group which required more than just pure engineering and technical skill. BART's engineers had to be responsive to the suggestions emanating from other members of the design team while still providing for system performance characteristics unmatched in the transit industry. The transit system itself is innovative in both design and performance, and in the methods of construction required to provide a platform for the high performance equipment. The equipment innovations include the automatic train control system, passenger vehicle, and automatic fare collection system. Highlights include the unprecedented laying technique of the transbay tube linking the City of San Francisco with Oakland and features of the track and roadbed system.

#### ACKNOWLEDGEMENT

American Society of Mechanical Engineers

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044338

#### A MODAL SPLIT MODEL FOR LONG DISTANCE TRAVEL

Wigan, MR Walmsley, DA

Transport and Road Research Laboratory, Crowthorne, England  
TRRL-LR-501, 1972, 19 pp

A modal split model is put forward that contains a description of the transport system available for long distance trips between a set of regions. Each journey is treated as being of three parts: (1) access: the departure from a specific origin area in one region to an access point to a main haul mode between the regions; (2) main haul: the trip between the two regions on a specific mode; (3) egress: the last leg of the journey, from the terminal in the city region of the destination to the destination itself. A simplified network model has been constructed on this basis, and contains a geographical representation of the transport alternatives. Every link in this network is a different alternative method of travel between the points it links, and the travel time, waiting time, and travel cost along that link summarizes the main characteristics of the set of travel choices that it represents. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-214548/0

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PB-214548/0

044341

#### ANALYSIS OF THE INTERCITY TRAVEL MARKET IN THE NORTHEAST CORRIDOR

Prokopy, J Ellis, R

Peat, Marwick, Mitchell and Company, 1025 Connecticut Avenue, NW, Washington, D.C., 20036

Final Rpt, Nov. 1971, 70 pp

Contract DOT-OS-10051

The overall objective of the study is to develop an understanding of the characteristics of the intercity travel market in the Northeast Corridor by identifying the most important groups of travelers, or submarkets; these submarkets are defined in terms of traveler and trip characteristics. To this end, the study stratifies the intercity travel market among four selected city-pairs, analyzes the results of this stratification, and synthesizes a set of submarkets. The results of the study, a set of the most important submarkets as well as an identification of the most important variables influencing travelers' responses to, and requirements for, intercity transportation, should be useful in the analysis of intercity transportation demands and in the development of the most promising alternatives for improving intercity transportation.

#### ACKNOWLEDGEMENT

National Technical Information Service, PB-214639/7

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PB-214639/7

044493

#### URBAN TRANSPORT DEVELOPMENT: PROSPECTS FOR IMPLEMENTATION

Hamilton, CW, Battelle Memorial Institute

American Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, New York, 10017

Paper 720363, 1972, 10 pp

This paper was presented at the Society of Automotive Engineers Meeting, April 10-12, 1972.

The record of the nation's cities in implementing plans for significant changes in their public transportation systems is strikingly poor. However, there is substantial evidence to suggest that all the important pieces necessary for major programs are available. This paper covers forces of change in urban transport development—sources of financing, institutional arrangements and their impact on decisionmaking; also discussed in urban transportation technology—options for the future, and transit implementation projects in cities.

#### ACKNOWLEDGEMENT

Engineering Index, EI 73 016946

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ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

044495

#### OVERVIEW OF SOME PROBLEMS IN GROUND TRANSPORTATION

Gravitz, SI, Boeing Company

Journal of Aircraft (American Institute of Aeronautics and Astronautics, 1290 Avenue of the Americas, New York, New York, 10019)

Vol. 9, No. 6, June 1972, pp 385-392, 14 Ref

Aerospace skill capabilities are applied to problem areas such as: Station spacing and passenger comfort; vehicle size and headway and power requirements as impacted by vehicle-guideway interaction; suspension dynamics in the context of ride quality and the trade between guideway roughness and suspension sophistication; propulsion and power in the context of electric systems for minimum on-line noise and pollution; guideways in the context of system cost sensitivity to configuration and stiffness requirements and interaction with other system elements; and control and communications in the context of high capacity, fail safe traffic control.

#### ACKNOWLEDGEMENT

Engineering Index, EI 72 001840

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044521

#### BART RAIL TRANSIT SYSTEM BEGINS OPERATION

Civil Engineering (American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017)

Nov. 1972, pp 63-67

In September 1972 the first line of the \$1.4 billion San Francisco Bay Area Rapid Transit District (BART) system was opened to revenue service. The 75 mile, 38 station commuter rail system is the first new concept in big city rapid transit in half a century. BART is notable in many ways, among them its: 3.6 mile Trans-Bay Tube, up to 130 ft below the surface of San Francisco Bay; 25 miles of line on aerial structure; automatic train operation; automatic fare collection. BART will be a major test of whether car-happy Americans can be induced to switch to transit, thus relieving congestion and pollution problems.

#### ACKNOWLEDGEMENT

Civil Engineering

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

American Society of Civil Engineers, 345 East 47th Street, New York, New York, 10017, Repr PC: Price



019474

**AN ESTIMATION OF THE QUANTITATIVE IMPACT OF THE ST. LAWRENCE SEAWAY ON THE HINTERLAND'S ECONOMY**

Schenkér, E. Koh, ST Kochan, J

Wisconsin University, Milwaukee, Center for Great Lakes Studies, Milwaukee, Wisconsin

WIS-SG-71, Preprint, 1970

21 pp

Sponsored in part National Science Foundation, Washington, D.C. Published in Proceedings of the Conference on Great Lakes Research (13th) Buffalo, N.Y., Apr 70, p168-186.

Economists are in agreement that the opening of the St. Lawrence Seaway for commercial navigation has benefited the region's economy. In terms of total population and employment, the region has experienced growth since 1958. The study analyzes the Seaway's contribution to the regional economic growth process. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-71-00754

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
COM-71-00754

019519

**PRESENT AND FUTURE INCOME AND EMPLOYMENT GENERATED BY THE ST. LAWRENCE SEAWAY**

Schenkér, E

Wisconsin University, Milwaukee, Center for Great Lakes Studies, Milwaukee, Wisconsin

WIS-SG-71-313, 1970

6pp

Published in Seaway Review, VI, N3, 6p 1970

In the first ten years of operation, the St. Lawrence Seaway has transformed at least a half-dozen Great Lakes harbors from relatively quiet places into true ocean ports. This paper summarizes the socio-economic implications of these transformations. Through study expansion of employment and incomes, the Seaway ports have made significant contributions to the economic growth of the Great Lakes region. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, COM-71-00759

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
COM-71-00759

019532

**UNION FRAGMENTATION: A MAJOR CAUSE OF TRANSPORTATION LABOR CRISES**

Shils, EB

Industrial and Labor Relations Review (New York State School of Indus and Labor Relations, Cornell University, Ithaca, New York)

Vol: 25, No. 1, Oct. 1971, pp32-52, 4 Tab, 20 Ref

The transportation industry's labor force is represented by some seventy-seven different unions, and it is the contention of the author that this fragmentation is causing the labor crises in our transportation industry. Each of the major transportation fields, trucking, air, railroads and the maritime, is examined. Union representation for each industry is presented along with a short review of the type of

labor relations each has had. From this examination of the strike records of these different industries the conclusion is drawn that fragmentation of labor union representation leads to labor unrest and industrial problems. The article goes on to examine the Nixon administration's proposals and to propose programs that the author would favor including a National Labor Relations Act to replace the Taft-Hartley Act and the Railway Labor Act. There is also a discussion of industrial unionism and union consolidation and its effect on the transportation industry. Author concludes that if all transportation workers were represented by one large union the problem of union fragmentation would be solved. This would then lead to gains that would benefit labor, management and the nation as a whole.

**ACKNOWLEDGEMENT**

United States Merchant Marine Academy, N-067

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
New York State School of Indus and Labor Relations, Cornell University, Ithaca, New York, Repr. Req Price

019676

**A STUDY OF THE INLAND WATERWAY USE CHARGE PROGRAM**

Charles River Associates Incorporated, 16 Garden Street, Cambridge, Massachusetts, 02138

Rpt 157-1, Dec. 1970, 82pp

DOT-OS-00072

The purpose of the study is to examine the economic implications of a number of proposed user charge methods. First the criteria are presented by which user charge methods should be evaluated. These criteria include economic efficiency, equity, and administrative simplicity. Then a number of alternative user charge mechanisms are examined and appraised in light of these criteria. In addition, estimates are made of the rates necessary under each user charge method to recover current annual operating and maintenance costs as well as investment costs. An attempt is also made to appraise the diversion of traffic that might occur on the different waterways if these charges were imposed. This study is confined to shallow draft, inland waterway transport. Port operations, deep channels connecting ports to the sea, deep draft coastal shipping, and Great Lakes shipping are excluded. While the theory of user charges is general, evaluation of impact is confined to shallow draft operations, principally on the Mississippi and its tributaries. (DOT abstract)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-201617

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PB-201617

028995

**ENERGY IN THE WORLD ECONOMY**

Darmstadter, J Teitelbaum, PD Polach, JG

Resources for the Future, Incorporated, 1755 Massachusetts Avenue, NW, Washington, D.C., 20036

Dec. 1970, 876pp

This book deals with quantitative aspects of long-term trends in energy consumption, production, and foreign trade; and, more particularly, with the transformation, during this century, of the world's fuel base away from coal and toward oil and natural gas. These latter changes, which occurred at different times and rates in the major geographic regions, are particularly important for two reasons: they reflected, as well as facilitated, significant changes which were taking place in the world's industrial life and in economic activity in general; and they gave rise to wholly new patterns of regional economic interdependence. The book sets out to accomplish three main tasks. The first, upon which the others depend, is to assemble statistical

series depicting movements in consumption, production, and international trade of energy commodities since 1925 by countries, regions, and the world as a whole. Secondly, these voluminous statistical materials are winnowed in order to bring into sharp focus the main features of those movements. The third task is to relate these main features to other economic variables and, in so doing, to provide an essential springboard for anyone wishing to evaluate prospects for the future. Key data has been selectively updated to 1968. Part One describes and interprets the significant statistical findings. Part Two presents a series of Statistical Profiles, each dealing with some unique facet of the overall picture. These profiles are derived from the detailed statistics in Part Three. Part Four deals with questions of methodology and definition connected with the detailed statistical series, and also provides country-by-country source notes. Part Five presents selected supplementary materials: on energy and gross national product, matrix tables of international energy flows, and a brief bibliography.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Resources for the Future, Incorporated, 1755 Massachusetts  
Avenue, NW, Washington, D.C., 20036, Repr PC: Req Price

**034658**  
**U.S.-CANADIAN OVERSEAS TRADE DIVERSION**

Manalytics, Incorporated, 625 Third Street, San Francisco,  
California, 94107

Project 2-115, Mar. 1972, 65 pp

The routing of U.S. overseas trade through Canadian ports has attracted wide public attention recently because of several concurrent developments. In 1971, ports on both U.S. seaboards were closed by strikes, and large volumes of overseas freight which normally would use U.S. routings were diverted through Canadian ports. The Canadian ports, and the rail and ocean carriers who serve them, have greatly increased container-handling capabilities in the last few years and are aggressively soliciting U.S. overseas traffic. Their efforts are being spurred, in part, by the container ship overcapacity on the North Atlantic, which has created intense competition between the carriers both within and without the existing conferences. In spite of the increased interest, little is known of the extent of the actual or potential diversions—either the amounts or the reasons. Since U.S. regulatory policy might be involved if the diversions are being encouraged by certain actions of the carriers, the Federal Maritime Commission authorized this study to: 1) develop definite statistics on the U.S. and Canadian overseas trades which originate or terminate in one country but transit ports in the other; and 2) determine why these shipments do not use home-country ports.

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Federal Maritime Commission, Public Reference Room,  
Washington, D.C., Repr PC: Req Price

**035627**  
**GREAT LAKES/ST. LAWRENCE SEAWAY FEEDER  
SYSTEMS-A FEASIBILITY STUDY**

Manalytics, Incorporated, 625 Third Street, San Francisco,  
California, 94107

Final Rpt, Mar. 1972, 237 pp

Contract DOT-OS-00066

A factual presentation is made of available market, costs, and competition that a potential operator of a cargo feeder system on the Great Lakes/St. Lawrence Seaway would face. The report includes a market analysis of unitizable cargo forecast for 1975 and 1980, analysis of vessel types and cargo handling methods, construction and operating costs, and the effects of competing transportation methods available to the shipper.

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-209664

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PB-209664

**037110**  
**PHASE II OF THE ECONOMIC IMPACTS OF MEETING  
EXHAUST EMISSION STANDARDS, 1971-1980. APPENDIX.  
PRESENTATION OF BASELINE AND ALTERNATIVE  
IMPACT FORECASTS OF MACROECONOMIC AND  
INDUSTRY PERFORMANCE**

Chase Econometric Associates, Incorporated, Philadelphia,  
Pennsylvania

Dec. 1971, 130p

See also Part 3, PB-207 202.

Pollution control devices on automobiles will not only affect the automobile industry but also all of the related industries supplying it. The report presents data on the impact that this pollution control will have on these industries and the economy in future years.

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-207203

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PB-207203

**037111**  
**PART II OF THE ECONOMIC IMPACTS OF MEETING  
EXHAUST EMISSION STANDARDS, 1971-1980. PART III.  
THE ECONOMIC IMPACT OF POLLUTION ABATEMENT**

Chase Econometric Associates, Incorporated, Philadelphia,  
Pennsylvania

Dec. 1971, 33p

See also Part 2, PB-207 201, and Appendix, PB-207 203.

The report discusses the economic impact of pollution abatement on the automobile industry. The topics include cost increases, price increases, estimates of demand relationships and of changes in prices by size-price category, the economic impact. (Author)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-207202

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.75, Microfiche: \$0.95  
PB-207202

**037112**  
**PHASE II OF THE ECONOMIC IMPACTS OF MEETING  
EXHAUST EMISSION STANDARDS, 1971-1980. PART II.  
BASELINE FORECASTS OF ECONOMIC PERFORMANCE**

Chase Econometric Associates, Incorporated, Philadelphia,  
Pennsylvania

Dec. 1971, 50p

See also Part 1, PB-207 200 and Part 3, PB-207 202.

The report presents a review of the automobile industry. It does not take into effect any pollution controls but rather studies the basic structure. The contents include: The chase econometrics long range interindustry forecasting system; The structure of automobile production in the United States; and Baseline forecasts of economic performance: 1970-1980.

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-207201

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

NTIS, Repr PC: \$3.75, Microfiche: \$0.95  
PB-207201

**037113**  
**PHASE II OF THE ECONOMIC IMPACTS OF MEETING EXHAUST EMISSION STANDARDS, 1971-1980. PART I. EXECUTIVE SUMMARY**

Chase Econometric Associates, Incorporated, Philadelphia, Pennsylvania

Dec. 1971, 25 pp

See also Part 2, PB-207 201.

The report summarizes the economic effects of mobile source emission controls on the automobile industry. It concentrates on the effects which emission controls will have on the cost and price of automobiles, and hence on shipments and employment of the automobile industry and its supplier industries. (Author)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-207200

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207200

**037164**  
**ENGINEERING ECONOMIC ANALYSIS IN RAILROAD PLANNING AND OPERATIONS**

Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611

1969, 103pp

Seven papers delivered at symposium cover such topics as engineering economy applied to investment in railroad plant and equipment; freight car investment; discounted per diem rates; motive power life cycle costing; rail renewal problem; replacement program; and road property investment.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 14924

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

**037174**  
**DEVELOPMENT AND USE OF COMPUTER MODELS FOR ANALYSIS OF LONG RANGE PLANNING DECISIONS AT SOUTHERN PACIFIC COMPANY**

Anderson, EP, Southern Pacific Transportation Company  
McAfee, RK  
Seelenfreund, A

AFIPS Conference Proceedings (Amer. Fed. of Information Processing Societies, Montvale, New Jersey)

Vol. 33 P, t 1, pp 431-9

Fall Joint Computer Conference, San Francisco, California, December 9-11, 1968.

Railroad has used series of computer models dealing both with strategic, corporate problems, and with operational investment problems; paper gives description of planning problems that typically have been encountered and describes two most important computer models used—operating cost model and investment analysis model; implementation and use of models is discussed.

**ACKNOWLEDGEMENT**  
Engineering Index, EI 70 17356

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

**039373**  
**RAILROAD TECHNOLOGY AND MANPOWER IN THE 1970'S**

Bureau of Labor Statistics, Washington, D.C.

DOL-BLS-B-1717, Final Rpt, 1972, 95p

The report describes changes in technology in the railroad industry; projects the effects of these changes on productivity, employment, and occupational requirements; and discusses methods of adjustment. The study is based on discussions with company, union, and government officials and with railroad equipment manufacturers. It also is based on attendance at conferences and exhibits as well as on information obtained from BLS sources and others in government, and on trade and technical publications. (Author)

**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-211209

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Government Printing Office  
L2.3:1717

**039383**  
**EXTENDING THE ST. LAWRENCE SEAWAY NAVIGATION SEASON: A COST-BENEFIT APPROACH**

Schenker, E      Bunamo, M      Smith, DB

Wisconsin University, Milwaukee, Center for Great Lakes Studies, Milwaukee, Wisconsin

WIS-SG-72-209, Jan. 1972

69 pp

Special Report no. 15

A study has found that limited extensions of the St. Lawrence Seaway season are technologically feasible. The costs of such extensions are known and the benefits derived can be estimated to approximate the total real benefits. It is suggested that a four week extension is the minimum necessary to generate significant transportation cost savings. Consideration should be given to trade offs between technological feasibility and economic benefits, and between the regional net present value account and the increase in costs needed to generate any increment in benefits.

**ACKNOWLEDGEMENT**  
National Technical Information Service, COM-72-1070

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
COM-72-1070

**039802**  
**FOREIGN MARITIME POLICIES: STUDY DEFINITION**

Maritime Transportation Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418

July 1971, 28p

Contract N00014-67-A-0244-002

The report defines, and strongly recommends, 'a study of the ways in which other nations use their maritime policy as a basic element of overall national policy.' The report outlines some of the broad changes taking place in the international environment—economic, political, and technological—that indicate a profound need for future-oriented analysis of maritime policies. It states four main purposes of the recommended study. It outlines a suggested project design, including the study's scope, research approach, staffing, and estimated budget. The report includes eight recommendations.

(Author)

## ACKNOWLEDGEMENT

National Technical Information Service, AD-738899

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AD-738899

039815

**PHASE II OF THE ECONOMIC IMPACTS OF MEETING  
EXHAUST EMISSION STANDARDS, 1971-1980. APPENDIX.  
PRESENTATION OF BASELINE AND ALTERNATIVE  
IMPACT FORECASTS OF MACROECONOMIC AND  
INDUSTRY PERFORMANCE**

Chase Econometric Associates, Incorporated, Philadelphia, Pennsylvania

App, Dec. 1971, 130 pp

See also Part 3, PB-207202, and PB-207204.

Pollution control devices on automobiles will not only affect the automobile industry but also all of the related industries supplying it. The report presents data on the impact that this pollution control will have on these industries and the economy in future years.

## ACKNOWLEDGEMENT

National Technical Information Service, PB-207203

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207203

039824

**THE RELATIONSHIP OF LAND TRANSPORTATION  
ECONOMICS TO GREAT LAKES TRAFFIC VOLUME**

Reebie Associates, Greenwich, Connecticut

Final Rpt, Oct. 1971, 175 pp

Contract C-1-35492

The study defines the transportation markets in the Great Lakes Area and the capabilities of existing and potential Lakes transportation systems in three phases: Market research; regulatory aspects; economic analyses of specific moves. Phase 1 examines existing Lakes traffic as well as non-water traffic moving through the hinterland. Phase 2 discusses two criteria that were established in resolution of disputes between land and water competition: 'preserve the inherent advantage of water transportation', and 'utilize average full costs'. Phase 3 indicates how bulk moves over 700 miles with initial and/or final rail haul best handled by water; hauls under 400 miles by direct rail; neo-bulk economically handled by water. Foreign trade to U.K. and Northern Europe is considered in cost via Lakes vs. via Atlantic Coast even considering the seasonal penalty.

## ACKNOWLEDGEMENT

National Technical Information Service, COM-71-0108

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
COM-71-0108

039861

**RAILROAD TECHNOLOGY AND MANPOWER IN THE  
1970'S**

Bureau of Labor Statistics, Washington, D.C.

DOL-BLS-1717, Final Rpt, 1972, 93p

The bulletin describes changes in technology in the railroad industry; projects their impact on productivity, employment, and occupational requirements; and discusses methods of adjustment. It is one

of a series designed to evaluate the impact of and benefits and problems created by automation, technological progress and other changes in the structure of production and demand on the use of the nation's human resources; and to establish techniques and methods of detecting in advance the potential impact of such developments.

## ACKNOWLEDGEMENT

National Technical Information Service, PB-210635

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PB-210635

039864

**GREAT LAKES/ST. LAWRENCE SEAWAY FEEDER  
SYSTEMS—A FEASIBILITY STUDY**

Manalytics, Incorporated, San Francisco, California DOT-OS-3-106

Final Rpt, Mar. 1972, 237p

Contract DOT-OS-00066

A factual presentation is made of available market, costs, and competition that a potential operator of a cargo feeder system on the Great Lakes/St. Lawrence Seaway would face. The report includes a market analysis of unitizable cargo forecast for 1975 and 1980, analysis of vessel types and cargo handling methods, construction and operating costs, and the affects of competing transportation methods available to the shipper.

## ACKNOWLEDGEMENT

National Technical Information Service, PB-209664

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PB-209664

039869

**TOWARD AN EFFECTIVE DEMURRAGE SYSTEM**

Ainsworth, DP Liba, CJ Keale, MJ

Reebie Associates, Greenwich, Connecticut

Final Rpt., July 1972, 372 pp

Contract DOT-FR-10038

Prepared in cooperation with Manalytics, Inc., San Francisco, Calif.

The report summarizes the results of research conducted into the components of the rail car load-to-load cycle and rail car terminal activity, car handling practices and policies of rail customers, and concepts of rail car value. The report further evaluates the effectiveness of the current railroad demurrage tariff in terms of the goal of efficient equipment utilization. It proposes replacement tariff components which deal with the following areas: demurrage application, non-chargeable time, average agreement, claims, and charges.

## ACKNOWLEDGEMENT

National Technical Information Service, PB-212069

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-212069

039875

**INTERMODAL TRANSPORTATION CAREERS—A GUIDE  
FOR DEVELOPMENT OF EDUCATIONAL PROGRAMS**

Kirschner (EJ) and Associates, Washington, D.C.

Final Rpt, Feb. 1972, 138p

Contract OEC-0-71-4433(357)

The report spells out the educational needs and criteria in the overall transportation systems field. The transportation program guidelines offer the educational community an opportunity to help renew or develop careers in the changing transportation systems professions, and for career mobility to those already employed in transportation. The curricular guidelines are interdisciplinary and multidisciplinary, embracing the transportation environment of development, operation and management. The suggested programs are divided into three levels: the 'beginning-entry level'(I); the 'intermediate job level'(II); and the 'semi-professional level'(III). Each core program has been made flexible enough to construct instructional units or modules of educational elements of specific skills, knowledge and concepts, while at the same time oriented toward career or job preparation. The core guidelines, for the development of curricula in intermodal transportation career education, are applicable to secondary, community college and technical school levels.

(Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-211683

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-211683

**039887**

**A STUDY OF THE EFFECTS OF INLAND FREIGHT RATES AND SERVICES ON THE ST. LAWRENCE SEAWAY**

Snively, King and Tucker, Incorporated, Washington, D.C.

Final Rpt, Dec. 1971, 116p

Contract DOT-OS-10019

The report examines selected railroad rates on commodities moving from the Great Lakes-St. Lawrence Seaway hinterland to Great Lakes, North Atlantic, and southern ports. A comparative analysis is made of rate and cost data for the sample regional commodity movements to determine if the existing rate structure is prejudicial to the Great Lakes-St. Lawrence Seaway system. From the comparative data, conclusions are drawn concerning the Interstate Commerce Act. Alternative procedures are explored and recommended for appropriate relief from any disadvantages to seaway traffic.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-209220

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-209220

**039898**

**RAILROAD OF THE YEAR: MISSOURI PACIFIC**

Shedd, T Ford, N

Modern Railroads (Cahners Publishing Company, Incorporated, 5 South Wabash Avenue, Chicago, Illinois, 60603)

Vol. 27, No. 7, July 1972, 20 pp, 4 Fig, 21 Phot

Missouri Pacific was featured as Railroad of the Year by this magazine. The article reviews MoPac gross and net performance and the integration of the C&EI. It reviews industrial development and personnel development. It reviews MoPac traffic patterns, including Trailer and Container traffic, and LCL. It reviews the Transportation Control System under development and presents a circular bar chart for the timing of the phases of TCS. It reviews operations including yard and terminal operations, car distribution, and unit trains and

run-through trains. It reviews MoPac renewal of physical plant, including welded rail, modernized yards, centralized traffic control, shop facilities, and car and locomotive acquisitions. It comments on industrial engineering and on materials control as used at MoPac. The MoPac approach to container traffic includes Containerpak, which involves four plans for moving containers.

**ACKNOWLEDGEMENT**

Modern Railroads

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Cahners Publishing Company, Incorporated, 5 South Wabash Avenue, Chicago, Illinois, 60603, Repr Req Price

**039900**

**FOR RAILFANS ONLY**

Trains (Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233)

Vol. 33, No. 4, Feb. 1973, 2 pp

Only a dedicated railfan would put up with the hours and pay of supervisory positions on many railroads. Many men from the ranks refuse promotion to supervisory jobs and return to their previous union job. Three reasons are given for such refusal of supervisory positions: (1) Most trainmaster jobs are seven day per week operations with ten hours a day considered an easy day, (2) the increased pressure from headquarters on supervision, and (3) the low pay scales for supervision. The average pay for road foremen is \$15,000 per year, while firemen with little seniority and an easier job earn more. Assistant Trainmasters start at \$950 to \$1000 per month, and people are not willing to take a cut in pay and a large increase in hours worked to be a supervisor. A trainmaster working long hours earns less than an engineer with a 4 or 5 hour passenger run.

**ACKNOWLEDGEMENT**

Trains

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233, Repr PC: \$0.75

**040606**

**FULLY ALLOCATED COST OF RAIL PASSENGER SERVICE BETWEEN NEW YORK AND WASHINGTON. COMPARISON OF CONVENTIONAL AND METROLINER COSTS DURING THE FOURTH QUARTER OF 1968 AND THE FOURTH QUARTER OF 1970**

Peat, Marwick, Mitchell and Company, Philadelphia, Pennsylvania

Final Rpt, Nov. 1971, 17p

Contract DOT-FR-00025

See also PB-202 048, and PB-202 049.

The report presents a comparative analysis of the fully allocated cost of rail passenger service between New York, New York and Washington, D. C. for the fourth quarters of 1968 and 1970. The objective of this phase of the study was to collect, analyze and present in a comparative format the fully allocated cost of operating those passenger trains. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208773

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-208773

040613

**INLAND WATERWAY TRANSPORT POLICY IN THE U. S**

Blood, DM

Wyoming University, Laramie, Wyoming

Final Rpt, Feb. 1972, 266 pp

Contract NWC-71-010

The report analyzes the role of inland waterway transport within the dual framework of national water policy and national transportation policy, based on a synthesis of existing information and policy debates about the development and future of inland waterway transport in the United States. A logical framework for identifying and evaluating the problem is developed as a basis for considering the future of inland waterway transport. A descriptive summary of the inland waterway system and industry is given, along with a review of the history and development of the system. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-208668

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PB-208668

040624

**CAPITAL STOCK MEASURES FOR TRANSPORTATION.  
VOLUME II. STATISTICAL SUPPLEMENT**

Scheppach, RC    Faucett, JG

Faucett (Jack) Associates, Incorporated, Chevy Chase, Maryland

JACKFAN-71-04-2, Final Rpt, June 1972, 170p

Contract DOT-OS-10195

See also Volume 1, PB-212 307.

The statistical supplement to a capital stock analysis of transportation modes is divided into four sections. The first section, A, presents the investment and capital stock series, both net and gross, in historical and constant dollars for reproducible capital. Stock estimates for nonreproducible capital, such as land, are presented in Section B. Section C gives inventory measures for the major types of revenue equipment, and Section D presents estimates of the average age of certain types of revenue equipment.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212308

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PB-212308

040625

**CAPITAL STOCK MEASURES FOR TRANSPORTATION.  
VOLUME I**

Scheppach, RC    Faucett, JG

Faucett (Jack) Associates, Incorporated, Chevy Chase, Maryland

JACKFAN-71-04-1, Final Rpt, June 1972, 133p

Contract DOT-OS-10195

See also Volume 2, PB-212 308.

The study presents capital stock measures for some twenty transportation modes for the period 1950-1970. The major commercial and non-commercial modes are included, and the large amount of public capital in highways, waterways, airports and airways has been estimated and allocated to the using modes. The estimates are

presented in both historical and constant 1958 dollars. A methodology to derive the cost of capital, and some comparisons of the capital intensity of transportation relative to other sectors of the economy are included. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212307

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PB-212307

041000

**MICROFILM SAVES SCL MONEY**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 6, June 1972, p 13, 1 Phot

Seaboard Coast Line is producing computer output on microfilm and saving time and money as a result. The faster microfilmer produces reports at saving in time compared to the impact printer. Mailing and storage costs of the output information are reduced. Reports produced on microfilm include consist reports, car moves, and freight bills. Waybills are also stored on microfilm. Over 200 microfilm readers are in use on SCL.

**ACKNOWLEDGEMENT**

Railway System Controls

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041044

**MP PLANNING OPERATIONAL CONTROL SYSTEM**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 5, May 1971, pp 20-22

Missouri Pacific is developing a computerized Transportation Control System to gather and develop information to control car movements. Installation is to be started in 1973 and completed in early 1975 for the information gathering phase. Installation of the total car movement control system is to be completed in 1977. The system will use in excess of 250 input-output locations over 12,000 miles of railroad in 13 states. The system will affect the daily movement of 400 trains, 250 switch engines, and 70,000 cars. The system will generate movement schedules for the approximately 18,000 cars per day released from industry or received in interchange. Factors considered in determining the schedule include: time car is available, the schedule of trains or engines, terminal or yard throughput times, train schedule combinations over routes, and restrictions on cars handled by certain trains. The system is designed not only to recognize and report exceptions to schedule movements, but to assist in preventing them. Responsibility for car and train movements will be vested in a Central Train Planning Bureau.

**ACKNOWLEDGEMENT**

Railway System Controls

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

041140

**HOW TO MANAGE A COMPLEX OF SEVEN RAILROAD  
DATA CENTERS**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 2, No. 7, July 1971, pp 28-31, 1 Fig

Managing a centralized center may be a relatively easy task when compared with managing the seven data centers on Penn Central. Management philosophy is focused on: selection of new profitable projects, control of project development and operations, and evaluation of systems performance. The control systems used at Penn Central have proven effective in optimizing computer operations. A new job must be set up for operations by an implementation group. An automatic scheduling and production control system has been developed, using a master magnetic tape file established by the implementation group. From this system, Penn Central can: theoretically evaluate cost/performance of various input devices, identify operators performing below desired levels, make available actual costs to the department being served, evaluate new technology for input of data, identify locally developed techniques of improved efficiency, identify performance ratios for entire centers, and analyze non-productive time.

**ACKNOWLEDGEMENT**  
Railway System Controls

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041142**  
**WESTERN PACIFIC GAINS CONTROL VIA ITS CENTRALIZED COMPUTER**

Railway Signaling and Communications (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 63, No. 1, Jan. 1970, pp 16-21, 3 Fig, 3 Phot

A computer based Management Information and Control System is helping Western Pacific obtain maximum car utilization. The car distribution phase and the car tracing phase are already operational, and the waybill data phase is under way. The fourth phase will tie everything together to provide planning and forecasting for the car utilization function. During a six week period, a business car toured the railroad providing training on input-output equipment. The railroad is divided into eleven service regions, each with a service center and regional car distributor. Cars are cleaned and inspected after being unloaded, and cars are moved between regions only on orders. WP gives the same priority to moving empties as it does to loads to give better service and to keep down per diem costs. AAR UMLER data is available from the computer. If there are 10 or more errors in a consist sent to the computer, the consist is rejected. One central computer handles message switching and the other is the MICS processor. There are 28 teletype circuits to 27 stations and 20 offices. Expansion of communications is required, and microwave is being installed from Sacramento to Portola, 180 rail miles.

**ACKNOWLEDGEMENT**  
Railway Signaling and Communications

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**041147**  
**REAPING THE REWARDS OF CONSOLIDATION**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 12, Dec. 1972, pp 20-23, 4 Phot

Seaboard Coast Line, the product of a 1967 merger of Atlantic Coast Line with Seaboard Air Line, is proof that mergers can work. SCL is now embarking on a program to consolidate certain SCL operations with those of wholly owned L&N. The consolidations involve three departments: traffic, purchasing, and management information services. Train operations are being coordinated with emphasis on run-through trains.

**ACKNOWLEDGEMENT:**

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041148**  
**BIG SOLUTIONS ARE DEMANDED—AND NOW**

Wallace, GR, Penn Central Transportation Company

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 12, Dec. 1972, pp 26-28, 1 Phot

Railroad freight marketing is of relatively recent origin, and a hard fact of railroad life is the uniquely heavy, long-range, single-purpose nature of the railroad capital commitment. In the past, capital once spent largely determined the philosophy of managers. Major stumbling blocks to railroad marketing include top managers who were too little involved and who were looking for instant wisdom rather than restructuring of the established fabric. The first element in a marketing analysis is the railroad property and its capabilities. The marketing officer must get beyond what passes for costing to find out what a movement produces in revenues and expenses, and also to determine the money effect of any new movement on the rest of the business. One important job is to identify likely areas of concentrated tonnage potential. While the knowledge of field salesmen is not systematic, in total it is immense. The peril of exhaustive study is consumption of time and the head of the marketing effort must have a feel for projects that are ripe. A difficult job is to convince railroad management. New capital is a problem, money is scarce around railroads. No new mistake in marketing can be as serious as holding fast to the disappearing conventional market.

**ACKNOWLEDGEMENT**  
Railway Age

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**041149**  
**SHIPPERS WARN OF SHIFT TO PRIVATE CARRIAGE**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 173, No. 12, Dec. 1972, pp 30-31, 1 Fig

A Railway Age pool of shippers indicated that 12 of the 114 respondents expect a decline in their use of rail service, while 46 expect use of rail service to be about the same, and 56 expect a relative increase. Comments indicate that rising transportation costs and service inadequacies are to blame for diversions of traffic from railroads. Too many problems with rail service are cited by shippers moving to private carriage.

**ACKNOWLEDGEMENT**  
Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041163**  
**CP PUTS TARIFFS ON MICROFILM**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 10, Oct. 1972, pp 28-29, 4 Phot

The Canadian Pacific Railway has started the change from paper tariffs to a microfilm system for all internal functions concerning rates and pricing. Internal use of microfiche is only the first phase in a campaign for wide acceptance of the new tariff system. The real economic impact of the microfiche won't be felt until other transportation modes make the jump. The advantages of microfiche over paper tariffs are numerous: lower production costs, less space requirement, faster and more economical mailing to customers, and ease of use.

**ACKNOWLEDGEMENT**

Railway System Controls

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.7

**041222****SNCF IMPLEMENTS COMPUTER SYSTEM**

Railway System Controls (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 3, No. 11, Nov. 1972, pp 26-27

The French National Railways is implementing the third phase of a three stage computer scheme aimed at increased car utilization. The system will monitor the locations of some 470,000 freight cars. The system includes two large Univac 1108 multi-processors and associated storage and peripherals. There are 500 Olivetti 318 terminals located at stations and yards. Each terminal is connected by a telegraph line to one of 40 concentrators. The HB 316 concentrators are linked to a message processing center by 20 full duplex 36000 or 4800 baud lines. Two additional Univac 1108 computers are installed for message processing. Due to increase in the 1108 workload, SNCF has ordered three Univac 1110 computers. Inventory control and passenger seat reservations will be added to the system.

**ACKNOWLEDGEMENT**

Railway System Controls

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.75

**041226****THE WRECK OF THE PENN CENTRAL**

Daugen, JR Binzen, P

Little, Brown and Company, 34 Beacon Street, Boston, Massachusetts, 02106

1971, 365 pp

The merger that formed the nation's largest railroad was followed by the nation's largest bankruptcy. This book examines the Penn Central situation from merger through bankruptcy. Written by two reporters from the Philadelphia Bulletin, the book covers the merger, some of the history of the two railroads prior to the merger, the planning of the merger, and some of the opposition to the merger. It also covers the Red Team and Green Team situation, the passenger and commuter problems, the financial ventures of some company officers, and the diversification program of the company. It further covers the freight transportation, union work rules, and bad weather problems suffered by the company. Finally, the book covers the last desperate efforts to avoid bankruptcy through private, and then government guaranteed, loans. In the last chapter, the book concludes that the merger could not have worked because it faced too many disadvantages.

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Little, Brown and Company, 34 Beacon Street, Boston, Massachusetts, 02106, Repr PC: \$7.95

**041232****ROAD-TO-ROAD DATA EXCHANGE**

Germany, JW, Southern Pacific Transportation Company

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

Dec. 1971, pp 12-14

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Road-to-road data exchange has been the subject of many investigations in industry but the results have been disappointing. Two other transportation industries, the Trucking Industry and the Airline Industry, are examined to find their success patterns. It is recommended that advance waybill information be in a form that could become a direct input into the computer system of the connecting carriers. Having advance information of this type would provide the capability for expeditious movement of the car by the connecting road and provide the input for advanced car scheduling systems. The exchange data requirements are industry-wide requirements but their implementation depends upon the action of individual companies.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041233****MODERN COMPUTER OUTPUT METHODS**

Pew, AE, III, Burlington Northern

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

Dec. 1971, pp 15-31, 5 Fig

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Computer users operate under three different modes of operation: 1) batch, both local and remote; 2) demand-time sharing, for conversational users; and 3) real-time for remote data entry and processing. The development and evolution of data processing operations at Burlington Northern is outlined.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041234****EXCHANGE OF DATA BETWEEN SHIPPERS AND CARRIERS OF ALL MODES**

Guilbert, EA, Transportation Data Coordinating Committee

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

Dec. 1971, pp 32-41

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The Transportation Data Coordinating Committee (TDCC) was created to achieve the use of uniform data codes, formats, and documentation for the distribution process. Six TDCC industry/government task force have concentrated on the stabilization of specific data areas that require uniform coding if computer information interchange is to be accomplished. These are: 1) commodity coding; 2) geographic coding; 3) patron (TDCC is in negotiations with Dun &



Bradstreet for the issuance and maintenance of a special transportation file of patrons); 4) Tariff Task Force; 5) Carrier Task Force; and 6) advanced concepts.

**ACKNOWLEDGEMENT**

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**041235**

**WORKSHOP ON MATERIALS DATA SYSTEMS—  
CONSIDER AUTOMATIC PURCHASE ORDERS**

Hoffmeister, HM, Missouri Pacific Railroad  
Rathert, RE, Missouri Pacific Railroad  
Kholbreecher, JA, Missouri Pacific Railroad

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

Papers, Dec. 1971, pp 42-58

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The design and implementation of the Missouri Pacific Railroad's "Automatic Purchase Orders", which is a flexible computer oriented ordering system, are discussed.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041236**

**MARKETING APPLICATION WORKSHOP—MARKETING  
MONITORING SPECIAL EQUIPMENT**

Jacobsen, RL, Denver and Rio Grande Western Railroad

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

Dec. 1971, pp 59-88, 6 Fig

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The Denver and Rio Grande Western Railroad has developed a system of marketing and controlling distribution of special equipment not in "assigned pool" service. This system was originally developed for covered hopper cars, but designed to encompass other special equipment later. A series of slides is included.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041237**

**MARKETING APPLICATION WORKSHOP—THE TIME  
PERFORMANCE ANALYZER**

Shamberger, RC, Southern Railway

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

Dec. 1971, pp 89-98, 3 Fig, 2 Tab

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The Time Performance Analyzer System is based on generalized information retrieval techniques, and since problem solution is dependent upon communication and inter-face between all departments responsible for car utilization and pool cars control, the system is "on-request" by any department. In order to be entirely flexible the TPA can produce up to 99 service study models per run.

**ACKNOWLEDGEMENT**

Association of American Railroads.

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**041238**

**MARKETING APPLICATIONS WORKSHOP—USE OF EDP  
IN EXPLOITATION OF ACCOUNTING RECORDS TO  
SATISFY SALES AND MARKETING INFORMATION  
REQUIREMENTS**

Spaeth, N, Missouri Pacific Railroad

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

Dec. 1971, pp 99-112, 8 Tab

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The Missouri Pacific Railroad developed a revenue statistical system to help satisfy the information needs of Sales and Marketing personnel. There was a need for a fast way to obtain movement and revenue information for marketing decision-making, and also a need to provide field sales personnel with revenue oriented sales solicitation. This system is described in detail and exhibits are included.

**ACKNOWLEDGEMENT**

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**041240**

**WORKSHOP ON IMPROVED EQUIPMENT UTILIZATION  
USING EXISTING DATA BASES**

Bosler, JW, Louisville and Nashville Railroad

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

Dec. 1971, pp 130-132

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Car utilization, as it is known today, began its growth in the late fifties. The Louisville and Nashville Railroad, after ten years of experience in computer oriented car utilization programs, is now implementing a new system called "Positive Control". It consists of three basic fundamentals for acquiring good car utility: 1) keeping assigned cars in their proper pools; 2) current adjustment in assignments to reflect peaks and valleys in loading patterns; 3) preventing the misuse of its special cars by foreign carriers. An explanation of the Louisville and Nashville Railroad's use of the AAR's TRAIN PROGRAM is given, along with a short historical review of the L&N's car utilization programs since 1960.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041241  
WORKSHOP ON IMPROVED EQUIPMENT UTILIZATION  
USING EXISTING DATA BASES**

Odom, PE, St. Louis-San Francisco Railway

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

Dec. 1971, pp 133-140, 3 App

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The St. Louis-San Francisco Railway is a centralized railroad with operating headquarters in Springfield, Missouri. In addition to the computer being located there, distribution of equipment, both freight cars and intermodal, are also handled there. The existing data base is called MICS (Management Information Control System). The present version, installed in April 1970, established a central data base covering each status change, in sequence, for each car, trailer, containers, engine, caboose, way bill and train. This requires that each change of status be reported in the same sequence that it occurs. This provides a data base making available to users information required for day-to-day or minute-to-minute operation through inquiry or extracted on tape for preparation of periodic historical reports. An appendix enumerates all activities that are reported on all equipment.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041242  
COMPUTER SECURITY WORKSHOP—DATA PROCESSING  
SECURITY**

Imbery, LS, Illinois Central Gulf Railroad

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

Dec. 1971, pp 141-145

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Computer centers should be centrally located and not on the ground level nor on the very bottom floor of a building. The separation of the library from the center is a must. All centers should have adequate fire protection. Control of access to the computer center should be tight and security checks made regularly. Some examples of how the Illinois Central Railroad deals with computer security are given.

**ACKNOWLEDGEMENT**

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**041243  
COMPUTER SECURITY WORKSHOP—SOFTWARE AND  
DATA SECURITY**

Curran, RF, Union Pacific Railroad

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

Dec. 1971, pp 146-149

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The protection of software and data from accidental or intentional disclosure to unauthorized persons, and from unauthorized modification or destruction is discussed. Security measures of Union Pacific Railroad are outlined.

**ACKNOWLEDGEMENT**

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**041244  
COMPUTER SECURITY WORKSHOP—AIR  
CONDITIONING/BACKUP POWER AS COMPONENTS OF  
COMPUTER SECURITY**

Phillippi, JK, Bessemer and Lake Erie Railroad

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

Dec. 1971, pp 140-153

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Modern data processing equipment cannot exist without proper air-conditioning. Backup power has also become almost a necessity since a relative lack of power supply integrity has become a fact of life in the last five years. Installation of air-conditioning and measures taken to prevent power problems at Bessemer and Lake Erie Railroad are described. Justification and costs of backup power are also discussed.

**ACKNOWLEDGEMENT**

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**041245  
COMPUTER SECURITY WORKSHOP—OFF SITE  
HARDWARE BACKUP**

Lacey, JJ, Elgin, Joliet and Eastern Railway

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

Dec. 1971, pp 154-158

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The backing up of batch type computer systems is presented. A method of determining and providing back-up capabilities is outlined. Some problems encountered by the Elgin, Joliet and Eastern Railway are discussed.

**ACKNOWLEDGEMENT**

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**041246  
COMPUTER SECURITY WORKSHOP—EVACUATION AND  
RECALL**

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

Dec. 1971

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Evacuation, although it is considered an important element of computer security, is usually neglected and shunted to the side by most sophisticated security planners. An evacuation plan is proposed: 1) An orderly and efficient transition from normal to emergency operations; 2) Delegation of emergency authority; 3) Assignment of emergency responsibility; 4) Coordination between responsible individuals to assure an efficient sequence of execution; 5) Safety precautions to be taken during the evacuation; 6) How and where to obtain assistance; and 7) Location of special equipment such as portable communication systems, fire extinguishers, fire hoses, flashlights. Recall procedures are also outlined.

**ACKNOWLEDGEMENT**

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**041247****MECHANICAL DATA SYSTEM WORKSHOP**

Cumbea, BA, Jr, Chessie System

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

Dec. 1971, pp 163-169

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

Computers are playing an ever increasingly important role in managing Mechanical Department functions and responsibilities. Development and implementation of a data systems for the locomotive fleet at C&O and B&O was started in 1966, and later, the car department system was developed and is presently in the implementation stage. Also, a new automated diesel engine lubricating oil control laboratory incorporating an IBM 1130 computer was installed at the B&O Cumberland Locomotive shop. All systems are effectively meeting the original design objectives and each is described and discussed.

**ACKNOWLEDGEMENT**

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**041248****MECHANICAL DATA SYSTEMS WORKSHOP**

Caldwell, WE, Jr, Southern Railway

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

Dec. 1971, pp 170-176

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The computer, as an essential tool of good management for the Railroads' Car Departments, is discussed.

**ACKNOWLEDGEMENT**

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**041249****NETWORK SIMULATION MODEL WORKSHOP**

Sauder, Southern Railway

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

Dec. 1971, pp 177-178

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The AAR Network Model was officially a project of the Committee on Analytical Techniques. As early as 1966, suggestions were being made that this Committee sponsor development of a generalized model for the industry. In 1967, the Network Model Subcommittee was created to undertake this task and in March 1971 the finished model product was officially accepted. The Subcommittee is now attempting to expose to the industry this newly developed Network Model, and to evaluate any extensions to the basic product that are felt to be worthwhile for the industry, such as the feasibility of adding a costing capability to the system.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041251****ENGINEERING APPLICATIONS WORKSHOP**

Nichols, GL, Louisville and Nashville Railroad

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

Dec. 1971, pp 186-211, 1 Fig, 2 App

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

In mid-1969 the Louisville and Nashville Railroad entered a new dimension in real time problem solving and data processing. A Remote Batch Entry System "ROBBIE" was developed by using sophisticated software to incorporate the powerful job capabilities of an IBM 360/50 computer with an efficient file communication system. ROBBIE enables engineers over the entire L&N system to have direct access to powerful central computers for problem solving in a near real time mode. A description and explanation of ROBBIE, as well as in example problem are included.

**ACKNOWLEDGEMENT**

Association of American Railroads

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**041252****ENGINEERING APPLICATIONS WORKSHOP**

Knittel, RH, Atchison, Topeka and Santa Fe Railway

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

Dec. 1971, pp 212-235

Papers presented at the 1971 AAR Annual Meeting, New Orleans, Louisiana, September 20-21, 1971.

The Atchison, Topeka and Santa Fe Railway complex contains two Model 360/65 systems as well as supporting Model 50 and Model 20 systems. The capabilities of the current system are explored and an example is given of one application which depicts how the data system is utilized in both programming and machine usage: two programs called respectively CLOG and CLEAR which deal with the creation and updating of the obstruction masters and the actual simulation of a given excess load configuration.

**ACKNOWLEDGEMENT**

Association of American Railroads

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041601

**RAILROADS AND THE INDUSTRIAL MIGHT OF AMERICA**

Watkins, HT, Chessie System

Progressive Railroad (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 1, Jan. 1973, pp 37-41, 2 Phot

For a decade, the real role of the railroads in national life has been largely ignored by a public and government more concerned with the "essentiality" of inter-city rail passenger service. About the time that problem was being overcome, the national focus shifted almost exclusively to railroad corporate catastrophe and chaos. Actually, the majority of railroads are paying their bills, are paying their taxes, do not have government loans, and are paying wages to employees and a return on investment to shareowners. These railroads are concentrating on moving efficiently and economically the million and one things the consuming public needs. The story of the Chessie System is given as an example of those positive, but largely unheard railroad stories. Railroad nationalization is rejected as a cure for the problem lines of the East who are facing bankruptcy.

**ACKNOWLEDGEMENT**

Progressive Railroad

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Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606, Orig PC: \$

041605

**A SINGLE INTERMODAL TRANSPORTATION COMPANY**

Claytor, WG, Jr, Southern Railway

Transportation Journal (American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60606)

Mar. 1972, pp 31-38

A presentation at the Eleventh Biennial Seminar of the American Society of Traffic and Transportation, Pennsylvania State University, University Park, Pennsylvania, September 10, 1971.

The movement of all kinds of freight in this country is carried on—and regulated—on a piecemeal basis, largely because of the historical way the various modes of transportation developed. Shippers would prefer to deal with a single source for their entire transportation package. But the only organization that can sell them total transportation would be a single intermodal transportation company, able to own and use any and all means of transportation under one management, with one sales force and one pricing policy, one accounting system and one corporate responsibility. After reviewing all the pros and cons, it can be concluded that total transportation is practical and is needed more than ever in today's complex transportation world.

**ACKNOWLEDGEMENT**

Transportation Journal

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60 Repr PC: \$2.50

041606

**THE TRANSPORTATION CHALLENGE**

Gill, LE, University of Southern California

Transportation Journal (American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60606)

Mar. 1972, pp 39-45

In our rapidly expanding economy, the demand for freight services is expected to double by the year 1986. A coordinated transportation system, under separate ownership, in which traffic is permitted to move by the most efficient means, is on absolute necessity. This paper points out five ways to reach this goal: (1) Implementation of a total cost approach to transportation; (2) Efficient use of containerization to decrease handling and other problems; (3) Establishment of through or joint rates under a single will of lading; (4) Establishment of regional intermodal terminals; and (5) Establishment of intermodal companies to cut handling costs and provide an efficient system for dispersal of goods.

**ACKNOWLEDGEMENT**

Transportation Journal

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60 Repr PC: \$2.50

041607

**A SINGLE INTERMODAL TRANSPORTATION COMPANY**

Frale, OH, Consolidated Freightways

Transportation Journal (American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60606)

Mar. 1972, pp 53-58

A presentation at the Eleventh Biennial Seminar of the American Society of Traffic and Transportation, Pennsylvania State University, University Park, Pennsylvania, September 10, 1971.

The concept of intermodal transportation has become a common one but its development to date has been slow and somewhat erratic. If intermodal service is desirable and if it is economically sound as it appears to be, and since its development through cooperation among the several modes has been somewhat less than spectacular, the question naturally arises, would its development be more rapid under the concept of "single intermodal transportation companies?" Strong intermodal companies could provide the broad financial base necessary to support investment in expansion and evolution of the system. An illustrative example of one intermodal company, Consolidated Freightways, is given:

**ACKNOWLEDGEMENT**

Transportation Journal

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60 Repr PC: \$2.50

041619

**EMPLOYMENT GUIDELINES**

IEEE Spectrum (Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10017)

Vol. 10, No. 4, N X-73-043, Apr. 1973, pp 57-60

This is the first edition of the "Guidelines to Professional Employment for Engineers and Scientists" as recently approved by the IEEE Board of Directors. The guidelines were developed as the result of the efforts of 17 engineering societies, including IEEE, to answer the need for scientists and engineers to play a larger role in the development of employment policies—a need that became particularly evident when the large-scale layoffs and relocations of recent months revealed certain deficiencies on the part of some employers. It is emphasized that the guidelines are by no means to be considered final and complete as they stand, but are in a state of dynamic change. The document is subject to periodic review by the participating societies for the sake of keeping it current, and a mechanism has been set up for incorporating revisions and amendments into future editions. However, even in this preliminary form the guidelines should

help to provide a firm basis for the employment of professional engineers and scientists and are expected to have significant impact in improving relations for employers of these professionals.

**ACKNOWLEDGEMENT**

IEEE Spectrum

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10 Repr PC: \$1.50

**041629**

**PRINCIPLES OF ENGINEERING ECONOMY**

Grant, EL Ireson, WG

Ronald Press Company, 79 Madison Avenue, New York, New  
York, 10016

1970, 640 pp

This is a book about a particular type of decision making. It explains the principles and techniques needed for making decisions about the acquisition and retirement of capital goods by industry and government. Normally, such decisions should be made on grounds of long-run economy. Because engineers make many such decisions and make recommendations for many others, the body of principles and techniques relating to them has been called "engineering economy." The same concepts and methods that are helpful in guiding decisions about investments in capital goods are useful in certain kinds of decisions between alternative types of financing. Applications to these other areas of decision making are also discussed in this book. It can serve as a working manual for engineers, management personnel, government officials, and others whose duties require them to make decisions about investments in capital goods. The underlying philosophy regarding comparisons of alternatives is the same as in previous editions. As before, continued emphasis throughout the book is placed on the following two important points: (1) It is prospective differences between alternatives that are relevant in their comparison. (2) The fundamental question regarding a proposed investment in capital goods is whether the investment is likely to be recovered plus a return commensurate with the risk and with the return obtainable from other opportunities for the use of limited resources. The purpose of calculations that involve the time value of money should be to answer this question.

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Ronald Press Company, 79 Madison Avenue, New York, New  
York, 10016, Orig PC: \$12.00

**043528**

**THE LIFE AND DECLINE OF THE AMERICAN RAILROAD**

Stover, JF

Oxford University Press, 200 Madison Avenue, New York, New  
York, 10016

1970, 324 pp

This book reviews the history of railroads in America. Chapters cover the early development of railroads in the east, the westward development over the prairies and across the continent, the integration of lines into systems, and the corruption and problems of the Granger era. The book then moves into the maturity of the industry in the early twentieth century, the new competition (auto, truck, bus, airline) that developed, and the industry's performance during two world wars. The book accounts for the decline of the railroad industry in the twentieth century. The book then moves into the passenger problem, and into changes in freight service. The book reviews the changes in railroading: diesels, radio, computer systems, unit trains, trailer and container on flat car service, and modern freight cars. The book concludes that the inherent economy of the flanged wheel on

the steel rail will never become truly obsolete, and finishes with consideration of commuter problems, merger trends, and excess plant capacity.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Oxford University Press, 200 Madison Avenue, New York, New  
York, 10016, Orig PC: \$7.50

**043532**

**PRECEDENCE NETWORKS FOR PROJECT PLANNING AND CONTROL**

Burman, PJ

McGraw-Hill, Incorporated, 1221 Avenue of the Americas, New  
York, New York, 10020

374 pp, 226 Fig

Announcement of this publication appeared in the Winter issue of the AREA News, 1973.

In this book can be found the various aspects of precedence networks introduced in logical order starting with the basic forms of network analysis—arrow diagrams, Gantt charts, bar graphs—and working through to advanced techniques and applications. Planned for use for either as a ready reference by the experienced project manager or as a self-instruction guide for the novice, the book deals with all phases of project planning: time, resources and costs. It includes methods of validation both diagrammatic and by computer, as well as allowances for seasonal uncertainties and other contingencies. The text presents and shows how to calculate alternative paths and possible repetition of paths.

**ACKNOWLEDGEMENT**

AREA News

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McGraw-Hill, Incorporated, 1221 Avenue of the Americas, New  
York, New York, 10020, Orig PC: \$15

**043593**

**EFFICIENCY IN DATA PROCESSING WILL BE KEY GOAL IN 1973**

Railway System Controls (Simmons-Boardman Publishing  
Corporation, 350 Broadway, New York, New York, 10013)

Vol. 4, No. 2, Feb. 1973, 6 pp

In general railroads, and also transit authorities, will be refining computer programs and general fine-tuning of systems analyses to make data processing more efficient. Other trends shaping up in '73 include: 1) Reducing the number of reports required by operating personnel. Also, a general reduction in the number of computer-produced paper reports. 2) More computer-produced microfilm reports, and general increase in use of microfilm in the areas of tariff printing and usage. Microfilm will find increased use as a storage medium for waybills and other pertinent records. 3) Increased use of intelligent, remote terminals especially in yard offices to provide edited material for input to a central computer. 4) Increased use of time-sharing for in-house work by various departments of railroads. Also, expansion of time-sharing using computers outside the railroad. 5) Increased use of optical character recognition devices to provide automatic input to computers of data from accounting records, waybills, payroll documents, etc.

**ACKNOWLEDGEMENT**

Railway System Controls

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: \$0.7

043597

**TELECOMMUNICATIONS AND THE COMPUTER**

Martin, J

Prentice-Hall, Incorporated, Englewood Cliffs, New Jersey, 07632  
1969, 469 pp

The announcement for this book was published in IEEE Spectrum, October 1970, Volume 7 number 10.

This book goes a long way toward filling a real need. More and more, computer systems depend upon communication networks. Although it is easy for a prospective customer to obtain a profusion of descriptive literature and technical data concerning the computer components of his system, it is extremely difficult to obtain similarly detailed technical information concerning the relevant communication links and services. Martin has presented a wealth of such information. His book will be most valuable to those approaching the problem from the computer side, but it will also be extremely useful to communications specialists who wish to understand the requirements of their computer-oriented customers. A broad range of subjects is covered—transmission mediums from open-wire lines to satellites, switching systems from step-to-step to electronic systems, data transmission terminals, network organization and so on. The level of presentation is largely non-mathematical and within the grasp of a technically oriented nonengineer. The technical accuracy is high. This is remarkable considering the breadth of material discussed. This book will be a valuable reference work for all who have a technical interest in the application of telecommunications to computer requirements.

**ACKNOWLEDGEMENT**

IEEE Spectrum

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Prentice-Hall, Incorporated, Englewood Cliffs, New Jersey, 07632,  
Orig PC: \$14.00

043610

**ENGINEERING ECONOMY APPLIED TO INVESTMENT IN RAILROAD PLANT AND EQUIPMENT**

Roggeveen, VJ, Stanford University  
Reed, RR, Department of Transportation

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp 7-29

Engineering Economy (EE) analysis is a method of applying compound interest mathematics to business decisions between alternative locations and designs. This method of analysis has proven better than intuitive decision making for the railroad business. An actual application of the EE method is presented with a decision to replace the deck on a railroad viaduct over a bridge. The choice is made between two deck alternatives by estimating construction costs, maintenance and repair costs, service life, and the going rate of interest. However, the wrong conclusions were made due largely to faulty estimation of data. Referring to additional examples, the EE method of analysis can properly apply to various levels of complexity.

**ACKNOWLEDGEMENT**

Railway Systems and Management Association

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611, R PC: \$5.00

043611

**FREIGHT CAR INVESTMENT**

Loftus, DL, Western Pacific Railroad

Railway Systems and Management Association, 163 East Walton

Street, Chicago, Illinois, 60611

Feb. 1969, pp 31-36, 1 Tab

The importance of economic analysis in the area of freight investment is stressed for the efficient allocation of resources and minimization of business risk. High quality value judgments then follow. Possible future changes in freight equipment requirements are projected, based on obsolescence and economic life. Another value judgment comes in estimating the profitability of traffic to be carried, with respect to R&D, operating costs, and revenue. Economic analysis gives sound basis to value judgments concerning the determination of the total freight car investment and the effects on the future rate of return.

**ACKNOWLEDGEMENT**

Railway Systems and Management Association

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Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611, R PC: \$5.00

043612

**DISCOUNTED PER DIEM RATES**

Landow, HT, Illinois Central Gulf Railroad

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp37-48, 15 Fig, 3 Tab

The per diem rate has to be discounted since the value of the car is calculated at depreciated book value. This presents a problem for the analyst to find the single equivalent value or price that will cover a series of per diem charges. A value is determined by the following values: (1) Compound Amount Factor used to transform present car worth into some future compounded amount (2) Compound Amount Factor used to transform a series of payments into a future value, (3) Present Worth Factor used to take a series of future payments and transform it into present worth, (4) Present Worth Factor used to take a single future payment and transform it into present worth, (5) Sinking Fund Factor used to go from a future payment to a series of equivalent prior values, and (6) Capitol Recovery Factor used to transform present worth into an equivalent uniform series. There are many ways to calculate the discounted per diem from this data. One method is chosen and corresponding tables are constructed. The single adjusted per diem value is determined without these calculations and using only the original cost value in the table.

**ACKNOWLEDGEMENT**

Railway Systems and Management Association

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043616

**ROAD PROPERTY INVESTMENT**

Romoff, HM, Canadian Pacific Railways

Railway Systems and Management Association, 163 East Walton Street, Chicago, Illinois, 60611

Feb. 1969, pp 75-103, 6 Fig, 11 Tab

The Canadian Pacific Railroad developed a system called Appraisal of Investment Decisions (Engineering Economy) in order to achieve optimal allocation of scarce capital expenditures. The railroad chose a decentralized internal organization for implementation due, in part, to its sprawling geographic location. Manuals were compiled on Road Property Investment, Equipment Investment, and Communications Investment for in-house distribution. The first manual describing the Discounted Cash Flow method of appraisal, Part I, accompanies the article.

**ACKNOWLEDGEMENT**

Railway Systems Management Association

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Railway Systems and Management Association, 163 East Walton  
Street, Chicago, Illinois, 60611, R PC: \$5.00

**043918**  
**THE BLOB CHART**

Beimborn, EA Garvey, WA

Industrial Engineering (American Institute of Industrial Engineers,  
25 Tech. Park/Atlanta, Norcross, Georgia, 30071)

Vol. 4, No. 12, Dec. 1972, pp 17-19

A new way to chart allocation of resources over time is simple, yet visually effective. It is possible to note milestones, periods of slack, critical paths, and the interrelationships of tasks in this type of chart, and it can be converted to a Gantt chart or PERT network. The development of a blob chart is illustrated by a student project in engineering systems design whose purpose was to find an optimal solution to the problem of increasing the mobility of the elderly in a socioeconomically and politically feasible manner.

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American Institute of Industrial Engineers, 25 Tech. Park/  
Atlanta, Norcross, Georgia, 30071, Re PC: Req Price

**044012**  
**RAILWAY STAFF AND UNIONS IN THE SEVENTIES**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 12, Dec. 1971, pp 470-472

Traditionally opposed both to change and to the use of commercial criteria in management, railway unions are now faced with the demands of a changed financial environment. Mr. J.H. Rees, Consultant to the European Conference of Ministers of Transport suggests co-operation between unions and management in meeting long-term objectives would increase security and provide unions with more responsibility for their future.

ACKNOWLEDGEMENT  
British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044013**  
**THE RIGHT SIZE OF TRAIN CREW**

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 3, Mar. 1972, pp 102-104

Wide discrepancies between the number of men required to crew a train in different parts of the world reflect the varied success of railway managements in overcoming patterns of working dictated originally by steam locomotives and trains without continuous brakes. In North America, for example, archaic work rules result in an output of only 4,030 train-km annually for each train crew man employed.

ACKNOWLEDGEMENT  
British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044050**  
**SCIENTIFIC SELECTION AND STAFF CARE BRING  
PRODUCTIVITY PAY-OFF**

Gardner, TW

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 11, Nov. 1972, pp 411-413

As railways move towards less labour-intensive methods of working, the quality and efficiency of staff becomes of greater importance. Rhodesia Railways has achieved a significant improvement in productivity since introducing scientific staff selection and training methods designed to match aptitude and job as closely as possible.

ACKNOWLEDGEMENT  
British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044072**  
**MILWAUKEE: MARKETING FOR TWO-WAY PROFIT**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 4, Feb. 1973, pp 22-30, 3 Phot

In an interview with Gus Welty, Milwaukee Road's President, Worthington L. Smith, discusses at length its traffic prospects, its plant, its market-development emphasis and its competitive situation.

ACKNOWLEDGEMENT  
Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

**044074**  
**HOW SHIPPERS RATE RAILROAD FREIGHT SALESMEN**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 4, Feb. 1973, pp 38-39

The "good-time, cigar passing, freight salesman" is gone. Railway Age, participating in a traffic poll among eighty-six shippers found that forty-four shippers saw some improvement in the quality of railroad freight selling in the last five years, sixteen reported only deterioration, and twenty-six saw no change. Today's salesman might be a step or two above his predecessor, but still has many steps to go to the top of the ladder.

ACKNOWLEDGEMENT  
Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

**044089**  
**BAR WORKS HARD TO COMPENSATE FOR SAGGING  
POTATO TRAFFIC**

Houser, FN

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, pp 30-31, 3 Phot

BAR's potato traffic, which had been hurt by unregulated trucking, has more than doubled and it is expected that there will be a 33 percent increase over the 1971-1972 seasons when all results are in. The largest segment of BAR traffic is paper and it accounts for nearly a quarter of BAR loads. In January 73, paper set an all-time record—up 19 percent over the previous January. Wood fiber is expected to be up 42 percent. Piggyback volume has doubled during 1972 and is expected to go up another 50 percent this year. BAR has gone into an accelerated track maintenance program; it has consolidated 26 agency stations into 13 regional centers with substantial savings in wages maintenance and taxes. BAR has also started a major program for upgrading its communications facilities.

ACKNOWLEDGEMENT  
Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

044090

#### CANADIAN NATIONAL'S NEW APPROACH TO FREIGHT SALES TRAINING

Roberts, JF, Canadian National Railways

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, pp 34-35, 2 Phot

Canadian National introduced a training program in 1965 to introduce their salesmen in the application of sales and marketing concepts and to upgrade their skills, in general, as industrial salesmen. Such things as product knowledge and the necessity of recognizing the customer's needs were covered. A fairly detailed course in physical distribution was also included. In addition marketing orientation seminars for CN management at all levels and in all departments have been introduced. Seventy new business centers, called Servocentres are in the process of being established. When fully operational, sometime in 1975, each Servocentre will be provided direct access to a sophisticated bank of computers, with the results that each center will possess the ability of providing instantaneous answers to the customer queries bearing on car distribution and movement, documentation, tracing, rates, and service.

ACKNOWLEDGEMENT  
Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: No charge

044091

#### RAILROADS PLAN TO HAUL BALED TRASH

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 6, Mar. 1973, p 50

Baled trash, compacted in 1-1/2-ton cubes by a facility of the American Solid Waste Systems at St. Paul, Minn., has been undergoing rail haulage tests. The material can be used for sanitary landfill and railroads offer the best prospects for economical, long-distance movement from cities which produce astronomical and growing quantities of garbage. A landfill operator is looking at the possibility of moving compacted Chicago trash to a site he has acquired and Rock Island provided two bulkhead flat cars which showed the practicability of the proposed system. Penn Central has developed a "resource recovery vehicle," a bulkhead flat with removable sides, that has been loaded at the St. Paul facility and was displayed in Cleveland, Ohio, which is due to receive a demonstration grant from the Environmental Protection Agency covering rail haulage of compacted trash.

ACKNOWLEDGEMENT

Railway Age

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013; Repr PC: No charge

044251

#### THE INFERNAL EDP TRIANGLE

Moore, J, Reader's Digest.

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp 1-11, 8 Fig, 4 Ref

This article is an attempt to describe the problems between the Data Processing Department, the Users, and Management. There is a distinct lack of communication between the User and EDP. The User wants everything perfect and disillusionment sets in...dates are missed...promises are broken...management meantime, wants EDP to cut the costs...EDP blames the User for being fickle, and management for not understanding all the things EDP could do if Management would just give his backing...Examples of interaction between EDP, the Users and Management are given and it is concluded that the three must share their problems with one another for "only united will they find the right way".

ACKNOWLEDGEMENT  
Railway Management Review

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Orig PC: \$7.50

044253

#### ECONOMIC AND OPERATING PROBLEMS OF HIGH SPEED INTERCITY RAIL PASSENGER SERVICE

Laughlin, MD, Peat, Marwick, Mitchell and Company

Railway Management Review (Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611)

Vol. 72, No. 4, 1972, pp 28-50, 4 Tab, 1 App

The economics of high speed (120 mph) rail operation with conventional cars and locomotives are examined and some of the issues which must be resolved before such service becomes feasible are discussed. The economic analysis includes an example of the probable cost of 120 mph operation which demonstrates the magnitude of investment and operating costs. This example is then used to illustrate the potential impact of various areas of cost reduction. The key safety issues of grade crossings, signal systems, municipal speed ordinances and train control devices and firemen are covered. Finally, the role of advance train concepts such as turbo-train is discussed, followed by a brief description of the institutional problems which must be overcome before implementation.

ACKNOWLEDGEMENT  
Railway Management Review

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Railway Systems and Management Association, 181 East Lake Shore Drive, Chicago, Illinois, 60611 Orig PC: \$7.50

044264

#### WORKERS' ATTITUDES AND TECHNOLOGY

Wedderburn, D Crompton, R

Cambridge University Press, 32 East 57th Street, New York, New York, 10022

1972, 176 pp



The notification of this publication appeared in Mechanical Engineering, April 1973, Volume 95, Number 4.

This work presents a further contribution to our understanding of the complexities which shape attitudes and behavior at work. Based on material obtained from a survey of workers employed by a single British firm—who operate production systems as widely different as continuous-flow chemical production and yarn spinning—this book highlights features of the production system which are crucial in influencing attitudes and behavior within the work setting and, through a comparison of craftsmen and semi-skilled workers, also illustrates the influence of differences of expectations upon work attitudes and behavior. The authors reject any approach which could be called technologically determinist but nonetheless seek to show that a comparative approach to the study of behavior in organizations may still fruitfully take as its starting point technology and the systems of control which are devised for the planning and execution of the task.

#### ACKNOWLEDGEMENT

Mechanical Engineering

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Cambridge University Press, 32 East 57th Street, New York,  
New York, 10022, Orig. PC: \$12.50

#### 044267

#### MORALE ON RAILROADS TODAY

American Association of Railroad Superintendents, 18154  
Harwood Avenue, Homewood, Illinois, 60403

Proceeding, June 1971, pp 82-89

The 75th Annual Meeting of the American Association of  
Railroad Superintendents was held at Le Chateau Champlain,  
Montreal, Quebec Canada, June 15-17, 1971.

Morale is very low when compared with the level of morale that existed 20 or 30 years ago. Morale in the industry suffers from two basic causes: Environment and Dissension. Seven major factors affect morale: (1) the feeling of insecurity, (2) the reduction of the pay differential between the skilled and the less-skilled, (3) deteriorating physical plants, (4) the railroad need for 24 hour, seven day operation aggravates the absenteeism problem, (5) the tendency to accept from employees less than their best leads to individuals becoming slipshod, (6) contractual agreements, with their built-in featherbedding, rob employees of their desire to produce efficiently, (7) supervisors assume that wages alone are sufficient motivation, and fail to use other approaches to motivate people. The report then discusses what factors contribute to an improvement in the workers' morale, and what can and should be done. Discussion of the committee report is presented on pages 27-42.

#### ACKNOWLEDGEMENT

American Association of Railroad Superintendents

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American Association of Railroad Superintendents, 18154  
Harwood Avenue, Homewood, Illinois, 604 Repr. PC: Req.  
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#### 044270

#### APPLICATIONS DIGEST, COMMITTEE ON ANALYTICAL TECHNIQUES

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

Jan. 1972

This report was prepared by the Subcommittee for Information  
Exchange.

This Applications Digest is a compendium of applied analytical techniques within the railroad industry. Its intent is to serve as a prime information exchange medium for individuals responsible for the successful application of analytical techniques in applied problem analysis, design, and solution. The Digest is now in its third year of publication. When originally released in mid-1969, it represented the efforts of member railroads represented on the Committee on Analytical Techniques. Since that time, three supplements have been issued representing new and expanded applications. The list of contributors has been expanded to include not only other member roads but also transportation oriented groups and agencies outside the industry. The scope of the digest itself has been expanded to include cross reference subject indices and references to technical journals.

#### ACKNOWLEDGEMENT

Association of American Railroads

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#### 044271

#### APPLICATIONS DIGEST, COMMITTEE ON ANALYTICAL TECHNIQUES, APPLICATIONS DIGEST SUPPLEMENT 1973

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

1973

This is the 1973 supplement to the Application Digest, Committee on Analytical Techniques. It contains an updated Keyword-in-Context Index and an "abstract status" sheet listing which abstracts have been revised, deleted or added.

#### ACKNOWLEDGEMENT

Association of American Railroads

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#### 044309

#### SAFETY THROUGH TRAINING—A COMPUTERIZED LOCOMOTIVE AND TRAIN SIMULATOR

Hazen, PL, Singer Company  
Booth, WC, Singer Company

Institute of Electrical and Electronics Engineers, 345 East 47th  
Street, New York, New York, 10017

Paper C73929-7-IA, Feb. 1973, 6 pp, 8 Fig

This paper was recommended by the IEEE Land Transportation Committee of the IEEE Industry Applications Society for presentation at the 1973 Joint ASME/IEEE Railroad Conference, St. Louis, Mo., April 11-12, 1973. The price is \$1.35 for members.

Safety is a major concern not only of everyone in the railroad industry in general, but of those of us responsible for the training of locomotive engineers in particular. Here, as in the acquisition of most skills, the familiar adage "practice makes perfect" applies. For many decades, locomotive engineers acquired this practice by the familiar on-the-job training (OJT) method. The fireman or prospective locomotive engineer spent years following the procedure practiced by the engineer on numerous runs, perhaps even encountering an occasional emergency. A long period of OJT was necessary before the trainee became a qualified locomotive engineer. Recent advances in simulation technology, including the advent of high performance, low cost mini-computers, have permitted the design of simulators which can subject the trainee to a "Real World" environment in a training simulator. Through sophisticated mathematical modeling techniques, it is now possible to generate all significant environmental cues with a

high degree of fidelity, thereby subjecting the trainee to a synthetically generated and accurately controllable 'Total Environment'.

**ACKNOWLEDGEMENT**

Institute of Electrical and Electronics Engineers

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York, 10 Repr PC: \$1.80

**044438**

**DOUBLE SHIFTING RAIL-LAYING EQUIPMENT--WHAT ARE THE ECONOMIC FACTORS**

Grogan, GE

Railway Track and Structures (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 69, No. 3, Mar. 1973, pp 32-35, 2 Fig, 1 Phot

The author states that the same general principles used here to develop the economics of double-shifting rail-laying equipment may also be applied to the double-shifting of other operations, such as track surfacing and tie renewals. A second shift for a rail-laying operation can be practicable, but seldom economical. As an alternative to hiring a second shift, paying indirect fringe benefits and assuming a host of potentially irksome details, working shift No. 1 a slightly longer period is considered.

**ACKNOWLEDGEMENT**

Railway Track and Structures

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**044518**

**ECONOMIC STUDIES OF THE GLASS FRACTIONS FROM MUNICIPAL-INCINERATOR RESIDUES**

Johnson, PW Barclay, JA

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

IC8567, 1973, 44 pp, 19 Fig

The announcement for this Information Circular appeared in the Bureau of mines--New Publications, March 1973, Monthly List 695.

Economic studies of four processes for using the glass fractions obtained from processing municipal incinerator residues are presented. Three processes--brick production, floor tile production, and glass wool production--use the colored glass fraction from an incinerator residue separation plant, and the fourth process, glass spheres production, uses the colorless glass fraction. The value of the product obtained from each of the plants was calculated on the basis of the interest rate of return method. Each of the processes appears economically attractive when comparing the product values with estimated selling prices. However the effect of the products on the market size and price must be determined.

**ACKNOWLEDGEMENT**

Bureau of Mines

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Government Printing Office, Superintendent of Documents, Washington, D.C., 20402, Repr PC: \$0.7  
2404-01294

**044519**

**BUREAU OF MINES RESEARCH PROGRAMS ON RECYCLING AND DISPOSAL OF MINERAL-, METAL-, AND ENERGY-BASED WASTES**

Kenahan, CB Kaplan, RS Dunham, JT Linnehan, DG

Bureau of Mines, College Park Research Center, College Park, Maryland, 20742

IC8595, 1973, 54 pp, 27 Fig

The announcement for this Information Circular appeared in the Bureau of Mines--New Publications, March 1973, Monthly List 695. This publication updates Bureau of Mines Information Circular 8529, which was issued August 1971.

A summary of Bureau of Mines research on recycling, reuse, and disposal of mineral-, metal-, and energy-based wastes is presented, accompanied by an extensive bibliography of related publications. The Bureau's waste recycling and disposal program is directed toward the following four main areas of research and development: (1) extraction of mineral, metal, and energy values from urban refuse; (2) upgrading and recycling of automotive and related ferrous and nonferrous scrap; (3) recovery, utilization, and stabilization of mine and mill processing wastes; and (4) recovery and reuse of values from industrial waste products.

**ACKNOWLEDGEMENT**

Bureau of Mines

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Government Printing Office, Superintendent of Documents, Washington, D.C., 20402, Repr PC: Req Price

**044523**

**TRANSPORTATION POLICY NEED: "A COMMANDING IDEA"**

Boyd, AS

Illinois Central Railroad, 135 East Eleventh Place, Chicago, Illinois, 60605

1972, 14 pp

This speech was prepared for the 15th Annual Transportation Seminar, Saint Anselm's College, Manchester, New Hampshire, May 16, 1972.

Transportation policy has to be put into some new perspective vis-a-vis the nation's policies for economic growth, urban renewal, environmental integrity, energy, even defense and international trade. An outline of what the future is going to be like and some ideas on how to improve the situation are given.

**ACKNOWLEDGEMENT**

Illinois Central Railroad

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Illinois Central Railroad, Corporate Relations Department, 135 East Eleventh Place, Chicago, Illinois, 60605, Repr PC: Req Price

**044555**

**NATIONAL FORUM ON "TRANSPORTATION DATA SYSTEMS"**

Transportation Data Coordinating Committee, Suite 309, 1101 17th Street, NW, Washington, D.C., 20036

Proceeding, 1972, 57 pp

Fourth National Forum, Addresses and Reports presented at the Presidential Ballroom, Statler Hilton Hotel, Washington, D.C., December 5-6, 1972.

The purpose of this Forum was to provide an awareness and a knowledge of the programs and events that are leading to the modernization of transportation administrative systems. The proceedings contain: (1) TDCC President's report; (2) TDCC—The Industry Catalyst; (3) Data Systems Impact on Railroads; (4) Shipper/Carrier Systems—A Concept for the Future; (5) Motor Carriers Computer Data Systems; (6) Luncheon Address; (7) Computerization in Sealand's Container System; (8) Airline Cargo Data System; (9) Forwarders Data Systems; (10) Intermodal Data Systems; (11) Facilitation of Shipper/Carrier Systems; (12) The FCC Forward Look; (13) Transportation Commodity Descriptions and Codes; (14) International Commodity Description and Coding; (15) Commodity Coding Activity; (16) Computerization, Data Transmission and Air Cargo Transportation; (17) Business Payments Systems to coordinate Manual and Automatic Data Processing with Electronic Fund Transfer; (18) Freight Payment Data Systems; (19) Bank Freight Payment Systems; (20) Freight Payment Systems; and (21) Summary Statement.

**ACKNOWLEDGEMENT**

Transportation Data Coordinating Committee

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Transportation Data Coordinating Committee, Suite 309, 1101  
17th Street, NW, Washington, D.C., 20036, Repr PC: Req  
Price

**044558****PRODUCTIVITY: THE KEY THAT CAN UNLOCK THE RAILROAD FUTURE**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 27-29

Productivity means a lot of things. It means capital productivity, investment with a meaningful return. It means people productivity, the maximizing of human resources. It means service improvement, reliability improvement, more runthrough and unit-train operations, more equipment and better utilization of it, less damage to customers' shipments, stepped up maintenance of track and other fixed plant, better terminal operations, more significant use of computer capabilities, an increase in innovation as applied to rail marketing and service design. Productivity means a better product and better ways of selling it. It means new demonstration of railroad essentiality to the public and its elected representative, so that needed legislative and regulatory reforms can be made. On the subject of the legislative situation, help could come from Washington, but it will not come easily. There will also be problems for the railroads on the labor/management front but down-to-earth demands could mean a fairly smooth ride. Capital expenditure will add up to 3.7 billion. Car orders will turn slightly upward as railroads try to open new markets. For shippers, there will be a greater reliability of service. An image problem remains and Amtrack is part of it and, of course, the big question is still: What will happen to the Penn Central?

**ACKNOWLEDGEMENT**

Railway Age

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

**044559****CAR ORDERS MAY REACH 60,000 THIS YEAR—BUT THERE ARE IFS**

Houser, FN

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 32-33

An upturn of car orders of possibly 15% is predicted for 1973. This could mean that the order total will be between 55,000 and 60,000 cars. With a fleet of 1.8 million, and an average car life of thirty years, about 60,000 cars are retired each year. Because the replacement rate is below that needed to meet peak requirements of shippers, Henry A. Correa, president of ACF, has been working with others in the industry to develop "a private National Freight Car Pool." E.T. Ahnquist, president of Pullman-Standard, says that the level of carbuilding activities in 1973 "will depend in substantial measure, on prompt action by the Congress to enable railroads to serve the fast growing economy."

**ACKNOWLEDGEMENT**

Railway Age

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

**044564****BUILDING ON A FIRM FOUNDATION**

Welty, G

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 61-62

Based on what management and labor were able to do in 1972, the odds almost have to favor a continuation of the building process. But, there will be a new set of problems to contend with. Among them: 1) Solutions will have to be found for the difficulties besetting the Railroad Retirement System. 2) Wage settlements will have to be reached with all rail labor organizations. 3) In the wage-settlement context, both management and the organizations will have to consider Phase 3 of the Administration's economic-guideline program. 4) Both management and operating crafts will be challenged to continue the work-rule's modernization process begun last year. 5) Some consideration will have to be given to what happens (or does not happen) on individual properties, in individual situations.

**ACKNOWLEDGEMENT**

Railway Age

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**  
Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

**044565****EASTERN PROBLEMS CLOUD AN OTHERWISE BRIGHTENING PICTURE**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 66-75, 10 Fig, 13 Tab

In the over-all, 1972 had its great moments, its times of significant accomplishments, but it was not consistent. Freight-traffic volume and freight revenues were up, a new railroad came into being, Illinois Central Gulf, a new company came into being, as Chicago & Northwestern employees bought the railroad from Northwest Industries. Rail management and rail labor organizations went quite a way toward improving relationships. Railroads won selective rate increases though not in the amount requested. 1972 was a good year for new services and improved rail service quality. Rail commuter traffic was up again. Major industry projects got under way, in the areas of track/train dynamics and freight car information systems. FRA refined its track standards and issued its initial equipment standards. And the first phase of an AAR/RPI tank car test and research project was completed. Both DOT and the AAR underwent reorganization. Railroads made more progress than in any recent year and maybe more than in any year ever, in getting attention for their legislative proposals.

**ACKNOWLEDGEMENT**

Railway Age

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**044566  
CAR AND LOCOMOTIVE ORDERS AND SIGNALING  
STATISTICS**

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 82-88.

The statistics are for 1972 and cover: Freight-train car orders;  
Locomotive orders; Locomotive orders-Foreign; Freight-trains car  
orders-Canada; Locomotive orders-Canadian domestic; Freight-train  
car orders-Canadian Foreign; Railroad signaling installed in 1972;  
and Railroad communications installed in 1972.

**ACKNOWLEDGEMENT**  
Railway Age

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[Faint, mostly illegible text, likely bleed-through from the reverse side of the page]

037115

**MAJOR TRANSPORTATION FACILITIES PLAN, UPPER CUMBERLAND DEVELOPMENT DISTRICT**

Colby, JM

Upper Cumberland Development District, Cookeville,  
Tennessee HUD-Tenn P-138(G)

TN-UPPD-1-72-138-2, Final Rpt, June 1972, 167p

The report consists of an inventory and analysis of existing transportation facilities and a plan for future transportation facilities. It contains an inventory of Tennessee highways, from principal arterial interstate through minor collectors. An inventory of rights-of-way, pavement widths, capacities, and conditions of all highways as classified by the Tennessee Department of Highways is included. Airports and rail facilities are inventoried, detailing the nature of each facility and its capabilities. The report presents a plan for transportation facilities needed for the years 1980 and 1990, and shows all existing and proposed regional transportation facilities for the Upper Cumberland Development District by general location, type and capacity.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210798

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$10.50, Microfiche: \$0.95  
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037116

**SOUTH ALABAMA REGIONAL TRANSPORTATION SYSTEM**South Alabama Regional Planning Commission, Mobile,  
Alabama HUD-AL-04-09-1005-3  
Mobile.

AL-04-09-1005-3, Final Rpt, 7107-7206, June 1972, 146p

The report presents a summary of the recommended improvements in the Region's transportation network; also, presented is a railroad relocation plan for the Mobile Urban Area. Primary emphasis is placed upon an organizational framework for policy and technical planning efforts affecting the development of the transportation system.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-210783

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PB-210783

039018

**THE HIGH SPEED GROUND TRANSPORTATION ACT OF 1965. 2ND REPORT**

Department of Transportation, Washington, D.C.

Sept. 1967, 55 pp

The report complies with Section 10 (a) of the High Speed Ground Transportation Act of 1965 as amended by the Department of Transportation Act of October 15, 1966, requiring the Secretary of Transportation to report to the President and the Congress, not less often than annually, with respect to activities carried out under the Act. The first report covered the fiscal year ending June 1966 and was submitted in September 1966. The three basic activities authorized by the Act are: Research and development in high speed ground transportation; Demonstration projects to determine the contributions that high speed ground transportation could make to more efficient and economical intercity transportation systems; A national program to improve the scope and availability of transportation statistics. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-176115

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PB-176115

039153

**THE HIGH SPEED GROUND TRANSPORTATION ACT OF 1965. 3RD REPORT**

Department of Transportation, Washington, D.C.

July 1969, 132 pp

See also Rept. no. 2, PB-176 115:

The Northeast Corridor simulation model was assembled and exercised; a comprehensive inventory of technology options was prepared; two rail passenger service demonstrations are beginning and the first system for broad, regional transportation analysis was established. A national capability in R and D and transportation analysis was established in universities and in private industry across the country. The impact of the HSGT program is depicted. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-185702

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NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-185702

039185

**COST ANALYSES FOR NECTP. VOLUME I. HIGH SPEED GROUND MODES**

Dienemann, PF Large, JP

Resource Management Corporation, Bethesda, Maryland

Vol. 1, Dec. 1969, 77 pp

Contract DOT-7-35297

See also Volume 2, PB-190 943.

The report documents the cost analysis of high speed ground transportation modes, including rail and tracked air cushion vehicles, performed for the Northeast Corridor Transportation Project of the U. S. Department of Transportation. It presents descriptions of each mode, the derivation of research and development, investment and operating costs, and an appraisal of results. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190942

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NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-190942

039186

**EXTERNAL COSTS AND BENEFITS ANALYSES, NECTP**

Dienemann, PF Lago, AM

Resource Management Corporation, Bethesda, Maryland

NECTP-224, Dec. 1969, 107 pp, 10 Ref

Contract DOT-7-35297

Rational decision-making in the transportation sector requires consideration of externalities third party effects. The study quantifies the incommensurable and imputed monetary values of costs and benefits of alternative NEC transportation system impacts on: noise, air pollution, aesthetics, safety, air and highway congestion, as well as the employment benefits from system construction. A final tableau of social costs and benefit impacts summarizes the monetary values of

incremental impacts of new NECTP transportation modes—high-speed rail, tracked air cushion vehicles, STOL, and VTOL—over the social costs of a 1975 base case composed of auto, bus, conventional air, and the continuation of current NEC demonstration rail projects underway. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190944

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PB-190944

**039187**

**THEORY AND IMPLEMENTATION OF COST AND BENEFIT ANALYSIS OF TRANSPORTATION SYSTEMS: THE NECTP**

Sanchez, L      Morgenstern, O      Heiss, KP      Young, KH      Monsod, S

Resource Management Corporation, 7910 Woodmont Avenue, Bethesda, Maryland

Dec. 1969, 298 pp

Contract DOT-FR-9-0044

Prepared in cooperation with Mathematica, Inc., Princeton, N.J.

The report presents the theory and application of transportation cost analysis methodology within a framework based on economic efficiency principles and on the application of welfare economics to decision-making in the transportation sector. The principles governing the efficient allocation of resources in transportation are set forth and adjustments required for market imperfections are discussed. Economic theory is applied to costing methods and techniques, and finally both transportation cost and productivity are brought together within a Pareto optimal framework for purposes of exploring the proper use of costs in decision-making. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-190945

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NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-190945

**039816**

**A GUIDE TO THE 1972 NATIONAL TRANSPORTATION NEEDS STUDY**

Department of Transportation, Office of Systems Analysis and Information, Washington, D.C.

Jan. 1971, 36 pp

The U.S. Department of Transportation has undertaken a national transportation needs study which will be used as a basis for legislative and expenditure recommendations to the President and the Congress. It is intended that the study results will be forwarded to Congress in 1972. This is the first study of what is intended to be a continuing assessment of the nation's transportation system, with biennial reports to Congress.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207525

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207525

**039817**

**NATIONAL TRANSPORTATION PLANNING MANUAL (1970-1990). MANUAL A: GENERAL INSTRUCTIONS**

Department of Transportation, Washington, D.C.

Jan. 1971, 73 pp

Revision of report dated 1970, see also report dated July 1970, PB-194964.

The manual is the first of a series of four being distributed to the Governor of each state. The manuals solicit state and local governmental assistance in meeting the statutory responsibilities of the U.S. Department of Transportation (DOT). These responsibilities encompass the recommendation of transportation policy to the Congress, and the administration of a number of federal transportation programs.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207526

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207526

**039818**

**NATIONAL TRANSPORTATION PLANNING MANUAL (1970-1990). MANUAL C: URBAN PUBLIC TRANSPORTATION**

Department of Transportation, Washington, D.C.

Jan. 1971, 66 pp

See also reports dated Jan. 1971, PB-207527, and PB-207529.

The Department of Transportation has undertaken a national transportation needs study, which will be used as a basis for transportation policy recommendations to the President and the Congress, and for administering Federal transportation programs. This manual supplements Manual A by providing guidance to the urban planning group designated by the Governor to prepare estimates of urban public transportation needs (1970-1990) and capital improvement programs (1974-1978 and 1979-1990).

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207528

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-207528

**039837**

**TRANSPORTATION SYSTEMS TECHNOLOGY: A TWENTY-YEAR OUTLOOK**

Kovatch, G      Barber, JB      Casey, RF      Zames, G

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts, 02142

DOT-TSC-OST-71-10, Final Rpt, Aug. 1971, 194 pp

An overall technology assessment of new and improved transportation systems is given. A broad survey has been made of new systems concepts for passenger and freight transportation in urban and interurban applications. Results of the findings are reported and projections of expected innovations and improvements are made along with discussion of some of the major limitations to wide scale applications over the next two decades. Recommendations for research and development emphasis in some of the more promising areas are given where possible although full analysis of cost factors and comparative analysis of competing systems were beyond the scope of this investigation.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-204800

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PB-204800

039901

**RAIL REORGANIZATION: THE PANACEA THAT PASSED**

Shaw, RB

Trains (Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233)

Vol. 33, No. 4, Feb. 1973, pp 26-28, 1 Tab, 1 Phot

Reorganization under bankruptcy laws, which in the past usually solved a railroad problem for at least a generation, today does not seem to solve anything. Bankruptcy and reorganization offers no solution for a carrier that cannot cover operating costs. The rail industry as a whole earned only one and one-half percent on its invested capital, much of which is sunk. But capital is mobile, and that which can flow out from the railroad industry will do so. Many railroads have moved to an industries' setup. A severe disinvestment in the railroad industry seems inevitable. Perhaps one-half or two-thirds of existing trackage will be scrapped. The process should have a stopping point. As marginal lines disappear and total investment is reduced, competition among railroads will diminish, and the stronger survivors will have a greater volume of traffic to route over their main lines. If economic factors are allowed to follow their course, we should soon see a leaner but healthier rail system.

**ACKNOWLEDGEMENT**

Trains

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Kalmbach Publishing Company, 1027 North 7th Street, Milwaukee, Wisconsin, 53233, Repr PC: \$0.75

041308

**THE FUTURE OF AMERICAN TRANSPORTATION**

Prentice-Hall, Incorporated, Route 9W, Englewood Cliffs, New Jersey, 07632

This book was edited by Ernest Williams and announced in Railway Locomotives and Cars, V145, N9, September 1971.

With transportation dollars buying fewer and poorer passenger and freight services, the American Assembly series has turned its attention to America's mismanagement of its transportation industries. Seven authors agree that today's situation is "substantially shaped by our government policies," listing inadequate federal legislation, impractical planning, and actual misappropriation of public funds.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Prentice-Hall, Incorporated, Route 9W, Englewood Cliffs, New Jersey, 07632, Repr PC: \$2.45, Ori HC: \$5.95

041320

**UMTA: NEW TEAM, SAME BALL GAME**

Railway Age (Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013)

Vol. 174, No. 1, Jan. 1973, pp 25-27, 1 Tab

This article, which is primarily a news article on the new appointments at DOT and UMTA, contains a one page summary of rail transit and commuter cars delivered in 1972, of the backlog of orders, and of expected 1973 orders.

**ACKNOWLEDGEMENT**

Railway Age

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$0.6

041603

**HOW MUCH ECONOMIC REGULATION OF RAILROADS?**

Progressive Railroading (Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606)

Vol. 16, No. 1, Jan. 1973, Executive, Vice Presi, dent

This article is adapted from an address made in 1972 at the 15th Annual Transportation Seminar at St. Anselm's College.

The basic tenet about regulations is that the soundest rational transportation system in this country will develop from vigorous competition, intramodal as well as intermodal, with limited but equal regulatory control. In this article the present paradox of regulation for the railroads is discussed.

**ACKNOWLEDGEMENT**

Progressive Railroading

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

Murphy-Richter Publishing Company, 9 South Clinton Street, Chicago, Illinois, 60606, Orig PC: \$

041604

**A CRITIQUE OF DOT TRANSPORT POLICY**

Nelson, JC, Washington State University

Transportation Journal (American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60606)

Mar. 1972, pp 5-22

In "A statement on National Transportation Policy" the Department of Transportation eschews the limited approach of suggesting changes in particular policy measures or in standards of regulation for an overall evaluation of where the United States should be heading in reformation of its transport promotional and regulatory policy. The emphasis in the DOT report is on the need for fundamental re-examination of transport policy as a whole and on the broad economic, social and environmental criteria to be applied in that re-examination. This broad-gauge approach has been criticized as too academic, too general, too comprehensive to be widely understood and as involving too much reading for most people concerned with transport policy. Criticism, and questions are discussed in this article under the headings: "The DOT framework and overall conception; DOT's concept of urgent problem's in the transport sector; DOT's alternative policy paths; DOT's new directions and thrusts for an effective new approach for transport policy; A critical evaluation for DOT's outlines for a modern transportation policy.

**ACKNOWLEDGEMENT**

Transportation Journal

**TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:**

American Society of Traffic &amp; Transportation, 547 West Jackson Boulevard, Chicago, Illinois, 60 Repr PC: \$2.50

041611

**TECHNOLOGICAL CHANGE IN REGULATED INDUSTRIES**

Brookings Institution, 1775 Massachusetts Avenue, NW, Washington, D.C., 20036

1970

Announcement of this book appeared in Transportation Journal, Spring 1972.

This volume, the second in a Brookings program of Studies in the Regulation of Economic Activity, contains five papers as well as a summary of the conclusions that emerged from their discussion. The effects of regulation on innovation are discussed in the introduction; Chapter 2 is a theoretical paper that examines the effect of regulation

on technological change; Chapters 3 and 4 analyze the impact of regulation on electric power and communications industries; Chapter 5 traces the development and adoption of new aircraft by commercial carriers since 1932; Chapter 6 covers the impact of economic regulation on firms carrying freight by surface transportation; Chapter 7 presents a summary of the papers and the conclusions of the conferees on the policy issues discussed in the paper.

#### ACKNOWLEDGEMENT

Transportation Journal

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Brookings Institution, 1775 Massachusetts Avenue, NW,  
Washington, D.C., 20036, Repr PC: Req Pri

041614

#### WE SHOULD OPEN UP THE HIGHWAY TRUST FUND NOW

Dear, A

Reader's Digest (Reader's Digest Association, Incorporated,  
Pleasantville, New York, 10570)

Vol. 102, No. 612, Apr. 1973, 4 pp.

Due to its publication in a national magazine, this article may influence public opinion.

Public transit has been plagued by deteriorating service and rising fares. More than 268 mass-transportation companies have gone out of business since 1954, and 20 more are on the brink of bankruptcy. The passengers now commute by car. The one quarter of our population that is too poor, too old, or too handicapped to own a car needs public transportation. At the root of the problem is the Highway Trust Fund, each time a new highway is opened, it produces an increase in the revenue for the Highway Trust Fund, which thus increases the money available for building highways. Cities are forced to use highway funds for highways, or lose them. Cities need the flexibility to plan their own transit expenditures. It is proposed that the Federal Highway Act be amended to allow cities to use their share of the Trust Fund money for bus or rail transit. The automobile contributes to the increasing energy shortage. Automobiles are responsible for at least 39 percent of our air pollution, and up to 80 percent in some cities. Balanced transportation is needed.

#### ACKNOWLEDGEMENT

Reader's Digest

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Reader's Digest Association, Incorporated, Pleasantville, New  
York, 10570, Repr PC: \$0.60

041617

#### TOWARD A NATIONAL RAILWAY SYSTEM

Langdon, J, Jr, Penn Central Transportation Company

New York Times (New York Times Company, 229 West 43rd  
Street, New York, New York, 10036)

Apr. 1973, p 14F

This appeared in the New York Times, Volume CXXII, No. 42-071.

In its struggle to regain viability, Penn Central faces the problems of regulatory control and union contracts. Additional problems, not as well known, arise from the fact that Penn Central, as an operating entity, is locked into a national railroad system that does not perform as a real system. The Penn Central interchanges freight cars with 70 other major railroads and joins with them in providing through service nationwide, but it does so under conditions that would not be tolerated if there were any choice. The trouble is that an effective system depends upon the concurrence of the railroads that comprise it and such concurrences are difficult to come by. The railroads must function as a system, one railroad cannot function in

isolation from others. The pricing of railroad freight traffic service is often done by regions, but when a general rate increase is involved, all railroads try to join in the application. Right now, one railroad refuses to apply for a modest increase to offset wage increases, with the result that there is no hope for any of the roads in that region and probably in the nation. If instead of being obliged to return cars made empty to their owning lines, the Penn Central could make full use of them for local loadings, greater efficiency would be the result. Railroads are now in a disagreement of the division of interline revenues. Individual railroads fight each other on every possible front. They protest competitors' mergers. Perhaps the time has come for the private ownership to consider an organizational structure to preside over the different operating units, possibly along the lines of AT&T or a holding company.

#### ACKNOWLEDGEMENT

New York Times

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New York Times Company, 229 West 43rd Street, New York,  
New York, 10036, Repr PC: Req Price

043283

#### A SIMULATION ANALYSIS OF THE ECONOMIC CONSEQUENCES OF ESTABLISHING MULTI-MODAL TRANSPORTATION COMPANIES

Tripp, RS

Air Force Institute of Technology, School of Engineering,  
Wright-Patterson AFB, Dayton, Ohio

AFIT-TR-72-6, Tech Rpt, Dec. 1972, 247 pp

The study is concerned with the examination of the economic consequences of establishing multi-modal transportation companies. The purpose is to examine the economic impact various combinations of parameters or test factors have on a transportation company formed from single modal carriers, and to determine on the average which organizational form, transportation company or single modal carriers, is economically superior. A simulation model was developed for the comparison of a transportation company with single modal carriers. The test factors selected for analysis are: the operating ratios of truck and rail modes, the load factors of these modes, the amount of available capacity, and the level of shippers' logistics constraints. (Author)

#### ACKNOWLEDGEMENT

National Technical Information Service, AD-753780

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NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
AD-753780

043521

#### PENN CENTRAL: THE ROAD TO NATIONALIZATION

Samuelson

Washington Post (Washington Post Company, 1150 15th Street,  
NW, Washington, D.C., 20003)

Newspaper, Mar. 1973, p B3

The Penn Central is slowly-but surely inexorably drifting toward nationalization. Under railroad bankruptcy proceedings, the railroad is supposed to be kept running and reorganized into a profit making company. However, a change in management has not brought the improvement many expected. Penn Central's real undoing has been the geography and history of the Northeast. Heavy industry isn't growing rapidly, travel distances are short, and freight yard costs are high. Total freight traffic is not what it was in 1955. And the problems won't go away no matter who owns Penn Central. Anti-pollution laws have caused utilities to shift to cleaner coal, resulting in an annual revenue loss of about \$75 million for Penn Central. At the present, erosion of the estate continues, and without government action, the time beyond which Penn Central cannot allow adoption of



the master plan, and get the railroad at hand. The trustees maximum requirements for making the railroad profitable include: (1) a one-time gift of \$600 to \$800 million to modernize, (2) the elimination of one man from every freight train crew, by attrition, (3) abandonment of service on 5,000 miles of lightly used track, and (4) additional underwriting by governments and Amtrak of losses on commuter and inter-city passenger trains. Congress is not eager to go the Amtrak route with Penn Central, but Judge Fullam in effect delivered an ultimatum: Either Congress make some very drastic—and unpopular—changes that will allow the railroad to become a profitable private company or he may simply shut it down October 1. As much as Congress would like to ignore Fullam, it can't. The Penn Central is virtually indispensable. The rail unions have never been known as weaklings on Capitol Hill, and if the government comes in, there may be a way of preserving the 5,700 jobs from crew reduction and of minimizing abandonments. The states and localities want real estate tax payments resumed, and want abandonment minimized. Shippers along the 5,000 miles of track to be abandoned claim there will be cases of genuine hardship. The bondholders' interest is relatively simple: Let the government pump in some money to resume real estate taxes, the conflicting interests, virtually anything the back on its feet as quickly as possible. Given the conflicting interests, virtually anything the government does about Penn Central will offend powerful forces. Congress may take the least unpopular and most expensive-way out (nationalization in some form).

## ACKNOWLEDGEMENT

Washington Post

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043530

## ENTERPRISE DENIED: ORIGINS OF THE DECLINE OF AMERICAN RAILROADS, 1897-1917

Martin, A

Columbia University Press, 440 West 110th Street, New York, New York, 10025

1971, 402 pp

This book presents an examination of the American Railroad Problem during the Progressive Era. Throughout the Progressive Era the increased tempo of industrial activity continued to be matched by the expanding diversity and complexity of economic life, with the gross national product nearly doubling in these decades. Although the railroads poured large sums of money into physical plant and equipment during this period, the book suggests that even more massive sums were needed for improvements to prevent the industry from falling behind. Operating costs were continually increasing during this period, but rate increases were not allowed to offset the increased operating costs. The railroads were not in good shape to meet the demands of World War I due to starvation for adequate funds for improvement during the Progressive Era. The key argument of the book is the suggestion that the unwillingness of the ICC to grant general rate increases during a period of policy uncertainty commencing with the enactment of the Hepburn Act in 1906 prevented the flow of investment funds from keeping pace with the demands upon the railroad system and paved the way for a collapse in the profitability of railroad operations after 1911. An appendix estimates the net new investment required by the American railroads in relation to demands upon them for the period 1889-1915. A bibliography is included.

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Columbia University Press, 440 West 110th Street, New York, New York, 10025, Orig PC: Req Price

043534

## LET'S PUT AN END TO TRANSPORT STRIKES

Bennett, RK

Reader's Digest Association, Incorporated, Pleasantville, New York, 10570

Mar. 1973, pp 83-86

Transport strikes have a severe impact on our economy. The transportation industry is at the center of our economy, and transport strikes sent shock waves through segments of our economy. Figures are quoted to indicate the losses to various industries due to transport strikes. Frequently, Congress must pass last minute emergency legislation to avoid serious transport strikes. Some new solution is needed. Proposed is legislation to give the President power to: (1) extend the cooling-off period an additional 15 days, (2) require essential segments of the transport industry to operate for up to six months during a strike, and (3) require labor and management to submit 'last, best offers' if a compromise cannot be reached. A neutral three member panel would select the fairest of the two offers as a final settlement. Compulsory arbitration tends to cause the two sides to adopt extreme positions in expectation that an arbitrator will strike a balance. The 'final-offer selection' aims to penalize those clinging to extreme positions and to provide an inducement to reach a compromise position, or at least to narrow the differences. Due to publication in a national magazine, this article may influence public opinion on this issue.

## ACKNOWLEDGEMENT

Reader's Digest

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043536

## SIGNALS RED

Forbes (Forbes Incorporated, 60 Fifth Avenue, New York, New York, 10011)

Vol. 111, No. 3, Feb. 1973, 1 pp

The entire article is reproduced here.

Americans hot to nationalize the Penn Central had better learn fast from Britain's mistakes, warns David Bowick, 49, chief executive of the British Railway Board, which marks 25 years of nationalization this year by adding a projected \$100 million in operating losses to its \$150-million annual subsidy. It's not just the losses that bother Bowick, who feels the day is past when "any country can operate its national rail network without government aid." Rather, his lament is what happens when the civil servants replace the railroaders at the long-term planning table. "When you separate current operations from long-term planning," he says, "you can be in trouble." The last time the British government took heed of its railwaymen was when the system embarked in 1955 on the \$5-billion modernization program that by the early Sixties made the British rail network a model for the world. At that point the then government began to dictate to the railroad—for example, forcing it to keep fares down as an anti-inflation measure, and designing coaches that knocked the ends off station platforms, locomotives whose lack of side windows made the engineer unable to see down the length of his train. All this, coupled with declining official interest in, and declining allocations for capital investment, led to what Bowick calls the "running down of the system"—almost an inevitability when a railroad becomes just one more drain on the public purse. The warning for American railroaders rings loud and clear. If the signal calls for nationalization, make sure you have a powerful lobby. You'll need it as much after nationalization as you did before.

## ACKNOWLEDGEMENT

Forbes

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10011

**043596**  
**THE UNIONS**

Johnson, H     Kotz, N

Simon and Schuster Incorporated, 1 West 39th Street, New  
York, New York, 10018

671-78261-4, Oct. 1972, 6 pp

Third in a new series of in-depth national reports by the  
Washington Post.

THE UNIONS is a far-ranging survey of labor today—from  
George Meany to the rank and file worker on the assembly line—A  
potent force of twenty million Americans facing a troubled future.  
After decades of struggle and bloodshed, America's labor unions  
have put together a membership and a bargaining strength that make  
them the most powerful force in the nation. Today with their direct  
challenge to the President over wage and price controls, the question  
of union power has assumed political importance. In this factual,  
firsthand report, labor leaders and labor's enemies speak out on the  
condition of the unions: their political clout in Washington; the sen-  
sibility at the top; the violence and jurisdiction disputes; the disturbing  
backlash against equal opportunity for black and Puerto Ricans; the  
low work skills of the young—the challenging attitude toward work  
itself.

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simon and Schuster Incorporated, Pocket Books Division, 1 West  
39th Street, New York, New York, 10018, Repr PC: \$1.25

**043624**  
**RESEARCH, DEVELOPMENT AND DEMONSTRATION  
PROJECTS**

Urban Mass Transportation Administration, 1612 K Street, NW,  
Washington, D.C., 20006

UMTA-RDD-72-4, June 1972, 316 pp

Directory of projects through 30 June 72.

The report is a comprehensive directory of research, develop-  
ment and demonstration projects sponsored by the Urban Mass  
Transportation Administration under Section 6 of the Urban Mass  
Transportation Act of 1964 (amended). Project number, approval  
and cost data, a brief textual summary of research objectives, and  
sources for further information are provided for all on-going and  
completed projects through June 30, 1972. Projects are listed under  
major topical areas, including: bus transit, rail transit, new systems,  
systems analysis, and planning research and service development.  
Appended materials include a listing of reports generated by the  
1967 New Systems Study and indexes to the projects by old and new  
project numbers, contractors, geographical areas, and subjects.  
(Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-213228

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NTIS, Repr PC: \$6.00, Microfiche: \$0.95  
PB-213228

**044033**  
**THE LEBER PLAN IN ACTION**

Leber, G

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 127, No. 9, Sept. 1974, pp 337-340

The West German government took a deliberate step towards  
planned integration of transport when it adopted the Leber Plan in  
1967. Looking back over the past four years, it's author is satisfied  
that trends which were clearly dangerous such as the imbalance be-  
tween road and rail in the the freight market—have been checked.

**ACKNOWLEDGEMENT**

British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044055**  
**AMTRAK: THE GAMBLE COMES OFF**

Hope, R

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 12, Dec. 1972, PP 460-463

America's National Railroad Passenger Corporation was  
launched in an unpromising atmosphere of political optimism, public  
disinterest and professional scepticism. As the social benefits of inter-  
city passenger trains gain wider acceptance, the editor reports that  
Amtrak has already achieved tangible gains in revenue and looks to  
further growth.

**ACKNOWLEDGEMENT**

British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044056**  
**RATE FLEXIBILITY WILL RESTORE RAIL PROFITS**

Ingram, JW

Railway Gazette International (IPC Transport Press Limited,  
Dorset House, Stamford Street, London SE1 9LU, England)

Vol. 128, No. 12, Dec. 1972, PP 451-453

Serious distortion of the US transport market results from official  
regulation of freight tariffs, states the author, Federal Railroad Ad-  
ministrator. This affects the whole economy and leads to serious un-  
der-utilisation of the railways where they could be of most value.

**ACKNOWLEDGEMENT**

British Railways Board

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
IPC Transport Press Limited, Dorset House, Stamford Street,  
London SE1 9LU, England, Repr PC: R Price

**044287**  
**THE NEW CASE FOR A RAILWAY TO ALASKA: OIL  
AND LNG BY UNITRAIN FROM THE ARCTIC**

Whitelaw, RL, Virginia Polytechnic Institute & State University

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

Paper 72-WA/RT-4, Nov. 1972, 12 pp, 4 Fig, 4 Tab, 12 Ref

Contributed by the Rail Transportation Division of ASME for  
presentation at the Winter Annual Meeting, New York, New  
York, November 26-30, 1972.

It has been shown in a Canadian study (2) that the logical  
market for Arctic oil and gas is the east central industrial area fo-  
cused at Chicago. A double-track rail trunk from Prudhoe Bay up the  
Mackenzie Valley can deliver 3 million bbl/day of oil at Edmonton

for 50¢/bbl, and 16 billion SCFD of LNG at Chicago for about 25¢ per MCF. With a second trunk from Edmonton through Rockies, Yukon and Alaska, this flow could be tripled and both costs reduced while paying all railroad construction and operating costs. Delivered at Chicago this gas would not only keep our continental pipeline network in use, but in regasification the LNG in a great meat packing area its refrigerating capacity could bring a significant economic return. Here for the first time is a genuine economic case for a railway to open up the untapped resources of the great northwest, with long term benefits far greater than Seward ever dreamed of.

**ACKNOWLEDGEMENT**

American Society of Mechanical Engineers

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ESL, Repr PC: 3DOL + 25¢/p, Microfilm: 3DOL + 5¢/fr

**044515****HOW TO SAVE URBAN AMERICA**

Regional Planning Association Incorporated, 235 East 47th Street,  
New York, New York, 10017

1973, 230 pp

This book, prepared by the Regional Plan Association, covers several of the critical issues facing the New York City metropolitan area. The issues covered are housing, transportation, environment, poverty, and cities and suburbs. To the extent that some of the proposed solutions are followed, they have implications for rapid transit, for commuter services, for the movement of building materials, and for the movement of fuels for utilities. To the extent that the proposed solutions may be adopted by other metropolitan areas, they may have implications for transportation far beyond New York.

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New American Library, P.O. Box 999, Bergenfield, New Jersey,  
07621, Repr PC: \$1.75

**044527****PUBLIC TRACKS, PRIVATE USERS**

Wyckoff, DD, Havard Business School

Transportation and Distribution Management (Traffic Service  
Corporation, 815 Washington Building, Washington, D.C.,  
20005)

Vol. 13, No. 4, Apr. 1973, pp 38-40, 2 Phot

The creation of a public railroad track system is an attractive and practical alternative to nationalization. Substantial portions of the railroad track of the country are in bad order. Privately owned track is subject to massive local taxation. Maintenance of private rights-of-way by railroads creates the necessity for large natural monopolies to absorb the fixed costs. There is substantial duplication of trackage over several major traffic lines. A public railroad track systems offers the advantage of making a major change in cost structure and services offered by the railroads while offering the potential of more efficient and productive use of facilities.

**ACKNOWLEDGEMENT**

Transportation and Distribution Management

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Traffic Service Corporation, 815 Washington Building,  
Washington, D.C., 20005, Repr PC: Req Pri

**044529****COMMON CARRIAGE THREATENED BY PRIVATE CARRIAGE**

Reistrup, PH

Illinois Central Gulf Railroad, 135 East Eleventh Place, Chicago,  
Illinois, 60605

Apr. 1973, 13 pp

This speech was prepared for delivery at the Pittsburgh Chapter Delta Nu Alpha, 10th Annual Education Seminar, Chatham Center, Pittsburgh, Pennsylvania, April 11, 1973.

A change in U.S. transportation policy is needed to counter the threat that private unregulated carriers pose to common, regulated carriers of all modes. Common carriage is threatened everywhere—railroads, highway carriers waterways—by forms of private carriage.

**ACKNOWLEDGEMENT**

Illinois Central Gulf Railroad

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Illinois Central Gulf Railroad, Press Relations, 135 East Eleventh  
Place, Chicago, Illinois, 60 Repr PC: Req Price

**044532****VNR METRIC HANDBOOK**

Fairweather, L Sliwa, JA

Van Nostrand Reinhold Company, 450 West 33rd Street, New  
York, New York, 10001

1972

The notification of this publication appeared in the 1972 Fall Issue of AREA News.

This handbook covers the needs of architects, building surveyors, civil engineers, interior and industrial designers, engineers, building product manufacturers, and far beyond. It contains the necessary details for planning building projects of all kinds, including offices, industrial buildings, public buildings, and housing, and for specific buildings ranging from indoor and outdoor athletic structures to warehouses. Included are basic metric data of an anthropometric nature for internal and external circulation and environmental subjects such as heating, thermal and sound insulation, and condensation, as well as structural design. Also included are unit dimensions for buildings, spaces, occupations and activities; dimensional sketches; terms employed in engineering services, structural design and loading; complete conversion factors, tables, and bibliography. At this time, when entry into the entire realm of metrics by the United States is imminent, implementation of this method by the architectural and manufacturing communities is mandatory, the announcement states.

**ACKNOWLEDGEMENT**

AREA News

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Van Nostrand Reinhold Company, 450 West 33rd Street, New  
York, New York, 10001, Orig PC: \$5.95

**044533****INDEX TO STANDARDS OF THE 1972 ANNUAL BOOK OF ASTM STANDARDS**

American Society for Testing and Materials, 1916 Race Street,  
Philadelphia, Pennsylvania, 19103

1972, 240 pp

The notification of this publication appeared in the 1972 Fall Issue of AREA News.

This book lists all the ASTM standards alphabetically by subject matter, indicates the numerical designation of each standard, and refers to the exact part of the 33-part Annual Book of ASTM Standards in which each standard is published. The second portion of the book lists the ASTM standards by numerical designation and also indicates in which part of the Annual Book of ASTM Standards each standard is published.

**ACKNOWLEDGEMENT**

AREA News

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
American Society for Testing and Materials, 1916 Race Street,  
Philadelphia, Pennsylvania, 19103 Orig PC: \$4.20

044563

**WASHINGTON: IN A CROWDED LEGISLATIVE HOPPER,  
STA REMAINS THE BIG ONE**

Beddow, R

Railway Age (Simmons-Boardman Publishing Corporation, 350  
Broadway, New York, New York, 10013)

Vol. 174, No. 2, Jan. 1973, pp 48-49

The proposed Surface Transportation Act of 1973 would: 1) Create a Revenue Financing division within DOT. For rails, the loan would cover track whose usage exceeds 5 million ton-mile a year, signals, switching, terminal facilities, communication and power systems, bridges, tunnels and other surface structures but not rolling stock; 2) Create a Federal Railroad Equipment Obligation Insurance

Fund administered by DOT which would insure interest and the unpaid balance of \$2 billion in equipment paper; 3) Authorize \$35 million for DOT aid to rails for a national rolling stock scheduling and control system; 4) Ban discriminatory state and local taxation of carrier property; 5) Permit rails to abandon uneconomic lines upon 90-day notice to ICC; 6) Instruct ICC to identify traffic moving at rates less than variable costs of services; 7) Direct ICC to establish standards and procedures for rate levels adequate to cover operating and capital costs, including return on investment; 8) Repeal Section 22 of the Interstate Commerce Act which gives lower rates to government; 9) Direct ICC to establish nondiscriminatory rates for the transport of recycled solid waste materials; 10) Permit ICC to submit budgets directly to Congress; 11) Require domestic water carriers of dry bulk commodities to publish rates; 12) Direct ICC to study rate bureaus and submit a report to Congress on their future.

**ACKNOWLEDGEMENT**

Railway Age

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Simmons-Boardman Publishing Corporation, 350 Broadway, New  
York, New York, 10013, Repr PC: No charge

039801

**QUARTERLY REPORTS: RAILWAY TECHNICAL RESEARCH INSTITUTE.**

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

Vol. 12, No. 4, Quart Rpt, Dec. 1971, 64p

See also Volume 12, Number 3, PB-204475.

Contents: Porewater pressure in soils induced by earthquake ground motions; Experiment of rock crushing breaking by microwave; Auto Multie; A theoretical study on AT feeding system; Properties of openwired leaky coaxial cable as a train telecommunication line; Proposals of improved signalling system for speed up on narrow gauge lines of JNR; Model analysis and simulation of inspection system of rolling stock; Failure prevention of air brake system; Material test and evaluation of carbon brushes for high speed traction motor; Performance test of the rail potential control device for SAN-YO SHIN KANSEN; Data transmission character using telephone circuit of SHF.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-207326

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PB-207326

039870

**QUARTERLY REPORTS: RAILWAY TECHNICAL RESEARCH INSTITUTE, VOLUME 13, NUMBER 2, 1972**

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

Vol. 13, No. 2, June 1972, 64 pp

See also Volume 12, Number 4, PB-207326.

Contents: Experimental study on application of static cone penetrometer to subsurface investigation of soft subsoils, Ground subsidence due to excavation and earth-pressure behaviour in tunnels, running safety test of car against derailment over an angular bend, resilient rail, ventilation of an underground railway with single-tracked shield tunnels, transverse vibration and instantaneous minimum clearance of wires caused by short-circuit current, analysis of traveling waves in an electric feeding system by digital computer, development of inspection car for overhead catenary system, linear train diagram recorder, how to predict the tooth root stress of a crowned gear, effect of non-linear characteristic on hunting of car-effect of side play between axle and bearing metal, statistical analysis of renewal data in rolling stock maintenance, unit load system for baggages, Technical notes.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212096

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-212096

039871

**SELECT BIBLIOGRAPHY ON INTERNAL RAILWAY TRANSPORT IN STEELWORKS**

Brinn, DG Lloyd-Owen, DR

British Steel Corporation, Strip Mills Division, London, England

BISRA-SM/BIB/782, Open Rpt, Aug. 1972, 18 Ref

The bibliography on internal railway transport in steelworks contains 18 references. (Author)

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212213

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PB-212213

040984

**TRANSIT RESEARCH ABSTRACTS**

Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418

Jan. 1973, 125 pp

This report was produced in cooperation with the Urban Mass Transportation Administration.

This document contains the abstracts of more than 450 Urban Mass Transportation Administration-sponsored research, development, and demonstration projects, technical studies, and other reports. It has been produced by the Highway Research Information Service. Financial support for the operation of this service within the Highway Research Board is provided by the Federal Highway Administration, the Urban Mass Transportation Administration, and all state highway and transportation departments.

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Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418, Repr PC: \$4.00

041227

**PRICE LIST OF PUBLICATIONS ISSUED BY TIME ASSOCIATION OF AMERICAN RAILROADS**

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

Jan. 1972, 61 pp

The main headings are: Operations and Maintenance Department; Research and Test Department; Management Systems Department; Economics and Finance Department.

**ACKNOWLEDGEMENT**

Association of American Railroads

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AAR, Repr PC: No Charge

041304

**WHO'S WHO IN RAILROADING AND RAIL TRANSIT**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013

456 pp

This book was edited by F.C. Osthoff and announced in *Railway Locomotives and Cars*, V146, N3, March 1972.

This 17th Edition with 456 pages contains 6,000 entries of which 1,500 are entirely new. Since 1885, Who's Who has been the standard, accepted authority. Again Who's Who is a gold mine of information about men important to you. They include railroad executives, leaders in the rail equipment and supply industries, railroad labor leaders, members of regulatory bodies, ICC personally transportation economists and specialists in rail finance in North America. Each entry gives the subject's present title; business and home addresses; age and marital status; education and clubs; details of his career.

**ACKNOWLEDGEMENT**

Railway Locomotives and Cars

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Orig HC: \$25.

041305

**JANE'S WORLD RAILWAYS**

McGraw-Hill, Incorporated, 330 West 42nd Street, New York, New York, 10036

1972, 606 pp, 1000 Phot

This book was announced in *Railway Locomotives and Cars*, V146, N2, February 1972.

The 1971-1972 edition reports that the past two decades have probably been the most important in railroading's century and a half history. The 606-page volume contains nearly a thousand photographs, over 200 maps and 150 diagrams. It gives details of virtually every rail line, including the 84,000-mile Soviet Railways which are estimated to have 10% of all trackage and handle 50% of total world freight traffic.

**ACKNOWLEDGEMENT**

*Railway Locomotives and Cars*

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
McGraw-Hill, Incorporated, 330 West 42nd Street, New York, New York, 10036, Orig HC: \$55.00

041312

**HANDY RAILROAD ATLAS OF THE U.S.**

Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013

1971

This Atlas was prepared by Rand McNally and announced in *Railway Locomotives and Cars*, V145, N7, July 1971.

The 1971 edition continues the style of previous issues, showing the railways on a state-by-state basis on maps which depict all routes, junctions, terminals and major cities, but do not have such extraneous material as drainage, county boundaries and highways. The mileages between key points are indicated; all railroads—trunkline and short line—are included. New tables have been added to show information about the railroads and states they serve, including the individual companies, their mileages and the locations of general offices. The Atlas should be a valuable reference for railroad officers and shippers, aiding in day-to-day operations and long range planning.

**ACKNOWLEDGEMENT**

*Railway Locomotives and Cars*

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Simmons-Boardman Publishing Corporation, 350 Broadway, New York, New York, 10013, Repr PC: \$3.4

041313

**JANE'S WORLD RAILWAYS**

McGraw-Hill, Incorporated, 330 West 42nd Street, New York, New York, 10036

1971, 686 pp

This book was announced in *Railway Locomotives and Cars*, V145, N4, April 1972.

"The railways are a growth industry," says the foreword to the 1970-1971 edition of this 686-page volume. Noting that a population growth of 4% annually would virtually double transportation requirements over a decade, Sampson sees a greater role for railways in the years ahead. However, increased business is not automatically assured and certainly cannot be traditionally handled. The 13th Edition contains a 177-page Supply Industry section, a 450-page Operating Industry section, and a 48-page Rapid Transit section.

**ACKNOWLEDGEMENT**

*Railway Locomotives and Cars*

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McGraw-Hill, Incorporated, 330 West 42nd Street, New York, New York, 10036, Orig HC: \$49.50

041683

**CONTRIBUTING INFORMATION TO RRIS**

Seamon, JH

Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418

73R01, May 1973, 3 pp.

The Railroad Research Information Service (RRIS) is a computer-based information service under development within the National Research Council with financial support from the Federal Railroad Administration. This service will give transportation administrators, engineers, and researchers rapid access to information about ongoing and completed railroad-related research. This paper identifies the type of material that is suitable for entry to RRIS Files and describes the mechanism of entry.

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Highway Research Board, 2101 Constitution Avenue, NW, Washington, D.C., 20418, Repr PC: No char

043239

**HIGH SPEED GROUND TRANSPORTATION ACT OF 1965**

Department of Transportation, 400 7th Street, SW, Washington, D.C., 20590

No. 5, Annual Rpt, 7010-7109, 1971, 200 pp

See also Rept. no. 4, PB-196 799.

The report is required by the High Speed Ground Transportation Act of 1965, and forms a status report on activities within the preceding year in R and D and demonstrations programs carried on under authorization of the Act. Progress is reported on: (a) Rail technology including track structures and development of the Rail Dynamics Laboratory; (b) The Metroliner and Turbo train demonstrations; (c) Advanced Systems including tracked air cushion vehicles and magnetically levitated vehicles; and (d) Advanced Technology including electric propulsion with linear motors and wayside power collection, controls and tunneling.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-212694

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-212694

043608

**DIRECTORY OF TRANSPORTATION LIBRARIES IN THE UNITED STATES AND CANADA**

Special Libraries Association, 235 Park Avenue South, New York, New York, 10003 ISBN 0-87111-217-5

LC 72-13998, 1973, 122 pp

Information detailing the collections of 106 transportation libraries in the United States and Canada was obtained by survey. Respondents filled out questionnaires which are published here. Each full page entry includes organization name, address, telephone, director's name, number of staff, items in the collection by category, collection description, special collections, services available to unaffiliated users, and library publications available for distribution. The entries are arranged in alphabetical order by category; a geographic index and corporate name index are included.

**ACKNOWLEDGEMENT**

Special Libraries Association

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Special Libraries Association, 235 Park Avenue South, Order  
Department, New York, New York, 100 Repr PC: \$33.75

**043609**

**SURVEY OF TRANSPORTATION LIBRARIES IN THE  
UNITED STATES AND CANADA**

Jacobson, B, Northwestern University  
Roy, M, Northwestern University

Special Libraries Association, 235 Park Avenue South, New  
York, New York, 10003

July 1972, 74 pp, 14 Fig, 13 tab

The principal purpose of this survey was to acquire data on U.S. and Canadian transportation library expenditures, staff, processing capacity, modal specialization and geographic distribution. Information was also requested on interaction between libraries and users outside the sponsoring organization and viewpoints were solicited on needs for and configurations of a library network within a national transportation information system. Statistical measures were computed from 101 returns. Multiple regression analysis was used to estimate missing values for expenditures. Libraries were classified by modal specialty, operator or manufacturer orientation and funding agency type. Selected groups were mapped using expenditures as size indicators. Transportation information user populations were also mapped to display disparities and overlaps in library user location. The survey indicated that transportation libraries are partitioned among a few large and many small units whose characteristics are not uniform even within modal groupings. Among available variables total staff had the highest correlation with total expenditures. The report concludes with the authors' suggestions for a national system of regional transportation libraries.

**ACKNOWLEDGEMENT**

Special Libraries Association

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
Special Libraries Association

**043619**

**A BIBLIOGRAPHY OF PUBLISHED RESEARCH REPORTS**

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

Sept. 1972, 61 pp

The bibliography presents abstracts of 302 major railroad research reports on contracted research and development, systems engineering, transportation surveys, and model development, along

with intramural research reports and program summaries. (Author)  
**ACKNOWLEDGEMENT**  
National Technical Information Service, PB-213047

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-213047

**041645**

**METROPOLITAN TRANSPORTATION AUTHORITY'S  
PROGRAM FOR MODERNIZATION OF THE LONG  
ISLAND RAIL ROAD**

Raabe, AG, New York Metropolitan Transportation Authority

IEEE Transactions on Industry & Genrl Applications (Institute of  
Electrical and Electronics Engineers, 345 East 47th Street, New  
York, New York, 10017)

Vol. IA-8, No. 4, July 1972, pp 499-503

The modernization of the Long Island Rail Road provided a major replacement of passenger cars used in electrified service as well as the first major extension of electrified service in more than 40 years. Rehabilitation of electric power supplies, installation of communication equipment, station platform improvements, and track upgrading have been accomplished.

**ACKNOWLEDGEMENT**

Engineering Index, EI 73 001074

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
ESL, Repr PC: 3DOL+25¢/p, Microfilm: 3DOL+5¢/fr

**039245**

**SUMMARY OF RESEARCH AT MIT ON TECHNOLOGY  
FOR HIGH SPEED GROUND TRANSPORT**

Seifert, WW

Massachusetts Institute of Technology, Cambridge, Massachusetts

No. 16, 71-8, Prog Rpt, 6711-6909, Aug. 1970, 85p

Contract DOT-C-85-65

;Contents: Systems analysis and vehicle control; Vehicle suspension systems; Propulsion; Vehicle and tube aerodynamics; Some guideway considerations.

**ACKNOWLEDGEMENT**

National Technical Information Service, PB-198015

TO PURCHASE COPIES OF THIS DOCUMENT WRITE TO:  
NTIS, Repr PC: \$3.00, Microfiche: \$0.95  
PB-198015

024743

**DEVELOPMENT OF PROGRAM FOR SELF LINING TUNNELS****PERFORMING AGENCY:**

Illinois University, Urbana, Urbana, Illinois

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lucke, W.N., Tel. 202-4260808

STATUS: Obligated START DATE: Nov. 1971 TOTAL FUNDS: \$166996 FUND TYPE: Contract CONTR. NO.: DOT-FR-20020 CONTR. TYPE: CR

To be performed at Urbana, Illinois and Denver, Colorado.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-232

025221

**LASER CUTTING CONCEPT FOR MECHANICAL TUNNELERS****PERFORMING AGENCY:**

United Aircraft Research Laboratories, East Hartford, Connecticut

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lucke, W.N., Tel. 202-4260808

STATUS: TOTAL FUNDS: \$99931 FUND TYPE: Contract CONTR. NO.: DOT-FR-20021

Using the contractor's 12-tub continuous-wave electric-discharge laser facility, a series of rock-melting tests will be performed to assess the importance to the rock kerfing process of laser power, power density, traverse speed, and optical system number. Laser hole drilling tests will be performed. The effect of a blowing jet to remove molten rock will be evaluated for both forms of laser drilling. These tests will be performed on rock cubes approximately 6 inches on a side, including a hard granite, a hard tap rock, and a third rock-type, specified by the contractor and of particular interest for the Northeast Corridor region.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-54

036795

**DOT PROGRAM FOR IMPROVEMENT OF GROUND TUNNELING TECHNOLOGY****INVESTIGATORS:**

Putukian, J., TMP, Tel. 617-4942019

**PERFORMING AGENCY:**

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 2142

**SPONSORING AGENCY:**

Office of Systems Development and Technology, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Money, L.J., Tel. 202-4262900

STATUS: Obligated START DATE: July 1972 COMPL. DATE: June 1973 TOTAL FUNDS: \$339000 FUND TYPE: PPA CONTR. NO.: PPA-OS-333/2

TSC to assist the Tunneling Projects Office, Office of Systems Engineering, OST, in the technical evaluation of proposals and the technical monitoring of anticipated contracts on underground excavation technology. TSC to assist the Tunneling Projects Office, Office

of Systems Engineering, OST, to assess the state of the art in tunneling technology to help insure that all technology applicable to the DOT tunneling program is used in an optimum manner.

**ACKNOWLEDGEMENT:**

Office of Systems Development and Technology/OST, GWA-73-OS

036889

**TUNNELING TECHNOLOGY 212 PPS# C.4.****PERFORMING AGENCY:**

Department of Interior, P.O.Box 25007, DFC, Denver, Colorado 80225

**SPONSORING AGENCY:**

Office of Systems Development and Technology, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Money, L.E., Tel. 202-4262900

STATUS: Obligated START DATE: Oct. 1972 TOTAL FUNDS: \$4000 FUND TYPE: -CS CONTR. NO.: DOT-AS-30026

Supply DOT with advice on tunneling technology by coordinating the exchange of information of a national and international basis.

**ACKNOWLEDGEMENT:**

Office of Systems Development and Technology/OST, PR# DOT-AS-30026

038648

**DEVELOPMENT AND TESTING OF NEW TUNNEL SUPPORTS****INVESTIGATORS:**

Peck, R.B. Kesler, C.E. Hendron, A.J. Gamble, W.L. Parker, H.W.

**PERFORMING AGENCY:**

Illinois University, Urbana, Board of Trustees, Urbana, Illinois 61801

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lucke, W.N., Tel. 202-4260808

STATUS: Obligated START DATE: Nov. 1972 COMPL. DATE: Aug. 1973 TOTAL FUNDS: \$297945 FUND TYPE: Contract CONTR. NO.: DOT-FR-30022

The University will investigate and test new concepts in rational tunnel design, new materials and techniques for shotcrete support of tunnels and new materials and improved structural design for segmented tunnel linings.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

038703

**DOT/TSC RESEARCH AND DEVELOPMENT TUNNELING PROGRAM****PERFORMING AGENCY:**

Foster-Miller Associates, Incorporated, 135 Second Avenue, Waltham, Massachusetts 02154

**SPONSORING AGENCY:**

Transportation Systems Center, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Putkin, J., Tel. 617-4942019



STATUS: Obligated START DATE: Nov. 1972 TOTAL FUNDS: \$58000 FUND TYPE: Contract CONTR. NO. : DOT-TSC-541

The objective of this contract is to provide engineering services to support the DOT/TSC research and development tunneling program and to provide expertise in the various related technical disciplines required to support the program. The specific items required are: define, implement and evaluate research and development programs with the objective of reducing tunneling costs, construction time, and improving the safety of underground excavation, establish progressive technical objectives to reduce tunneling costs by 30% during the next decade, accompany DOT personnel on visits to domestic and foreign organizations and facilities.

ACKNOWLEDGEMENT:  
Transportation Systems Center

**043389  
NAS COMMITTEE ON ROCK MECHANICS**

INVESTIGATORS:  
Cook, E.

PERFORMING AGENCY:  
National Academy of Sciences-Natl Research Council, 2101 Constitution Avenue, NW, Washington, D.C. 20418

SPONSORING AGENCY:  
Department of the Army, Department of Defense, Washington, D.C. 20037 PROJ. NO. DA0A9654

STATUS: Active START DATE: July 1972 COMPL. DATE: June 1973 TOTAL FUNDS: \$3000 FUND TYPE: Contract

The objectives are: to review new developments and trends in rock mechanics research, implement and enhance exchange of technical information among scientists, identify and encourage research activities that will advance rock mechanics technology and coordinate international efforts in rock mechanics research. This contract is an extension of Contract DA 49 092 ARO-150. Rock mechanics technology directly impacts on Army responsibilities for rapid excavation, drilling and blasting, underground construction, and prediction of engineering properties of rock masses. The proposed program and activities of the Committee for Rock Mechanics are consistent with the responsibilities of US Army Corps of Engineers and Office Chief of Research and Development to keep abreast of new developments and to direct Army research toward most promising areas pertinent to Army requirements.

ACKNOWLEDGEMENT:  
Science Information Exchange, GQA 19654 2

**043390  
RESEARCH STUDY ON DYNAMIC ANALYSIS OF EMBEDDED FOOTINGS ON LAYERED SUBSOIL**

INVESTIGATORS:  
Lysmer, J.

PERFORMING AGENCY:  
California University, Berkeley, Department of Civil Engineering, Berkeley, California 94720

SPONSORING AGENCY:  
Department of the Army, Department of Defense, Washington, D.C. PROJ. NO. DA0C8156

STATUS: Active START DATE: July 1972 COMPL. DATE: June 1973 FUND TYPE: Contract

The object is to compute the steady state, time dependent, particle displacements, and phase relationships generated within a layered soil system by the forced, torsional, sinusoidal oscillation of a rigid circular footing located on, or embedded in, this system. This work unit, together with work unit DA OH 8017, which is being conducted in-house by OCE Waterways Experiment Station, is for

the study of transmission and reception of ground motion by foundations, and supports the Army's operational requirements for shelter and supplies, firepower, and surveillance and communications. Both work units are applicable to the reliability of nuclear and fossil-fueled power plants such as in the Ballistic Missile Early Warning (BMEW) System—to criteria for surface or buried guidance and detection elements of IBM and Anti-IBM facilities—and to seismic communication and identification detection.

ACKNOWLEDGEMENT:  
Science Information Exchange, GQA 38156 2

**043402  
STABILIZATION OF STEEP LAND SLOPES**

INVESTIGATORS:  
Schwab, G.O.

PERFORMING AGENCY:  
Ohio State University, Agricultural Experiment Station, 190 North Oval Drive, Columbus, Ohio 43210

SPONSORING AGENCY:  
Ohio State Government, State House, Columbus, Ohio 43215 PROJ. NO. 0010670

The objectives are to devise a method of identifying potential landslide areas from simple soil and topographic characteristics and to develop and evaluate methods for stabilizing land slopes by such practices as diversion channels, surface drains, subsurface drains, and vertical wells.

ACKNOWLEDGEMENT:  
Science Information Exchange, GY 10670 4

**043411  
EVALUATION OF STEEL BRIDGE DEFLECTION CRITERIA**

INVESTIGATORS:  
Wright, R.N., Professor  
Walker, W.H.

PERFORMING AGENCY:  
Illinois University, Urbana, Department of Civil Engineering, Urbana, Illinois 61801

SPONSORING AGENCY:  
American Iron and Steel Institute, 150 East 42nd Street, New York, New York 10017 PROJ. NO. 146

STATUS: Active START DATE: Feb. 1972 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$28000

Optimal designs for steel stringer bridges with composite reinforced concrete decks are compared for current and revised criteria for the bridge flexibility and slenderness. Human reactions to bridge motions, deck durability, load distribution, and dynamic response characteristics are considered as bases for recommendations for criteria permitting greater economy and more freedom of selection of both configuration and materials.

ACKNOWLEDGEMENT:  
Science Information Exchange, PAN 46 4

**046054  
U.S. NATIONAL COMMITTEE ON TUNNELING TECHNOLOGY**

INVESTIGATORS:  
Israelsen, O.A., Executive Secretary, Tel. 202-9611831

PERFORMING AGENCY:  
National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20418

SPONSORING AGENCY:  
Bureau of Reclamation, C Street between 18th and 19th, NW, Washington, D.C.

RESPONSIBLE INDIVIDUAL:  
Stamm, G.G., Acting Commissioner

STATUS: Active      START DATE: Mar. 1972      FUND TYPE:  
Contract

The purposes of the U.S. National Committee on Tunneling Technology (USNC/TT) are: a) To serve as the national state-of-the-art of tunneling technology and in the effective use of the subsurface by promoting the coordination of activities pertaining thereto—assessment, research, development, education, training, and collection

and dissemination of information. b) To effect appropriate participation in all activities of the International Tunneling Association (ITA) through the NAS-NAE-NRC, which adheres to the ITA on behalf of the scientists, engineers, and technologists of the United States interested in tunneling technology.

013867

**CONSTRUCT TEST TRACK****PERFORMING AGENCY:**

Atchison, Topeka and Santa Fe Railway, 80 East Jackson Boulevard,  
Chicago, Illinois 60604

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

O'Sullivan, W., Tel. 202-4262860

STATUS: Obligated    START DATE: Apr. 1969    COMPL.  
DATE: Dec. 1973    TOTAL FUNDS: \$847200    FUND  
TYPE: Contract    CONTR. NO.: DOT-FR-00043    CONTR.  
TYPE: BOA

Basic Agreement for design, construction, instrumentation, data collection & analysis, and maintenance of a test track. The purpose of the test track is to investigate methods of providing more stable railroad track for the higher train speeds and heavier car loadings.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

013869

**TEST-CAR DATA ACQUISITION 212 PPS# 4.C.2****PERFORMING AGENCY:**

ENSCO, Incorporated, Springfield, Virginia

**SPONSORING AGENCY:**

Federal Railroad Administration, Department of Transportation, 400  
7th Street, SW, Washington, D.C. 20590    PROJ. NO: Commandant (FSp-2/7)

**RESPONSIBLE INDIVIDUAL:**

Woll, T.P., Tel. 202-4260855

STATUS: Obligated    START DATE: Jan. 1970    COMPL.  
DATE: Jan. 1972    TOTAL FUNDS: \$2030000    FUND  
TYPE: Contract    CONTR. NO.: DOT-FR-00015    CONTR.  
TYPE: CPFF

The Contractor shall furnish the necessary qualified personnel, facilities, materials, equipment, and such other services as may be required, and in consultation with the Government perform the required operation and development of the research car data collection system including instrumentation, data collection, data processing, computer programming, data analysis and system refinement. Efforts are to be directed toward appreciably upgrading instrumentation and data processing methods as well as developing new approaches and improved methods.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-80

018953

**TRACK GEOMETRY SURVEY DEVICE****INVESTIGATORS:**

Derr, A., Manager, Transportation Programs, Tel. 516-3336960

**PERFORMING AGENCY:**

General Applied Science Laboratories, Incorporated, Merrick and  
Stewart Avenues, Westbury, New York 11590

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Woll, T.P., Tel. 202-426-0855

STATUS: Obligated    START DATE: June 1971    COMPL.  
DATE: June 1972    TOTAL FUNDS: \$177313    FUND  
TYPE: Contract    CONTR. NO.: DOT-FR-10016

**OBJECTIVES AND SCOPE:**

Development, fabrication and demonstration of a special Track Geometry Survey Device which will measure the track geometry of a high precision railroad test track at the Pueblo Test Center.

**APPROACH AND METHODS:**

The Device shall be developed in accordance with technical specifications of the contract and contractor's proposal.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

019580

**FIELD STUDIES OF TRACK SUPPORTED ON PRESTRESSED CONCRETE TIES: TESTS TO EVALUATE STRUCTURAL CAPACITY OF SLAB AND BEAM RAIL SUPPORT STRUCTURES 212 PPS# 4.C.2.2.****PERFORMING AGENCY:**

Atchison, Topeka and Santa Fe Railway, Chicago, Illinois

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

O'Sullivan, W., Tel. 202-4260855

STATUS: Obligated    TOTAL FUNDS: \$199900    FUND  
TYPE: Contract    CONTR. NO.: DOT-FR-9-0043    CONTR.  
TYPE: BOA

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-135

019704

**TRACK AND ROADBED DYNAMICS****INVESTIGATORS:**

Cornell, E.R.

**PERFORMING AGENCY:**

Canadian Institute for Guided Ground Transport

**SPONSORING AGENCY:**

Canadian National Railways, Montreal, Quebec Canada  
Ministry of Transport, Canada, Ottawa, Ontario Canada  
Queens University, Kingston, Ontario Canada

**OBJECTIVES AND SCOPE:**

This project aims to ascertain what is known about track resilience, and the associated vibration characteristics, using Multichannel Time Series Analysis, and Fast Fourier Techniques in conjunction with high speed data acquisition.

**ACKNOWLEDGEMENT:**

Roads and Transportation Association of Canada

036278

**CONSTRUCTION OF THREE EIGHT HUNDRED FOOT SLABS AND BEAMS OF REINFORCED CONCRETE FOR SUPPORTING EXPERIMENTAL TIES****PERFORMING AGENCY:**

Atchison, Topeka and Santa Fe Railway, 80 East Jackson Boulevard,  
Chicago, Illinois 60604

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

O'Sullivan, W.B., Tel. 202-4260855

STATUS: Obligated START DATE: June 1972 COMPL. DATE: Sept. 1972  
 TOTAL FUNDS: \$211500 FUND TYPE: Contract  
 CONTR. NO. : DOT-FR-90043/12 CONTR. TYPE: CR

Construction of three 800 foot slabs and beams of reinforced concrete for supporting experimental ties and conventional 136 pound rail thereto upon the Kansas Test Track section authorized by the basic ordering agreement contract DOT-FR-90043. The twin beam configuration will be slabs of approximately nine feet wide and 1.5 feet thick.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, RA-11 JAP

036282

## RESPONSE OF CONTINUOUSLY SUPPORTED RAIL WHEN SUBJECTED TO STATIC AND DYNAMIC LOADS

## INVESTIGATORS:

Kerr, A.D., Professor

## PERFORMING AGENCY:

New York University, Bronx, School of Engineering and Sciences, University HN, Bronx, New York 10453

## SPONSORING AGENCY:

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

STATUS: Obligated START DATE: May 1972 COMPL. DATE: Feb. 1973  
 TOTAL FUNDS: \$35721 FUND TYPE: Contract  
 CONTR. NO. : DOT-FR-20064

To conduct analysis of certain specific track and vehicle related problems. These studies will be directed to consideration of such topics as the damped response of railroad track systems to rolling loads traveling at varying speeds.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR # 72-201

036357

## GASL TRACK SURVEY DEVICE

## PERFORMING AGENCY:

Porter (Norman) Associates, 2488 Grand Concourse, New York, New York 10458

## SPONSORING AGENCY:

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

STATUS: Obligated START DATE: Apr. 1972 COMPL. DATE: July 1972  
 TOTAL FUNDS: \$9990 FUND TYPE: Contract  
 CONTR. NO. : DOT-FR-20059 CONTR. TYPE: FFP

The contractor shall provide all necessary qualified personnel materials and services to perform a survey at the Reading Facility to validate the GASL Track Survey Device.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR # 72-164

036737

## TRACK COMPONENT AND TRACK RESPONSE INVESTIGATIONS

## PERFORMING AGENCY:

Chessie System, 2 North Charles Street, Baltimore, Maryland 21201

## SPONSORING AGENCY:

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

STATUS: START DATE: Aug. 1971 COMPL. DATE: Aug. 1972  
 TOTAL FUNDS: \$34948 FUND TYPE: Contract  
 CONTR. NO. : DOT-FR-20015 CONTR. TYPE: CS

C&O Railway Company and the B&O Railroad Company will conduct a series of track component and track response investigations.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR # 71-176

038054

## ANALYZE DATA FOR SOIL PRESSURE CELLS

## PERFORMING AGENCY:

Atchison, Topeka and Santa Fe Railway, 80 East Jackson Boulevard, Chicago, Illinois 60606

## SPONSORING AGENCY:

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

## RESPONSIBLE INDIVIDUAL:

O'Sullivan, WB, Tel. 202-4260855

STATUS: Obligated START DATE: June 1972 TOTAL FUNDS: \$276809  
 FUND TYPE: Contract CONTR. NO. : DOT-FR-90043/7  
 CONTR. TYPE: CR

The contractor shall, through a contract with the Portland Cement Association, procure, install, monitor, and analyze data from Soil Pressure Cells in the cross tie portions of the Kansas Test Track on the Santa Fe Main Line. These additional cells will supplement and add to already existing load cells and measuring devices provided under the Basic Task Order No. 7. This supplemental program will yield additional data concerning the track characteristics and will reduce future overall monitoring costs for the Government by reducing the amount of labor involved in moving the lesser number sensors to new station locations and will allow more data to be collected over a greater distance of the test section without moving instrumentation devices.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR # 72-192

038056

## REVIEW OF PRICING OF RAILROAD ROADWAY

## PERFORMING AGENCY:

Morrison-Knudsen Company, Incorporated, 400 Broadway, Boise, Idaho 83707

## SPONSORING AGENCY:

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

## RESPONSIBLE INDIVIDUAL:

Lawson, K.L., Tel. 202-4262965

STATUS: Obligated START DATE: Oct. 1972 COMPL. DATE: Nov. 1972  
 TOTAL FUNDS: \$8800 FUND TYPE: Contract  
 CONTR. NO. : DOT-FR-30016

Pricing of railroad roadway and electrification improvements planned for the Northeast Corridor, Boston to Washington, D.C., referring to documentation from the Northeast Corridor Report, furnished to the Contractor by the Federal Railroad Administration. A brief letter report shall be furnished immediately upon completion of the work summarizing the general confidence level of the Northeast Corridor route improvement pricing.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR # 73-72

038059

## FIELD STUDIES OF TRACK

## PERFORMING AGENCY:

Atchison, Topeka and Santa Fe Railway, 80 East Jackson Boulevard, Chicago, Illinois 60606

## SPONSORING AGENCY:

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

## RESPONSIBLE INDIVIDUAL:

O'Sullivan, WB, Tel. 202-4260855

STATUS: Obligated START DATE: Aug. 1972 TOTAL  
FUNDS: \$88656 FUND TYPE: Contract CONTR. NO. :  
DOT-FR-9-0043/6 CONTR. TYPE: CPFF

Clarify administrative information and the limitation of costs  
allowable.

## ACKNOWLEDGEMENT:

Federal Railroad Administration

## 038063

## OPERATION AND MAINTENANCE OF DOT TEST CARS

## PERFORMING AGENCY:

Penn Central Transportation Company, .6 Penn Central Plaza,  
Philadelphia, Pennsylvania 19104

## SPONSORING AGENCY:

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

## RESPONSIBLE INDIVIDUAL:

Lawson, K.L., Tel. 202-4262965

STATUS: Obligated START DATE: Oct. 1972 COMPL.  
DATE: Oct. 1975 TOTAL FUNDS: \$161800 FUND  
TYPE: Contract CONTR. NO. : DOT-FR-20052

Operation and Maintenance of DOT-Test Cars and other test  
railroad vehicles as may become available through future programs  
during the contract term. Contract includes a coordinators services,  
parking facilities for non-operational periods, shop and field services,  
access to trackage for testing series under contract DOT-FR-20032  
and modification services as conform to approved FRA programs.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR# 73-36

## 038729

## BALLAST CRIB AND SHOULDER COMPACTOR

## PERFORMING AGENCY:

Plasser-American Corporation, 2001 Myers Road, Chesapeake, Vir-  
ginia 23324

## SPONSORING AGENCY:

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

STATUS: Obligated START DATE: Oct. 1972 COMPL.  
DATE: Feb. 1973 TOTAL FUNDS: \$74070 FUND TYPE:  
Contract CONTR. NO. : DOT-FR-30001

In conjunction with studies planned at the High Speed Ground  
Test Center at Pueblo, Colorado, as well as peripheral studies, it is  
desired to test and quantitatively evaluate the results of crib and

shoulder compaction with respect to track support and stability. To  
accomplish testing over an anticipated range of track structures and  
compaction requirements, the machine desired will be capable of a  
degree of adjustability as defined in the following requirements.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR# 73-113

## 038782

DATA ACQUISITION SYSTEMS FOR THE URBAN RAIL  
SUPPORTING TECHNOLOGY PROGRAM

## PERFORMING AGENCY:

Sperry Rand Corporation, Univac Division, P.O. Box 3525, St. Paul,  
Minnesota 55101

## SPONSORING AGENCY:

Transportation Systems Center, Department of Transportation, 400  
7th Street, SW, Washington, D.C. 20590

## RESPONSIBLE INDIVIDUAL:

Robichaud, Tel. 202-4262484

STATUS: Obligated TOTAL FUNDS: \$250000 FUND  
TYPE: Contract CONTR. NO. : DOT-TSC-561 CONTR.  
TYPE: FFP

This contract is for the development and fabrication of data ac-  
quisition systems for acquisition and storage of test data on-board a  
rapid rail vehicle and also at wayside, monitoring and collecting data  
as vehicles move over the rails. The acquisition of all systems is ex-  
pected to provide a good test capability, needed in the UMTA Rail  
Technology Program. The delivery of all units and spares should be  
completed with in nine months from the commencement date of the  
proposed contract.

## ACKNOWLEDGEMENT:

Transportation Systems Center

## 043400

MOBILITY OF OIL-TYPE PRESERVATIVES IN IMMERSSED  
WOOD

## INVESTIGATORS:

Miller, D.J.

## PERFORMING AGENCY:

Oregon State University, Corvallis, School of Forestry, Forestry Re-  
search Laboratory, Corvallis, Oregon 97331

## SPONSORING AGENCY:

Oregon Legislative Assembly, State Capitol, Salem, Oregon  
97310 PROJ. NO. 0009588

The objective is to describe the movement of oil-type preserva-  
tives in treated wood immersed in water.

## ACKNOWLEDGEMENT:

Science Information Exchange, GY 9588 2

**013865**  
**RESPONSE OF THE CONTINUOUSLY SUPPORTED RAIL**  
**WHEN SUBJECTED TO STATIC AND DYNAMIC LOADS 212**  
**PPS# 4.B.2.**

INVESTIGATORS:  
 Kerr

PERFORMING AGENCY:  
 New York University, New York, New York, New York

SPONSORING AGENCY:  
 Federal Railroad Administration, Department of Transportation, 400  
 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
 O'Sullivan, WB, Tel. 202-4262860

STATUS: Obligated START DATE: June 1970 COMPL:  
 DATE: Mar. 1972 TOTAL FUNDS: \$36141 FUND TYPE:  
 Contract CONTR. NO. : DOT-FR-10019 CONTR. TYPE:  
 CR

A systematic study of the response of a railroad track when sub-  
 ject to various loads, such as constrained thermal expansions, the  
 moving train, etc.

ACKNOWLEDGEMENT:  
 Federal Railroad Administration, 72-161

**013877**  
**WHEEL/RAIL LAB DESIGN**

INVESTIGATORS:  
 Reese

PERFORMING AGENCY:  
 Wyle Laboratories, Huntsville, Alabama

SPONSORING AGENCY:  
 Federal Railroad Administration, Department of Transportation, 400  
 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
 Lawson, K.L., Tel. 202-4260956

STATUS: Obligated COMPL. DATE: Sept. 1972 TOTAL  
 FUNDS: \$2825000 FUND TYPE: Contract CONTR. NO.  
 : DOT-FR-00009 CONTR. TYPE: CPFF

Systems engineering, management and operation of the WRD  
 Research Facility in Pueblo, Colorado.

ACKNOWLEDGEMENT:  
 Federal Railroad Administration

**019710**  
**A STUDY OF STRESSES AND DEFORMATIONS UNDER**  
**DYNAMIC AND STATIC LOAD SYSTEMS IN TRACK**  
**STRUCTURES AND SUPPORT**

PERFORMING AGENCY:  
 Canadian Institute for Guided Ground Transport

SPONSORING AGENCY:  
 Canadian National Railways, Montreal, Quebec Canada  
 Ministry of Transport, Canada

OBJECTIVES AND SCOPE:  
 The aim of this research is to improve the design procedures for s-  
 perimposed loads on muskogs to permit these areas to be used for  
 embankments for transportation systems. The project will begin with  
 the study of near failure performance of muskogs under surface loads.

ACKNOWLEDGEMENT:  
 Roads and Transportation Association of Canada

**025369**  
**MONITORING OF WHEEL/RAIL SIMULATOR PROTOTYPE**  
**CONTROL SYSTEM EFFORT**

INVESTIGATORS:  
 Lavery, A.L., Tel. 617-4942040

PERFORMING AGENCY:  
 Transportation Systems Center, Department of Transportation, 55  
 Broadway, Cambridge, Massachusetts 02142

SPONSORING AGENCY:  
 Federal Railroad Administration, Department of Transportation, 400  
 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
 Lawson, K., Tel. 202-4262965

STATUS: TOTAL FUNDS: \$70000 FUND TYPE:  
 PPA CONTR. NO. : PPA-RR-210 CONTR. TYPE: CR

The FRA, as manager of the joint FRA/UMTA wheel/rail dy-  
 namics research facility, has retained Wyle Laboratories to act as  
 system manager for the effort. The Wyle effort includes the construc-  
 tion and testing of a prototype control system which consists of a  
 single simulator module and its associated digital, analog, instru-  
 mentation and mechanical subsystems. This PPA designates TSC as  
 technical monitor for FRA of the prototype control system imple-  
 mentation and test for the remainder of FY 72. This effort will re-  
 present additional scope to the work on the wheel-rail simulator pre-  
 sently being performed by TSC for UMTA.

ACKNOWLEDGEMENT:  
 Federal Railroad Administration

**036280**  
**COMPARATIVE ANALYSIS OF DYNAMICS OF FREIGHT**  
**AND PASSENGER RAIL VEHICLES**

PERFORMING AGENCY:  
 Battelle Columbus Laboratories, 505 King Avenue, Columbus, Ohio  
 43201

SPONSORING AGENCY:  
 Federal Railroad Administration, Department of Transportation, 400  
 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
 Lawson, K.L., Tel. 202-4262695

STATUS: Obligated START DATE: May 1972 COMPL.  
 DATE: Oct. 1972 TOTAL FUNDS: \$48012 FUND TYPE:  
 Contract CONTR. NO. : DOT-FR-20077 CONTR. TYPE:  
 CPFF

A comparative Analysis of Dynamics of Freight and Passenger  
 Rail Vehicles will be undertaken to determine the effects of track on  
 the vehicles and vice versa. This study is part of an overall study to  
 perform a comprehensive analysis of the economic, technical and in-  
 stitutional factors involved in implementing and operating improved  
 Passenger Train service in the United States as opposed to tracked  
 Air Cushion Vehicle or Magnetically Levitated Vehicle Systems.

ACKNOWLEDGEMENT:  
 Federal Railroad Administration

**036296**  
**STEEL WHEEL/STEEL RAIL DYNAMIC INTERACTIONS/**  
**HAMMOND, INDIANA**

PERFORMING AGENCY:  
 Pullman Standard, 200 South Michigan Avenue, Chicago, Illinois  
 60604

SPONSORING AGENCY:  
 Transportation Systems Center, Department of Transportation, 50  
 Broadway, Cambridge, Massachusetts 02142

RESPONSIBLE INDIVIDUAL:  
 Ehrenbeck, R., Tel. 617-4942443

STATUS: TOTAL FUNDS: \$99829 FUND TYPE: Contract  
 CONTR. NO. : DOT-TSC-436

Determination of the dynamic interactions present in the Pullman-Standard steel wheel/steel rail traction and guidance subsystem and assessment of the effects of these interactions on vehicle ride quality, environmental impact and guideway design.

ACKNOWLEDGEMENT:  
 Transportation Systems Center

**038647**  
**FOUR (4) WHEEL/RAIL DYNAMICS SIMULATOR TRACK MODULE**

PERFORMING AGENCY:  
 Gulf and Western Industrial Products Company, Research and Development Center, 101 Chester Road, Swarthmore, Pennsylvania 19081

SPONSORING AGENCY:  
 Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
 Spencer, P., Tel. 202-4269644

STATUS: Obligated COMPL. DATE: Jan. 1976 TOTAL FUNDS: \$1773771 FUND TYPE: Contract CONTR. NO. : DOT-FR-20033 CONTR. TYPE: CPIF

The proposed contract will include the following effort to provide four wheel/Rail Dynamics simulator Track Module Systems: a) Program management and administrative services: b) Preliminary and final detail designs: c) Engineering analyses: d) Documentation: e) Materials, procurement and manufacturing: f) Assembly services, in-plant subsystem and systems performance tests: and g) Shipping, on-site installation and checkout services. Track Module Systems will be used in research, development, testing and other activities associated with railroad vehicle wheel/track interactions at the High Speed Ground Test Center, Pueblo, Colorado.

ACKNOWLEDGEMENT:  
 Federal Railroad Administration

**038727**  
**EXPERIMENTAL AND THEORETICAL STUDY OF THE MECHANICS OF ROLLING CONTACT**

INVESTIGATORS:  
 Nayak, P.R.

PERFORMING AGENCY:  
 Bolt, Beranek and Newman, Incorporated, 50 Moulton Street, Cambridge, Massachusetts 02138

SPONSORING AGENCY:  
 Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
 Lawson, K.L., Tel. 202-4262965

STATUS: Obligated START DATE: Apr. 1971 COMPL. DATE: Dec. 1972 TOTAL FUNDS: \$63730 FUND TYPE: Contract CONTR. NO. : DOT-FR-10031 CONTR. TYPE: CPFF

There are two tasks to this contract. In task 1—Junction Deformation Studies—the contractor will design and build an apparatus for the study of the behavior of large-scale model junctions at high sliding speeds and in the presence of high vibration levels. The junctions will be modeled by steel spheres of approximately 1/8 inch radius. In task 2—Rolling Friction Studies—the contractor will build a simple rolling contact/apparatus on which the effects of slip velocity, surface vibration, surface roughness, and surface temperature on the rolling friction coefficient will be conducted.

ACKNOWLEDGEMENT:  
 Federal Railroad Administration, PR# 71-90

**014827  
METROLINER ELECTRICAL SYSTEMS RELIABILITY****INVESTIGATORS:**

Watt, C.W., Task Manager, Tel. 617-4942054  
Ebacher, R., Project Contact, Tel. 617-4942257

**PERFORMING AGENCY:**

Transportation Systems Center, Department of Transportation, 55  
Broadway, Cambridge, Massachusetts 02142 PROJ. NO. PPA  
RR06-0

**SPONSORING AGENCY:**

Federal Railroad Administration, Department of Transportation,  
Washington, D.C. 20591 PROJ. NO. 71-RR-0

**RESPONSIBLE INDIVIDUAL:**

Lawson, K.L., Tel. 202-4260855

STATUS: Active START DATE: Jan. 1971 COMPL. DATE: June 1972  
TOTAL FUNDS: \$160000 FUND TYPE: PPA CONTR. NO.: PPA-RR-06/0  
CONTR. TYPE: CR

**OBJECTIVES AND SCOPE:**

This work will be done in close cooperation with staff of the Office of High Speed Ground Transportation, the Penn Central Railroad, and their contractor. Working closely with personnel from the Office of High Speed Ground Transportation, the responsible staff from TSC will familiarize itself thoroughly with the electrical systems of the Metroliners, the problems that have been evident in their operation to date, and with the analyses already done as to the causes and possible cures for these problems. Utilizing the expertise and equipment available at the Transportation Systems Center, analysis to determine the cause of failure of parts and equipment will be made as needed. Based on the information derived from the above tasks, maintenance practices will be reviewed.

**ACKNOWLEDGEMENT:**

Transportation Systems Center

**016867  
DEMONSTRATE A DUAL-MODE GAS TURBINE ELECTRIC  
POWERED COMMUTER RAILROAD CAR****PERFORMING AGENCY:**

Washington Metropolitan Area Transit Authority, 950 L'Enfant  
Plaza, SW, Washington, D.C.

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Silien, J.S., Tel. 202-4260090

STATUS: Obligated START DATE: Dec. 1971 COMPL. DATE: Dec. 1974  
TOTAL FUNDS: \$7400000 FUND TYPE: Grant CONTR. NO.: DOT-UT-613

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, NY-06-0005

**019577  
TECHNICAL MONITOR FOR "METROLINER" IMPROVE-  
MENT PROGRAM SYSTEM****PERFORMING AGENCY:**

Pan-Technology Consulting Corporation, 1771 N Street, NW,  
Washington, D.C. 20036

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lawson, K., Tel. 202-4261227

STATUS: Obligated COMPL. DATE: Aug. 1973 TOTAL FUNDS: \$337623  
FUND TYPE: Contract CONTR. NO.: DOT-FR-10028

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

**024752  
DEVELOP STANDARD SPECIFICATIONS FOR NEW LIGHT  
RAIL CARS****PERFORMING AGENCY:**

Massachusetts Bay Transportation Authority, Boston, Massachusetts  
02101

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Mora, J., Tel. 202-4260090

STATUS: Obligated START DATE: Nov. 1971 TOTAL FUNDS: \$133598  
FUND TYPE: Grant CONTR. NO.: DOT-UT-630

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, MA-06-0015

**025372  
METROLINER IN THE WESTINGHOUSE WEST MIFFLIN,  
PA. FACILITY 212 PPS# 5.A.****PERFORMING AGENCY:**

Westinghouse Electric Corporation, 1801 K Street, NW, Washington,  
D.C. 20006

**SPONSORING AGENCY:**

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

STATUS: COMPL. DATE: May 1970 TOTAL FUNDS: \$1757244  
FUND TYPE: Contract CONTR. NO.: DOT-FR-10036

Tasks included under this area are all manufacturing labor and materials necessary to remove equipment from the car, modify equipment and reapply modified equipment to the car. This will include manufacturing, assembly, testing and installation of new equipment, manufacture of tools to produce equipment and to handle car and engineering shop supervision necessary to modify one Metroliner in the Westinghouse West Mifflin, Pa. facility.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-239, 72-47

**025403  
URBAN RAPID RAIL VEHICLE PROGRAM 212 PPS# 2.1.****PERFORMING AGENCY:**

Boeing Company, Vertol Division, Philadelphia, Pennsylvania

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Silien, J.S., Tel. 202-4260090

STATUS: START DATE: June 1971 COMPL. DATE: 1973  
TOTAL FUNDS: \$9487000 FUND TYPE: Contract CONTR. NO.: DOT-UT-10007

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, IT-06-0026

**032748  
CATALYTIC WASTE TREATMENT SYSTEM FOR GREAT  
LAKES ORE CARRIERS****INVESTIGATORS:**

Nance, P.D.

**PERFORMING AGENCY:**

Cleveland-Cliffs Iron Company, Cleveland, Ohio 44115



**SPONSORING AGENCY:**

Environmental Protection Agency, Office of Water Programs, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active COMPL. DATE: June 1971 TOTAL FUNDS: \$98318 FUND TYPE: Grant

**OBJECTIVES AND SCOPE:**

The overall objective of this grant is to develop a physiochemical system of treating sanitary, galley, laundry, shower and wash basin wastes generated on an ore carrier operating on the Great Lakes with a crew of 30 men. The proposal envisages using three subsystems. One subsystem, employing a proprietary catalytic-incinerator for solid-liquid separation and solids reduction, and proprietary catalytic columns for dissolved solids removal and oxidation, would treat only sanitary wastes. The second subsystem, treating sanitary and galley wastes, would employ a centrifuge for solids, grease, liquid separation; and incinerator for grease and solids reduction and catalytic columns for dissolved solids removal and oxidation. The third subsystem would use electrolytic chlorination to sterilize shower, wash basin and laundry waste water. These three subsystems would be designed with appropriate holding tanks, recycling tanks and automatic controls to treat in excess of 2,900 gallons of waste water per day. After fabrication, the subsystems will be assembled on shore and tested before installation on board ship. Upon installation of the subsystems there would be a 90 day shipboard evaluation followed by a 6 months program to evaluate performance reliability. Effluent requirements for the proposed system would be less than 50 mg/l of suspended solids, less than 50 mg/l of BOD and less than 240 MPN of coliform organisms per 10 ml.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020-HLY

**034616****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****INVESTIGATORS:**

Nance, P.D.

**PERFORMING AGENCY:**

Thiokol Chemical Corporation, Wasatch Division, Ogden, Utah

**SPONSORING AGENCY:**

Environmental Protection Agency, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$123000 FUND TYPE: Contract CONTR. NO.: 68-01-0115

**OBJECTIVES AND SCOPE:**

The objective is to design, develop and test a compact, low-cost, highly reliable waste treatment system for sanitary vessel waste with a crew complement of 10 men. Emphasis on adaptability of the proposed design to both smaller and larger pleasure craft will be included. The proposed system employs the unique feature of a filter/incinerator developed by Thiokol. As reported by Thiokol for the system performance, the effluent contains less than 50 mg/l of suspended solids and Biochemical Oxygen Demand (BOD) and less than 240 MPN/100 ml. of coliform. This quality would more than satisfy the stated objectives of the RFP. A seven month Phase II demonstration on board a houseboat is proposed after the Phase I development.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJG

**034617****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****PERFORMING AGENCY:**

Westinghouse Electric Corporation, Research and Development Center, Baltimore, Maryland

**SPONSORING AGENCY:**

Environmental Protection Agency, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$157000 FUND TYPE: Contract CONTR. NO.: 68-01-1027

**OBJECTIVES AND SCOPE:**

The objective of this project is to develop and test a small, reliable recirculating waste treatment system for small pleasure craft up to 26 feet in length. The system will be designed to treat the waste generated by four people and will fit into a space of 20 cubic inches. All of the components, with the exception of an incinerator have been evaluated in Westinghouse Research Laboratories. The components of the proposed system include (1) a commode base, (2) a unique moving spring screen solid separator, (3) a liquid reservoir, (4) a solids incinerator, and (5) a disinfection/chemical treatment device. The above components will be designed, fabricated and tested in the laboratory using human waste during Phase I. Phase II involves building, installing and testing the device aboard the MIDWIFE, mother ship for the Westinghouse Deepstar submersibles.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJH

**034618****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****INVESTIGATORS:**

Graham, D.H.

**PERFORMING AGENCY:**

Hercules Incorporated, 910 Market Street, Wilmington, Delaware 19899

**SPONSORING AGENCY:**

Environmental Protection Agency, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$233125 FUND TYPE: Contract CONTR. NO.: 68-01-0137

**OBJECTIVES AND SCOPE:**

This project is to design, develop and demonstrate a compact modular system for all wastes from pleasure craft. The system utilizes pressure filtration, carbon adsorption, incineration and vapor phase catalytic and chlorination oxidation. The components of the system can be designed such that a treatment device may consist of from one to four modules, depending on space and weight limitation of vessels. Phase I, the laboratory phase, will consist of developing and testing the individual components. Following the lab phase, a prototype system will be assembled for vessel installation and demonstration.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJI

**034619****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****INVESTIGATORS:**

Fischer, W.C.

**PERFORMING AGENCY:**

Fairbanks, Morse and Company, Research Center, Beloit, Wisconsin

**SPONSORING AGENCY:**

Environmental Protection Agency, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$191122 FUND TYPE: Contract CONTR. NO.: 68-01-0130

**OBJECTIVES AND SCOPE:**

The objective of this program is to design, develop and demonstrate a sanitary waste treatment device for a crew size of 25, but applicable design changes can expand the treatment capability to 20 to 50 man crew sizes. The unique feature of the proposal is the inclusion of separate distinct systems for treating urine and toilet stools. The urinal system utilizes effluent from carbon columns as a recirculatory flush media. The treatment of sewage from toilet stools will also be handled in a recirculating system. Solids will be separated in this system by gimbal mounted filter paper. Solid waste generated, including filter paper and spent carbon, will be incinerated.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJJ

**034620****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****INVESTIGATORS:**

Brown, L.S.

**PERFORMING AGENCY:**

Ocean Systems, Incorporated, 11440 Issac Newton Industrial Square North, Reston, Virginia 22070

**SPONSORING AGENCY:**

Environmental Protection Agency, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$194590 FUND TYPE: Contract CONTR. NO. : 68-01-0133

**OBJECTIVES AND SCOPE:**

The objective is to design, develop and test a compact, low-cost completely closed combustion toilet system based on the store and burn concept. The system is a one module unit that stores the daily wastes from a crew complement of 3 to 4 men for once a day incineration. The system is vented to the atmosphere only. There are no effluent discharge lines for by-passing the system. Therefore, water pollution is precluded by the system design. An inert ash generated in the combustion process requires periodic disposal. A shipboard Phase II demonstration is proposed for a period of 9 months following the 9 month Phase I development.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJK

**034621****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****INVESTIGATORS:**

Remus, G.A.

**PERFORMING AGENCY:**

General American Transportation Corporation, General American Research Division, Niles, Illinois

**SPONSORING AGENCY:**

Environmental Protection Agency, 400 M Street, SW, Washington, D.C. 20024

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$137800 FUND TYPE: Contract CONTR. NO. : 68-01-0116

**OBJECTIVES AND SCOPE:**

This project is to design, fabricate and test a system for treating sanitary and galley wastes from vessels with a 6 to 20 man crew. The unique feature of the proposed system is the incorporation of a hydrophilic filter consisting of a screen and sponge to accomplish solids-liquid separation. A Phase I, 9 months period is included for development of full-scale system and laboratory testing. A Phase II period includes installation on board a vessel for performance testing.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJL

**034622****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****INVESTIGATORS:**

Schmidt, F.

**PERFORMING AGENCY:**

Ametek, Incorporated

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$119700 FUND TYPE: Contract CONTR. NO. : 68-01-0104

**OBJECTIVES AND SCOPE:**

The objective of this program is to design, develop and demonstrate a compact, simple to operate, reliable and relatively maintenance free physical-chemical waste treatment system for recreational watercraft. The unique feature of the proposed system is the incorporation of the combined process of in-depth filtration and carbon adsorption in a moving bed. An electrically driven, variable pitch screw shaft moves the filtration/adsorption mixed media on an intermittent basis. The active zone of the unit is replenished periodically with fresh media while the spent media is wasted to a storage canister which requires emptying once per boating season.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJM

**034623****DEVICES FOR ON-BOARD TREATMENT OF WASTES FROM VESSELS****PERFORMING AGENCY:**

Gulf and Western Industrial Products Company

STATUS: Active START DATE: June 1971 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$106269 FUND TYPE: Contract CONTR. NO. : 68-01-0136

**OBJECTIVES AND SCOPE:**

The objective of this project is to design, develop and demonstrate a compact, simple to operate, sanitary waste treatment system for handling 15 man days (3 times 5 or 5 times 3) of waste from existing marine heads before filter replenishment. The Phase I development program is for experimental verification of the Clarke's Carbon treatment for sanitary waste followed by filtration. Reportedly, the system produces an effluent closely approaching drinking water quality. Any finely divided activated carbon will suffice, but superior performance is reported for the Clarke's Carbon system. Phase II proposes installation and demonstration on a 34 foot sailing vessel.

**ACKNOWLEDGEMENT:**

Environmental Protection Agency, 15020 HJN

**036048****TURBO TRAIN****PERFORMING AGENCY:**

United Aircraft Corporation, Sikorsky Aircraft Division, North Main Street, Stratford, Connecticut 06602

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Schmidt, W.G., Tel. 202-4260772

STATUS: Obligated START DATE: Apr. 1972 COMPL. DATE: Jan. 1973 TOTAL FUNDS: \$6161484 FUND TYPE: Contract CONTR. NO. : DOT-FR-10022 CONTR. TYPE: FFP

Contract provides for maintenance and servicing, new intermediate cars, fuel, new designed single axle guidance arms, TRANSPORTATION support, IC-40 car repairable components.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-183, 72-246

036354

**RESEARCH STUDY TO PERFORM ANALYSIS OF RAILROAD CAR TRUCK AND WHEEL FATIGUE****PERFORMING AGENCY:**

IIT Research Institute, 10 West 35th Street, Chicago, Illinois 60616

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Bray, D.E., Tel. 202-4261227

STATUS: Obligated    START DATE: June 1972    TOTAL FUNDS: \$223803    FUND TYPE: Contract    CONTR. NO. : DOT-FR-20070    CONTR. TYPE: CPFF

Identify and investigate the load and environmental factors which influence performance efficiency of freight car trucks and wheels, devise and conduct an experimental program to determine the effect of the frequency and magnitude of the dynamic loads which are imposed upon trucks and wheels in a range of freight operations, define engineering design and service life criteria for freight car trucks and wheels, investigate the interrelation between existing designs and manufacture and the degree of structural adequacy which each offers, evaluate alternative conceptual approaches to freight car truck design on the basis of broad application of costs and benefits.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 73-19

036771

**METRO IMPROVEMENT****PERFORMING AGENCY:**

General Electric Company

**RESPONSIBLE INDIVIDUAL:**

Gannett, M.C., Tel. 202-4260772

STATUS: Obligated    START DATE: June 1971    TOTAL FUNDS: \$3296392    FUND TYPE: Contract    CONTR. NO. : DOT-FR-10037

In order to determine why the Metroliner has not performed as originally planned and to assume a role of leadership in the future development of this type equipment, work is to be performed to correct the Metroliner reliability problems and to make necessary modifications and improvements based upon operating experience. Investigation and train modifications based upon findings will be conducted. It is anticipated that the engineering effort and the modification work will require two years to complete.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

038060

**FLAW DETECTION IN RAILWAY WHEELS USING ACOUSTIC SIGNATURES****PERFORMING AGENCY:**

Houston University, Department of Mechanical Engineering, Houston, Texas 77004

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Bray, D.E., Tel. 202-4261227

STATUS: Obligated    START DATE: Oct. 1972    COMPL. DATE: Oct. 1974    TOTAL FUNDS: \$115573    FUND TYPE: Contract    CONTR. NO. : DOT-FR-30002

Phase I involves testing for defect identification by continuous static excitation. Methods and equipment for finding defects shall be developed. Phase II shall use the methods and facilities developed in Phase I to study the acoustic signatures of a variety of railroad wheel designs, sizes and typical flaws.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-271

038061

**RAIL HAZARDOUS MATERIAL TANK CAR DESIGN STUDY****PERFORMING AGENCY:**

Calspan Corporation, 4455 Geheese, Buffalo, New York 14221

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Bray, D.E., Tel. 202-4261227

STATUS: Obligated    START DATE: Oct. 1972    COMPL. DATE: Aug. 1973    TOTAL FUNDS: \$84555    FUND TYPE: Contract    CONTR. NO. : DOT-FR-20069    CONTR. TYPE: CPFF

The objectives of the study are: (1) to provide the basis for defining practical and economical safety improvements which can be either retrofitted to in-service cars or incorporated into the design and manufacture of new tank cars, and (2) define the safety research gaps which must be remedied before a prototype tank car can be designed to optimal safety/economic considerations.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

041804

**ANTI-DERAILEMENT SENSOR****INVESTIGATORS:**

Kluge, F.C.

**PERFORMING AGENCY:**

Naval Ordnance Laboratory, Department of Navy, White Oak, Maryland 20910

**SPONSORING AGENCY:**

Department of Defense, Washington, D.C.    PROJ. NO. NOL600X0141

The Federal Railroad Administration is responsible for this contract until completion.

The objective is to conduct an engineering study of the development and use of an automatic sensor system to detect incipient failure modes and alert train crews in time to prevent a significant number of major derailments from occurring.

**ACKNOWLEDGEMENT:**

Defense Documentation Center, DN234348

007457

**MARINE GAS TURBINE DEVELOPMENT PROJECT****INVESTIGATORS:**

Osswald, R.F., Tel. 518-374-2211X55929

**PERFORMING AGENCY:**

General Electric Company, Gas Turbine Department, Schenectady, New York

**SPONSORING AGENCY:**Maritime Administration, Department of Commerce, Washington, D.C. 20230 PROJ. NO. DDM-467  
General Electric Company, Gas Turbine Department, Schenectady, New York**RESPONSIBLE INDIVIDUAL:**

Levine, Z., Program Manager, Tel. 202-967-3484

STATUS: Active START DATE: June 1970 COMPL.  
DATE: June 1975 TOTAL FUNDS: \$8143000 CONTR.  
NO.: C-O-35510 CONTR. TYPE: 421000**OBJECTIVES AND SCOPE:**

Objective is development of an improved marinized heavy-duty gas turbine with: (1) High power output for merchant marine application; (2) Lower initial and operating costs; (3) Unrestricted bunker C fuel burning capability; (4) Pollution-free exhaust systems. Project provides for parallel investigations and current use of test facilities for more than one task.

**ACKNOWLEDGEMENT:**

Maritime Administration

016868

**TEST OF STORED ENERGY PROPULSION SYSTEM RAPID TRANSIT VEHICLE****PERFORMING AGENCY:**

Washington Metropolitan Area Transit Authority, 950 L'Enfant Plaza, SW, Washington, D.C. 20006

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, DOT, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Silien, J.S., Tel. 202-4260090

STATUS: Active START DATE: Sept. 1971 COMPL.  
DATE: June 1973 TOTAL FUNDS: \$1264000 FUND  
TYPE: Grant CONTR. NO.: DOT-UT-550**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, NY-DMG-8

016877

**TEST AND EVALUATION OF AC PROPULSION SYSTEM AND REDESIGN INTERIOR OF CAR****PERFORMING AGENCY:**

Cleveland Transit System, 1404 East 9th Street, Cleveland, Ohio 44114

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, DOT, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Moraen, J.S., Tel. 202-4260090

STATUS: Active START DATE: Sept. 1971 COMPL.  
DATE: Apr. 1973 TOTAL FUNDS: \$1274200 FUND  
TYPE: Grant CONTR. NO.: DOT-UT-551**ACKNOWLEDGEMENT:**Urban Mass Transportation Administration, OHIO-DMG-5  
025220**TRAIN CONTROL AND OPERATIONS EVALUATION****INVESTIGATORS:**

Hergenrother, K., Tel. 617-4942048

**PERFORMING AGENCY:**

Transportation Systems Center, DOT, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Regan, L.G., Tel. 202-4261510

STATUS: COMPL. DATE: June 1972 TOTAL FUNDS:  
\$135000 FUND TYPE: PPA CONTR. NO.: PPA-RR-  
201/2 CONTR. TYPE: CR

An important aspect of railroad safety concerns locomotive speed indicators, and the recording of speed and other safety-related locomotive functions. Present equipment for this purpose will be evaluated, and a study of the technical problems of locomotive data recording will be performed. The recent public awareness of the national ecology has made it necessary that the railroads both measure and control their noise and engine exhaust emissions. This problem has been divided into two tasks in FY72: 1. system analysis, including industry pollution survey and suggested method of analysis and standards; and 2. evaluation of measurement and control techniques. Evaluation of locomotive speed indicators and study of the technical problems of locomotive data recording. System Analysis, including industry pollution survey.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

036276

**TASK ANALYSIS OF RAILROAD ENGINEMAN'S FUNCTIONS****PERFORMING AGENCY:**

McDonnell Douglas Corporation, 2600 North Third Street, Saint Charles, Missouri 63301

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Regan, L.G., Tel. 202-4261510

STATUS: Obligated START DATE: June 1972 COMPL.  
DATE: Aug. 1972 TOTAL FUNDS: \$15000 FUND TYPE:  
Contract CONTR. NO.: DOT-FR-20036 CONTR. TYPE:  
FFP**OBJECTIVES AND SCOPE:**

The analysis shall include the principle tasks of the Engineman in road freight operations. For each task, the step-by-step procedures for task performance shall be listed, together with tabulations for each step of the following: 1. Information received, b. Display or communications method, c. Information processing and decision making required of the Engineman, d. Response of action required, e. Controls of communications for response, f. Potential hazards associated with the step, g. Interaction of other members of the operating crew.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # RP-38

019702

**A COMMUNICATIONS SYSTEM FOR LONG TRAINS****INVESTIGATORS:**

Aitken, G.J.M.

**PERFORMING AGENCY:**

Canadian Institute for Guided Ground Transport

**SPONSORING AGENCY:**Canadian National Railways, Montreal, Quebec Canada  
Ministry of Transport, Canada, Ottawa, Ontario Canada  
Queens University, Kingston, Ontario Canada**OBJECTIVES AND SCOPE:**

This project aims to develop a communications system capable of communicating braking and locomotive control instructions as well as providing a voice channel on long trains. Individual car-mounted components will be used which will permit inductive, capacitive, or radiative coupling.

**ACKNOWLEDGEMENT:**

Roads and Transportation Association of Canada

019708

**CONTROL OF MULTI-LOCOMOTIVE POWERED TRAINS****PERFORMING AGENCY:**

Canadian Institute for Guided Ground Transport

**SPONSORING AGENCY:**Canadian National Railways, Montreal, Quebec Canada  
Ministry of Transport, Canada, Ottawa, Ontario Canada  
Queens University, Kingston, Ontario Canada**RESPONSIBLE INDIVIDUAL:**

McLane, P.J.

**OBJECTIVES AND SCOPE:**

This project will apply linear control theory in the design of an "auto-pilot" for multi-locomotive powered trains by regulating the relative displacement and velocity of vehicle members in strings of high-speed vehicles; while maintaining tractive effort for the locomotives.

**ACKNOWLEDGEMENT:**

Roads and Transportation Association of Canada

025196

**COMMUNICATIONS FOR HIGH SPEED GROUND TRANSPORTATION****PERFORMING AGENCY:**

Transportation Systems Center, DOT, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Ward, E., Tel. 202-4260850

STATUS: TOTAL FUNDS: \$135000 FUND TYPE:  
PPA CONTR. NO.: PPA-RR-204 CONTR. TYPE: CR

This project is a continuation of the study and evaluation of wayside communications systems for high speed trains. It is divided into three tasks which are outlined in detail below. These are to study and evaluate available systems throughout the electromagnetic spectrum: to determine the risk of EMI with the PCM telemetry system at Pueblo; and to develop a computer model of a long PCM transmission line.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-RR

036732

**DEVELOPMENT AND USE OF AN AUTOMATIC SENSOR SYSTEM****PERFORMING AGENCY:**

Naval Ordnance Laboratory, White Oak, Silver Spring, Maryland 20910

**SPONSORING AGENCY:**

Federal Railroad Administration

STATUS: Obligated START DATE: Aug. 1971 COMPL. DATE: Feb. 1972 TOTAL FUNDS: \$25000 FUND TYPE: IA CONTR. NO.: DOT-AR-20001

**OBJECTIVES AND SCOPE:**

Conduct a six-month, first phase study of the development and use of an automatic sensor system to prevent or reduce the severity of accidents resulting from certain important types of derailment.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # RP-1

016844

**HUMAN FACTORS IN RAILROAD OPERATIONS****INVESTIGATORS:**

Devoe, D.B., Task Manager, Tel. 617-4942368

**PERFORMING AGENCY:**

Transportation Systems Center, DOT, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590 PROJ. NO. 72-RR

**RESPONSIBLE INDIVIDUAL:**

Regan, L.G., Tel. 202-4261510

STATUS: Obligated    COMPL. DATE: June 1972    TOTAL FUNDS: \$295000    FUND TYPE: PPA    CONTR. NO.: PPA-RR-209    CONTR. TYPE: CR

In view of the limited amount of data now available on the influence of human behavior on the efficiency and safety of railroad operations, a human factors program will be undertaken to develop standards of work fitness and work duration, human engineering design criteria, procedures for routine reporting and detailed investigation of human factors in railroad accidents, and job characteristics data for railroad operations.

**ACKNOWLEDGEMENT:**

Transportation Systems Center

036745

**HUMAN FACTORS OF RAILROAD OPERATIONS****INVESTIGATORS:**

Devoe, D.B., Tel. 617-4942368

**PERFORMING AGENCY:**

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Regan, L.G., Tel. 202-4261510

STATUS: Obligated    START DATE: June 1972    COMPL. DATE: June 1973    TOTAL FUNDS: \$300000    FUND TYPE: PPA    CONTR. NO.: PPA-RR-309

In view of the high incidence of railroad accidents due to human factors and the lack of federal regulations regarding safe performance by railroad personnel, a human factors program has been undertaken to provide the technical services necessary in this area for support of FRA regulatory responsibilities. Support is provided in the development of physical fitness standards, and research efforts in the areas of detailed task analysis, physiological measurement, accident investigation and vandalism. Additional work will be undertaken in the areas of standards for operating rules, railroad signals, training for railroad operations, aptitudes, attitudes and type of supervision and establishing a simulation facility and its research program.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, GWA-73-RR

012617

**PROTECTIVE DEVICES AT RAILROAD GRADE CROSSINGS****PERFORMING AGENCY:**

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

**SPONSORING AGENCY:**

Federal Highway Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

STATUS: Active START DATE: Aug. 1968 COMPL. DATE: Dec. 1972 TOTAL FUNDS: \$100000 FUND TYPE: In-House

To develop analytical procedures for evaluating the cost-effectiveness of protective devices at railroad grade crossings.

**ACKNOWLEDGEMENT:**

Federal Highway Administration, 032321354

014822

**GRADE-CROSSING PROTECTIVE DEVICES****INVESTIGATORS:**

Hopkins, J.B., Task Manager, Tel. 617-4942048

**PERFORMING AGENCY:**

Transportation Systems Center, DOT, 55 Broadway, Cambridge, Massachusetts 02142 PROJ. NO. PPA-RR02-1

**SPONSORING AGENCY:**

Federal Railroad Administration, DOT, 400 7th Street, SW, Washington, D.C. 20591 PROJ. NO. 71-RR-1

**RESPONSIBLE INDIVIDUAL:**

Lawson, K.L., Tel. 202-4260855

STATUS: Active START DATE: Jan. 1971 COMPL. DATE: June 1972 TOTAL FUNDS: \$295000 FUND TYPE: ID CONTR. NO. : PPA-RR202 CONTR. TYPE: CR

**OBJECTIVES AND SCOPE:**

This program will continue to utilize modern technological advances in the conceptualization, development, test, and evaluation of warning devices and train detection systems for grade crossing protection. The primary goals of lower cost and/or greater effectiveness will be sought through three specific avenues.

**ACKNOWLEDGEMENT:**

Transportation Systems Center

025441

**LOCOMOTIVE CRASH ATTENUATION DEVICE****INVESTIGATORS:**

Koplow, M.D.

**PERFORMING AGENCY:**

Transportation Systems Center, DOT, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

STATUS: TOTAL FUNDS: \$92400 FUND TYPE: PPA CONTR. NO. : PPA-RR-211 CONTR. TYPE: CR

**OBJECTIVES AND SCOPE:**

The train-strikes-vehicle type accident accounts for about 75% of the 1,100 or more annual train-involved grade crossing fatalities. The chief victims of these accidents are passenger car occupants (85%), but infrequent train/bus collisions have been notable tragedies. The fatality producing mechanisms of these accidents-impact force, disintegration, penetration, and fire, can be reduced in severity by modifying the forward cushioning device, while other design features can lessen the tendency of the train to drag, penetrate, roll, or otherwise destroy the impacted vehicle. This task undertakes the analysis, development, fabrication and testing of a crash attenuation device for trains. The device must be effective for a major potential of being reasonably economical to manufacture and install. In addition, the device must be practical. Its use must be compatible with efficient railroad practice.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration:

035714

**A FIELD EVALUATION OF DRIVER INFORMATION SYSTEMS FOR HIGHWAY-RAILWAY GRADE CROSSINGS****INVESTIGATORS:**

Heathington

**PERFORMING AGENCY:**

Purdue University, Lafayette, Indiana 47907

**SPONSORING AGENCY:**

Federal Highway Administration, Department of Transportation, Washington, D. C. 20590

**RESPONSIBLE INDIVIDUAL:**

Huntington, P.E., Tel. 202-5575224

STATUS: Active COMPL. DATE: Feb. 1972 TOTAL FUNDS: \$7000 FUND TYPE: HP&R CONTR. NO. : C-36-59N

To evaluate the performance of motorists as they approach a crossing with the present standard flasher and to evaluate the effectiveness of the following crossing warning/protection improvements: red flashers over the roadway, crossing illumination, and automatic gates with high-intensity flashers on the gate arms.

**ACKNOWLEDGEMENT:**

Federal Highway Administration, 026012354

036023

**HUMAN FACTORS COUNTERMEASURES TO IMPROVE HIGHWAY-RAILWAY INTERSECTION SAFETY 212 PPS# 1.b.****PERFORMING AGENCY:**

National Highway Traffic Safety Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Regan, L.G., Tel. 202-4261510

STATUS: START DATE: Sept. 1971 TOTAL FUNDS: \$83300 FUND TYPE: ID CONTR. NO. : DOT-AR-20005

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PP 41230

036727

**NATIONAL PUBLIC RAILROADS-HIGHWAY GRADE CROSSING INFORMATION SYSTEM****INVESTIGATORS:**

Sproles, M.R.

# RAIL-HIGHWAY GRADE CROSSINGS

08A

## PERFORMING AGENCY:

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

## SPONSORING AGENCY:

Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590  
Association of American Railroads

## OBJECTIVES AND SCOPE:

Develop a Centralized Comprehensive, National Public Railroad-Highway Grade Crossing Information System and number each public railroad-highway grade crossing.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR # RP-67

036744

## GRADE CROSSING PROTECTION

### INVESTIGATORS:

Hopkins, J.B., Tel. 617-4942048

### PERFORMING AGENCY:

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

## SPONSORING AGENCY:

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

## RESPONSIBLE INDIVIDUAL:

Lawson, K., Tel. 202-4262965

STATUS: Obligated START DATE: July 1972 COMPL. DATE: June 1973 TOTAL FUNDS: \$700000 FUND TYPE: PPA CONTR. NO.: PPA-RR-302

Development of improved technology for grade crossing protection, and delineation of the optimal application of both conventional and innovative systems. The FY73 effort will consist of four tasks: (1) coordination of relevant past and present activities of FRA and others, summarizing the present status and specifically recommending a future course, (2) further development and extensive field test of new means of train detection and signal activation, to provide technically and economically acceptable alternatives to and improvements on track circuits, (3) extension of past studies of desirability and means of enhancing train visibility to support a large-scale test of the concept, and (4) study of the feasibility of locomotive-mounted crash attenuation structures.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, GWA-73-RR



**09A**

**MATERIALS SCIENCE**

**036769**

**POLYMER CONCRETE**

**PERFORMING AGENCY:**

Department of Interior, Washington, D.C.

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lampros, A.F., Tel: 202-4260808

**STATUS:** Obligated

**START DATE:** Dec. 1971

**TOTAL**

**FUNDS:** \$45000

**FUND TYPE:** IA

**CONTR. NO. :** DOT-

AR-20014

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

036351

**RAILROAD LOCOMOTIVE EXHAUST EMISSION CONTROL****INVESTIGATORS:**

Hergenrother, K., Tel. 617-4942041

**PERFORMING AGENCY:**

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590 PROJ. NO. RP-30

**RESPONSIBLE INDIVIDUAL:**

Lawson, K., Tel. 202-4262965

**STATUS:** START DATE: July 1972    **COMPL. DATE:** Sept. 1973  
**TOTAL FUNDS:** \$120000    **FUND TYPE:** PPA  
**CONTR. NO.:** PPA-RR-301

A program started with the Environmental Protection Agency in FY72 to identify and evaluate the retrofitable engine modifications will continue. A cooperative effort will be undertaken with the American Association of Railroads to study the sensitivity of diesel engine emissions to maintenance and repair procedures.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR# RR-73

043420

**MEASUREMENTS OF PARTICULATES IN AUTOMOTIVE EXHAUST****INVESTIGATORS:**

Springer, G.S.

**PERFORMING AGENCY:**

Michigan University, Ann Arbor, Department of Mechanical Engineering, Ann Arbor, Michigan 48106

**SPONSORING AGENCY:**

Environmental Protection Agency, Office of Research and Monitoring, Washington, D.C. PROJ. NO. R-801476

**STATUS:** Active    **START DATE:** Nov. 1972    **COMPL. DATE:** Oct. 1973  
**TOTAL FUNDS:** \$31490

The major objectives of the proposed research program are to establish competence in the field of particle technology and to apply this competence to the study of particles in the exhaust of automotive engines. The particular aims of this program are: (1) to construct sampling equipment and develop experimental procedures suitable for collecting and analyzing particles in the automotive exhaust (2) to apply these experimental techniques to automotive engines and determine the physical and chemical characteristics of particulates under a wide range of engine operating conditions (3) to determine how the data obtained can be applied to suggest fuel, hardware or cycle modifications resulting in the reduction of automotive emissions.

**ACKNOWLEDGEMENT:**

Science Information Exchange, 7GX 6403 2

013856

**ADVANCED LIM WITH POWER CONDITIONING EQUIPMENT FOR USE ON TACRV 212 PPS# 72-1.C.1.****INVESTIGATORS:**

Simpson, A., Project Manager, Tel. 213-3239500X281

**PERFORMING AGENCY:**

AiResearch Manufacturing Company, Garrett Corporation, 2525 West 190th Street, Torrance, California 90509

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Larsen, P.J., Tel. 202-4260808

STATUS: Obligated    START DATE: June 1970    COMPL. DATE: June 1973    TOTAL FUNDS: \$4792064    FUND TYPE: Contract    CONTR. NO.: DOT-FR-00029    CONTR. TYPE: CPFF

**OBJECTIVES AND SCOPE:**

Design and laboratory development of a self supported Linear Motor operating from power conditioned from standard wayside electric power. Linear motor being designed for operation at 300 mph providing a thrust of 15,000 lbs. for use on the TACRV. The power conditioning equipment being designed operates from wayside power of 8250 Volts and provides to the linear motor variable frequency and voltage using solid state technology. Upon completion of Task 1, the design manufacture will proceed under Task 2 with completion of ADLIM system by April 1971 for installation in TACRV and testing at the High Speed Ground Test Center. The design, manufacture has proceeded under Task 2 with completion of 1/2 ADLIM system by April 1971 for installation in TACRV and testing at the High Speed Ground Test Center.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-124

013860

**WAYSIDE POWER DISTRIBUTION AND COLLECTION SYSTEM FOR HIGH SPEED TRACKED AIR CUSHION VEHICLE****INVESTIGATORS:**

Colburn, G.

**PERFORMING AGENCY:**

AiResearch Manufacturing Company, Garrett Corporation, 2525 West 190th Street, Torrance, California 90509

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Harding, J.T., Tel. 202-4260808

STATUS: Obligated    START DATE: Mar. 1971    COMPL. DATE: June 1972    TOTAL FUNDS: \$1518457    FUND TYPE: Contract    CONTR. NO.: DOT-FR-10002    CONTR. TYPE: CPFF

Garrett will perform the lab tests necessary to translate their conceptual design for a power collector/distributor system into hardware which is capable of delivery of uninterrupted three phase power to the TACRV at speeds up to 300 mph. The result of this contract will be a full scale collector and distributor plus final design for the remainder of the distribution system.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

013876

**CONTINUATION OF HIGH SPEED GROUND TEST RESEARCH 212 PPS# 72-1.c.1.****INVESTIGATORS:**

Wormley, D.N., Associate Professor

**PERFORMING AGENCY:**

Massachusetts Institute of Technology, Cambridge, Massachusetts

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lampros, A.F., Tel. 202-4260808

STATUS: Obligated    START DATE: Dec. 1970    COMPL. DATE: Sept. 1972    TOTAL FUNDS: \$134084    FUND TYPE: Contract    CONTR. NO.: DOT-FR-10007    CONTR. TYPE: CR

Continuation of Research in Coupled Dynamic Interactions between High Speed Ground Transport Vehicles and Guideway Structures. Task 1 is being performed to optimize and formulate guidelines for designers of vehicles guideway systems. Continuation of Basis Research and Development in Fluid Suspension Dynamics. Task 2 concerns the development of new techniques for improving the ride quality of tracked air cushion vehicles, through active control of the air cushion system, and the development of associated guidelines for vehicle designers.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-110

014825

**ELECTRIC POWER AND PROPULSION FOR HIGH SPEED TRACKED VEHICLES****INVESTIGATORS:**

Raposo, F.L., Task Manager, Tel. 617-4942031

**PERFORMING AGENCY:**

Transportation Systems Center, Department of Transportation, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

Federal Railroad Administration, Department of Transportation, Washington, D.C. 20591    PROJ. NO. 71-RR-1

**RESPONSIBLE INDIVIDUAL:**

Ward, E.J., Tel. 202-4260850

STATUS: Active    START DATE: Nov. 1970    COMPL. DATE: June 1972    TOTAL FUNDS: \$255000    FUND TYPE: PPA    CONTR. NO.: PPA-RR-05/1    CONTR. TYPE: CR

**OBJECTIVES AND SCOPE:**

This task is concerned with advanced concepts in electric power and propulsion for high speed tracked vehicles, which will guide the development of light weight and reliable systems. The sub-system components consist of the linear electric motor, power conditioning, collection and distribution. This task provides DOT with a technical base in electric power and propulsion from which to assess contractor effort. This task is a continuation of FY71, and combines the previous separate tasks of power conditioning and power collection.

**ACKNOWLEDGEMENT:**

Transportation Systems Center

014826

**RAM WING SUSPENSION****INVESTIGATORS:**

Barrows, T.M., Task Manager, Tel. 617-4942451

**PERFORMING AGENCY:**

Transportation Systems Center, Department of Transportation, 55 Broadway, Cambridge, Massachusetts 2142

**SPONSORING AGENCY:**

Federal Railroad Administration, Department of Transportation, 400  
7th Street, SW, Washington, D.C. 20591 PROJ. NO. 71-RR-1

**RESPONSIBLE INDIVIDUAL:**

Lampros, A.F., Tel. 202-4260808

STATUS: Active START DATE: Dec. 1970 COMPL.  
DATE: June 1972. TOTAL FUNDS: \$50000 FUND TYPE:  
PPA CONTR. NO.: PPA-RR-07/0 CONTR. TYPE: CR

**OBJECTIVES AND SCOPE:**

This PPA is an extension of a program begun in fiscal 1971 which studied the feasibility of ram wing suspension systems. The program has shown that the ram wing concept for suspending a high speed ground transportation vehicle does indeed show a great deal of promise. Research on this concept will continue with a goal of establishing a rational procedure for designing full scale vehicles. In addition to the glide tests begun in FY71, towing tank tests will be conducted on various ram wing models. Also, the possibilities of building a drum tunnel, a new type of facility for testing ground transportation vehicles, will be explored.

**ACKNOWLEDGEMENT:**

Transportation Systems Center

**016806**

**PRODUCE COMMAND AND CONTROL SYSTEMS FOR AUTOMATED TRANSIT NETWORKS****PERFORMING AGENCY:**

Applied Physics Laboratory, Johns Hopkins University, 8621 Georgia Avenue, Silver Spring, Maryland 20910

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Gimmler, F., Tel. 202-4264047

STATUS: Obligated START DATE: June 1969 COMPL.  
DATE: Nov. 1972 TOTAL FUNDS: \$765000 FUND  
TYPE: IA CONTR. NO.: DOT-UT-109

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, MD-06-0011

**019705**

**GUIDED RADAR FOR OBSTACLE DETECTION IN GUIDED TRANSPORT SYSTEMS-SIGNAL PROCESSING ASPECTS****INVESTIGATORS:**

Aitken, G.J.M.

**PERFORMING AGENCY:**

Canadian Institute for Guided Ground Transport

**SPONSORING AGENCY:**

Canadian National Railways, Montreal, Quebec Canada  
Ministry of Transport, Canada, Ottawa, Ontario Canada  
Queens University, Kingston, Ontario Canada

**OBJECTIVES AND SCOPE:**

The project aims to establish performance specifications, dispersion and attenuation characteristics, and waveguide-object interactions.

**ACKNOWLEDGEMENT:**

Roads and Transportation Association of Canada

**036104**

**ELECTRIC POWER AND PROPULSION FOR HIGH SPEED TRACKED VEHICLES****INVESTIGATORS:**

Raposa, F.L., Tel. 617-4942031

**PERFORMING AGENCY:**

Transportation Systems Center, Department of Transportation, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Guarino, M., Tel. 202-4260808  
Harding, J.

STATUS: TOTAL FUNDS: \$300000 FUND TYPE:  
PPA CONTR. NO.: PPA-RR-205/1 CONTR. TYPE: CR

This task is concerned with advanced concepts in electric power and propulsion for high speed tracked vehicles, which will guide the development of light weight and reliable systems. The sub-system components consist of the linear electric motor, power conditioning, collection and distribution. This task provides DOT with a technical base in electric power and propulsion from which to assess contractor effort. This task is a continuation of FY71, and combines the previous separate tasks of power conditioning and power collection.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

**036748**

**RAM AIR CUSHION****INVESTIGATORS:**

Barrows, T.M., Tel. 617-4942451

**PERFORMING AGENCY:**

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lampros, A.F., Tel. 202-4269564

STATUS: Obligated START DATE: July 1972 COMPL.  
DATE: June 1973 TOTAL FUNDS: \$65000 FUND TYPE:  
PPA CONTR. NO.: PPA-RR-307

The ram air cushion (formerly ram wing) has been shown to be a very attractive concept for high speed ground transportation. Research will continue on experimentally validating the theoretical models for this concept using the towing tank technique developed during FY72, and parametric studies will be carried out to determine promising vehicle configurations. An additional effort will be made to determine the best method of propulsion for these vehicles. Detailed plans will be formulated for a powered model demonstration.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, GWA-73-RR

**038058**

**CONDUCT PRELIMINARY STUDIES, PREPARE PRELIMINARY COSTS ESTIMATES AND ESTABLISH DESIGN PARAMETERS****PERFORMING AGENCY:**

Mitre Corporation, Bedford, Massachusetts 01730

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lucke, W., Tel. 202-4260808

STATUS: Obligated START DATE: May 1972 COMPL.  
DATE: Oct. 1972 TOTAL FUNDS: \$497594 FUND  
TYPE: Contract CONTR. NO.: DOT-FR-7-35248/15  
CONTR. TYPE: CPFF

Deliverable Items are: TACRV (w/o LIM-PCU) Test Plan to establish base-line TACRV performance, also dynamics test program. Procurement specifications and design requirements for variable geometry TACRV guideway section, also reaction rail test program.

A math model of the integrated power distribution system/power conditioning unit/LIM for the 5,000 lb. thrust TACRV-LIM/PCU. The reports called out in the LIMRV section, Par. 2. Updated Test Center Master Plan. Preliminary design of a Tube Vehicle System test facility at the Test Center. SLIM test report and development Work Statement. Comparative analysis report on levitation systems. Work Statement for development of a vehicle to evaluate the maglev concept full scale at the HSGTC. 5-year obstacle detection development plan. Recommendations for future LIMRV.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-147

**038062****HIGH SPEED SUSPENDED VEHICLE SYSTEMS****PERFORMING AGENCY:**

TRW Systems, 1 Space Park, Redondo Beach, California 90278

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Gross, A., Tel. 202-4269660

STATUS: Obligated START DATE: July 1972 COMPL. DATE: June 1973 TOTAL FUNDS: \$378005 FUND TYPE: Contract CONTR. NO.: DOT-FR-30004

The work to be performed under the proposed contract is directed to the completion of the High Speed Suspended Vehicle Systems (SVS) Study including an economic comparison of the SVS class with alternate systems and a comprehensive investigation of cable supported guideways. The study will also investigate critical gas dynamics relationships to provide data vital to the potential employment of the Tube Vehicle Systems for high speed operations. The study will evaluate the potential of the SVS on a comparative basis with other types now being contemplated.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

**038644****TRANSLATION OF TESTS ON TRANSPAPID 02 SYSTEM****PERFORMING AGENCY:**

Krauss-Maffei AG, DGA International, Incorporated, 1225 Nineteenth Street, NW, Washington, D.C. 20036

**SPONSORING AGENCY:**

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

STATUS: Obligated START DATE: Dec. 1972 COMPL. DATE: Mar. 1973 TOTAL FUNDS: \$19574 FUND TYPE: Contract CONTR. NO.: DOT-FR-30017 CONTR. TYPE: FFP

The contractor shall compile, interpret, translate, from German to English, print, and deliver to the Federal Railroad Administration certain data accumulated from tests of the Transrapid 02 System, which shall include: data on accelerations of the primary suspension and motions at any speed up to 100 mph, data, for simulators only, on eddy current effects and on lift-to-drag ratios over entire speed range up to 300 mph, and data on energy consumption, relationships of tolerances and costs for guideway construction, safety aspects, and electro-magnetic interferences.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 14-66

**038645****WAYSIDE POWER DISTRIBUTION & COLLECTION SYSTEM****PERFORMING AGENCY:**

AiResearch Manufacturing Company, Garrett Corporation, 2525 West 190th Street, Torrance, California 90509

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Novotny, R.A., Tel. 202-4269564

STATUS: Obligated START DATE: Jan. 1973 COMPL. DATE: Feb. 1974 TOTAL FUNDS: \$1299452 FUND TYPE: Contract CONTR. NO.: DOT-FR-30036 CONTR. TYPE: CPFF

The proposed contractor shall continue performance to deliver a "Wayside Power Distribution & Collection System" for the Tracked Air Cushion Research Vehicle (TACRV). This "Phase III" segment is for installation, Acceptance Testing and Development" of the system. Phase I and II currently being performed by AiResearch Mfg. Co. under Contract No. DOT-FR-10002.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

**038646****TEST PROGRAM ON THE LINEAR INDUCTION MOTOR TEST VEHICLE****PERFORMING AGENCY:**

AiResearch Manufacturing Company, Garrett Corporation, 2595 West 190th Street, Torrance, California

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Grumwald, K., Tel. 303-9473352

STATUS: Obligated START DATE: Jan. 1973 COMPL. DATE: June 1974 TOTAL FUNDS: \$1534088 FUND TYPE: Contract CONTR. NO.: DOT-FR-30026 CONTR. TYPE: CPFF

Test program on the linear induction motor test vehicle at the High Speed Ground Test Center, Modifications to the vehicle. The primary objective of the test program is to obtain meaningful high-speed test data on LIM electrical performance and vehicle dynamics at speeds in excess of 200 mph, and preferably in the vicinity of 250 mph.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 73-18

**038789****TRACKED AIR CUSHION RESEARCH VEHICLE, PHASE V, TEST OPERATIONS PROGRAM****PERFORMING AGENCY:**

Grumman Aerospace Corporation, Bethpage, New York 11714

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lampros, A.F., Tel. 202-4269564

STATUS: Obligated START DATE: Feb. 1973 COMPL. DATE: Jan. 1976 TOTAL FUNDS: \$600000 FUND TYPE: Contract CONTR. NO.: DOT-FR-30041 CONTR. TYPE: CPFF

The TACRV Phase V Test Operations Program will be implemented and conducted in conformance with Grumman Report PMT-B4-R72-6 TACRV Phase V Test Operations Plan. Effort will be required at DOT's High Speed Ground Test Center and Grumman, Bethpage to satisfy the various activities associated with TACRV test operations. The TACRV Test Operations Program consists of the following tasks: Test Operations-HSGTC, Test Operations-Bethpage, Ingress/Egress System Design, Fabrication and Installation, Guideway Perturbations Design, Fabrication and Installation,

TACRV Remote Control Design, TACRV Systems Interface Management and TACRV Arrestment System Study.

ACKNOWLEDGEMENT:  
Federal Railroad Administration, PR# 72-158

007411

**DEVELOP NATIONAL POLLUTION RESPONSE CENTER  
HAZARDOUS MATERIALS INFORMATION SYSTEM  
(CHRIS)****PERFORMING AGENCY:**

Little (Arthur D), Incorporated, Acron Park, Cambridge, Massachusetts 02140

**SPONSORING AGENCY:**

United States Coast Guard, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590 PROJ. NO. POL

**RESPONSIBLE INDIVIDUAL:**

Coburn, J.L., Jr., Tel. 202-4261023  
Lindak, J.E.

STATUS: Obligated START DATE: Nov. 1970 COMPL. DATE: Apr. 1972 TOTAL FUNDS: \$217820 FUND TYPE: Contract CONTR. NO. : DOT-CG-03,223-A CONTR. TYPE: CPFF

**OBJECTIVES AND SCOPE:**

Develop a computerized information system to provide pertinent information for both routine and emergency control of dangerous chemical shipments. The routine application would be evaluation of proposed shipments and design work. The emergency information would predict magnitude and nature of disaster, decontamination measures, critical times and exposures, to aid on-scene commanders in coping with a large scale spill. The information system will be incorporated as part of the National Pollution Response Center as delineated in the National Multi-agency oil and hazardous materials contingency plan.

**APPROACH AND METHODS:**

Contract for Fundamental System Development of subject information system, to include at least the following: (a) user and user need survey, (b) assesment of existing data and information, (c) preliminary systems design, (d) overall management plan.

**PROGRESS AND RESULTS:**

Reported under individual work units.

**ACKNOWLEDGEMENT:**

United States Coast Guard, 714151

025370

**RAIL AND WHEEL FLAW DETECTION****INVESTIGATORS:**

Lyons, J.W., Tel. 617-4942040

**PERFORMING AGENCY:**

Transportation Systems Center, Department of Transportation, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Bray, D.E., Tel. 202-4262965

STATUS: TOTAL FUNDS: \$26000 FUND TYPE: PPA CONTR. NO. : PPA-RR-212 CONTR. TYPE: CR

Defects in and failure of equipment such as trucks, wheels and axles, couplers, brakes, etc., were responsible for 23.25% of all train

accidents in 1970 and caused \$38.3 million damage to equipment and track. Although extensive inspections of these items are carried out during manufacture, overhaul, and maintenance, few techniques or methods are available for in-service inspection. Defects can develop. A program to provide the necessary technology for greater reliability of suspension components and rails, and to develop in-service inspection methods and criteria for these items, has been initiated to promote greater safety in railroad freight and passenger service.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, 72-RR

036274

**DATA COLLECTION****PERFORMING AGENCY:**

Central Technology, Incorporated, 811 Fenton Street, Silver Spring, Maryland 20910

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lawson, K.L., Tel. 202-4262965

STATUS: Obligated START DATE: May 1972 COMPL. DATE: Nov. 1972 TOTAL FUNDS: \$117523 FUND TYPE: Contract CONTR. NO. : DOT-FR-10052

CENTEC in its data gathering efforts to date has obtained access to the extensive derailment report files of several large railroads. These reports record track geometry as related to the derailment. Assembly of these data into a meaningful categorization could disclose the track geometry limits that tend to induce derailments. Such findings would bear directly on the FRA efforts to set minimum safety standards for track geometry. It is proposed that these data be collected and assembled accordingly.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR# RP-44

043419

**ALCOHOL INFLUENCES ON PERCEPTUAL-COGNITIVE BEHAVIOR****INVESTIGATORS:**

Perrine, M.W. Huntler, M.S.

**PERFORMING AGENCY:**

Vermont University, Department of Psychology, 85 South Prospect Street, Burlington, Vermont 05401

**SPONSORING AGENCY:**

Public Health Service, Department of Health, Education and Welfare

The proposed research consists of an interrelated series of experiments designed to study the influences of several blood alcohol concentrations obtained with three different beverage alcohols (ethanol, bourbon, and beer) upon certain key perceptual-cognitive functions which are assumed to be especially crucial for successful automobile driving.

**ACKNOWLEDGEMENT:**

Science Information Exchange, 1MH 17583 4

010342

**COMMODITY FLOW DATA STUDY OF UNITED STATES FOREIGN TRADE**

INVESTIGATORS:  
Church, D.E.

## PERFORMING AGENCY:

Bureau of the Census, Department of Commerce, Suitland, Maryland  
PROJ. NO. Project No. 7097

## SPONSORING AGENCY:

Office of Policy and International Affairs, Policy and Int Affairs Assistant Secretary/DOT, 400 7th Street, SW, Washington, D.C. 20590  
Army Corps of Engineers, Department of the Army, Washington, D.C.

## RESPONSIBLE INDIVIDUAL:

Murphy, R.D., Analyst, Tel. 202-4264203  
Olson, H., Tel. 312-3536370

STATUS: Active    COMPL. DATE: May 1970    TOTAL FUNDS: \$247000    FUND TYPE: IA    CONTR. NO.: DOT-AS-00043    CONTR. TYPE: CR

Deliverable items will be of two categories: (a) Govt. use only; data tape (b) Public use; data tape with proprietary information concealed and/or deleted.

## OBJECTIVES AND SCOPE:

To obtain current (1970) U. S. waterborne and airborne foreign trade commodity flow data regarding (a) outbound flows from identifiable origins within the U. S. through U. S. ports of exit to foreign countries, and (b) inbound flows from foreign countries through U. S. ports of entry to identifiable U. S. interior destinations. Trade data (sample bases) for C. Y. 1970 will provide basis for data base; (c) Statistical sampling using Bureau of the Census foreign trade tapes as universe. Information to be supplemented by use of questionnaire survey.

## ACKNOWLEDGEMENT:

Office of Policy and International Affairs/OST

025222

**ALTERNATIVE RAIL BASED GRAIN DISTRIBUTION SYSTEMS 212 PPS# 3.A.1.**

## PERFORMING AGENCY:

Iowa State University, Ames, Iowa

## SPONSORING AGENCY:

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

## RESPONSIBLE INDIVIDUAL:

Boone, J., Tel. 202-4261659

STATUS:    START DATE: Apr. 1972    TOTAL FUNDS: \$191319    FUND TYPE: Contract    CONTR. NO.: DOT-FR-20025

Fully describe the region's grain marketing system in terms of, but not limited to location, number, destination and transportation network. Develop the costs of production, storage, conditioning, and transportation of grain within the region. Forecast the production and off-farm consumption of grains produced within the region. Develop and analyze a series of rail-based transportation/storage alternatives. Select the alternative that will produce the least cost of physical distribution for the region's grains, subject, but not limited, to: magnitude of investments required, financial viability, and flexibility.

## ACKNOWLEDGEMENT:

Federal Railroad Administration, PR# RP-20

032743

**CHANGING SUPER-CARRIER CARGO FLOWS AND ROUTES**

## INVESTIGATORS:

Nossum, B., Tel. 4572494

## PERFORMING AGENCY:

New York State University, Oswego, Oswego, New York

## RESPONSIBLE INDIVIDUAL:

Bruffey, J.A., Assistant Professor, Tel. 4572494

## OBJECTIVES AND SCOPE:

To examine changes in the bulk commodity trading pattern since the introduction of super-ship technology. Investigation centers upon the major bulk commodities entering international seaborne commerce—i.e. crude petroleum, iron ore, grain and coal. Time period: 1955-1971.

## ACKNOWLEDGEMENT:

New York State University, Oswego

035952

**TRANSPORTATION FACTORS IN DOMESTIC AND FOREIGN MARKETING OF GRAIN, FEED INGREDIENTS AND MIXED FEEDS**

## INVESTIGATORS:

Thompson, W.H.

## PERFORMING AGENCY:

Iowa State University, Agricultural Experiment Station, Administration, Ames, Iowa

## SPONSORING AGENCY:

Iowa State Government

## OBJECTIVES AND SCOPE:

Determine domestic and foreign markets for grains, feed ingredients and mixed feeds. Determine costs of transporting the commodities to markets. Determine the services necessary to move the commodities.

## APPROACH AND METHODS:

By interviews with grain producers and processors in Iowa, and with grain handling firms and transportation agencies in the state and at export ports, changes in the direction and nature of the movements will be studied. Interviews with similar firms and agencies and observations of grain handling will be made at foreign ports. An analysis of transportation policies in common market nations (EEC) will be undertaken before follow-up studies to the Grain Transportation Report of 1967 are made.

## PROGRESS AND RESULTS:

Field Research has been completed on the dollar Loss and Damage to country elevators during 1969-70 as a result of transportation equipment shortages. Field research completed in the grain movements from Iowa in 1968-1969. This is an updating of Special Report #50. Field research completed on the export movements of grains from Iowa.

## ACKNOWLEDGEMENT:

Science Information Exchange, GY 56160 2

036540

**INTEGRATED TRANSPORTATION DATA MANAGEMENT SYSTEM**

## PERFORMING AGENCY:

Cain (Tolis) Corporation, 7316 Wisconsin Avenue, Bethesda, Maryland 20014

## SPONSORING AGENCY:

Office of Policy and International Affairs, Washington, D.C. 20590    PROJ. NO. TPI-10

STATUS:    COMPL. DATE: Feb. 1972    TOTAL FUNDS: \$416000    FUND TYPE: Contract    CONTR. NO.: DOT-OS-00049



**OBJECTIVES AND SCOPE:**

The Department has shown specific interest in programs to obtain detailed information about inter city passenger travel and goods movement. The Railroad Waybill sample is the only source of data from which reasonable reliable and comprehensive data can be obtained on Railroad Freight Traffic Characteristics and Requirements within the U.S. In order to maintain the data on an ongoing basis, the Department has accepted the responsibility for acquiring, processing, tabulating and publishing the Rail Freight Flow Data.

**APPROACH AND METHODS:**

Produce rail and motor freight flow data files and tabulations. Together with data relating to other modes of freight movements, the results will form a comprehensive Government-industry transportation data program. The data will be used in analysis, planning, developing and forecasting efforts related to freight transportation. This proposal called for the development of a computer-based system to optimize compatibility among forms of freight data, to permit incorporation of the latest and best development in information retrieval to meet the requirements of many of dissimilar usage of the system.

**ACKNOWLEDGEMENT:**

Office of Policy and International Affairs/OST

**043604****ECONOMICS EFFECT OF CHANGING RAILROAD SYSTEMS ON GRAIN HANDLING FIRMS****INVESTIGATORS:**

Baumel, C.P. Thompson, W.H. Fleming, D.K.

**PERFORMING AGENCY:**

Iowa State University, Department of Agricultural Economics, Ames, Iowa 50010

**SPONSORING AGENCY:**

Department of Agricultural, Cooperative State Research Service, Washington, D.C. PROJ. NO. 227790

STATUS: Active START DATE: Dec. 1969 COMPL. DATE: June 1974 CONTR. NO. : HATCH

This information reflects only the results obtained during the period specified and final results are subject to completion of the investigation.

The objectives of this project are to: estimate the effect of railroad abandonment or reduced service on country elevator operations; determine the needed adjustment in the grain industry resulting from railroad abandonment or reduced services; evaluate alternative options open to country elevator operations in adjusting to these changes; and estimate the effect of these changes on the flow of grain shipments.

**APPROACH AND METHODS:**

Develop a model describing the grain transportation system in Iowa. Collect data for use in the model. Complete the analyses required to achieve the objectives.

**PROGRESS AND RESULTS:**

A questionnaire was developed to determine farmer storage and transportation capability. This was mailed to a sample of 650 farmers in a 6 1/2 county area. An 81 percent response was obtained. These data are being analyzed. A questionnaire was developed to determine country elevator capability to receive, dry, store and ship out grain. This questionnaire was mailed to all 94 elevators in the 6 1/2 county area and 100 percent of the elevators responded. These data are being analyzed. Models have been developed to estimate elevator storage, receiving and drying requirements in the 6 1/2 county area. A model is under development to estimate structural changes in the movement of grain given specific changes in the transportation system.

**ACKNOWLEDGEMENT:**

Department of Agriculture, 0056040

**043605****GEOGRAPHIC DIFFERENTIALS IN RAILROAD RATES AND SERVICES: IMPLICATIONS FOR NEBRASKA AGRICULTURE****INVESTIGATORS:**

Anderson, D.G.

**PERFORMING AGENCY:**

Nebraska University, Department of Agricultural Economics, Lincoln, Nebraska 68503

**SPONSORING AGENCY:**

Department of Agriculture, Cooperative State Research Service, Washington, D.C. PROJ. NO. 227790

STATUS: Active START DATE: Apr. 1968 COMPL. DATE: Apr. 1973 CONTR. NO. : HATCH

This information reflects only the results obtained during the period specified and final results are subject to completion of the investigation.

Objectives are to: determine extent of geographic rate discrimination in transport of agricultural commodities; determine geographic rate/cost effects of innovations; determine geographic availability of transport services; relate cost to availability; and analyze geographic farm input price/transport rate pattern.

**PROGRESS AND RESULTS:**

Work continued during 1971 toward analyzing the supply and demand structure for rail transportation of grain. Research on the supply side is largely completed; additional research into demand is going ahead. Results will provide insights into problems of freight car shortages and suggest alternative solutions. Results of a mail questionnaire survey of Nebraska country, subterminal and terminal grain elevators have been tabulated and published. Survey results document grain flows by destination and mode of transport for calendar year 1969. About one-half of Nebraska's feed grain production and most of the wheat and soybeans move into market channels as grain. Railroads remain the major shipping mode and have increased their share of the traffic slightly since the 1950's. Grain shipped from Nebraska origins moves to a wide range of destinations; few major changes have occurred since the 1950's. Results provide valuable information on trends in grain marketing patterns and will be useful evidence in freight rate hearings.

**ACKNOWLEDGEMENT:**

Department of Agriculture, 0010489

**043606****BULK TRANSPORT OF FRUITS AND VEGETABLES BY COVERED RAIL HOPPER CAR****INVESTIGATORS:**

Black, W.R.

**PERFORMING AGENCY:**

Department of Agriculture, Transportation Research Br/Transp I Facilities Div, Federal Center Building, Hayttsville, Maryland 20782

**SPONSORING AGENCY:**

Department of Agriculture, Cooperative State Research Service, Washington, D.C. PROJ. NO. 27790

This information reflects only the results obtained during the period specified and final results are subject to completion of the investigation.

The Objectives are to evaluate feasibility of transporting selected fresh fruits and vegetables in bulk in refrigerated railroad covered hopper cars.

**PROGRESS AND RESULTS:**

Shipments of California White Rose-type potatoes in bulk in refrigerated, covered hopper cars and shipments by conventional methods in 100-pound burlap bags in ice bunker and mechanical refrigerator cars to a Boston, Mass. prepackaging plant were studied during the year. The packout rate for saleable potatoes received in the bulk hopper cars averaged about 2 percent more than those received in bags in conventional refrigerator cars. Product temperatures in the shipments received in all types of cars were at satisfactory levels. Total potential savings in refrigeration, loading and unloading labor, and material costs in favor of the large hopper car were found to to-

tal \$960.00 for a 176,000 pounds hopper carload as compared with a 48,000 pound load of bagged potatoes in a conventional refrigerator car. Further savings for the shippers ranging as high as \$1,900.00 per carload are also possible through incentive freight rates for use of the large hopper cars.

**ACKNOWLEDGEMENT:**

Department of Agriculture, 0021708

001546

**MARITIME RESEARCH INFORMATION SERVICE (MRIS)****INVESTIGATORS:**

Oren, J.B., Executive Director, MTRB, Tel. 202-9611440  
 Irick, P.E., Asst Director for Special Activities, Tel. 202-9611611  
 Mellor, D.G., Maritime Information Specialist, Tel. 202-9611687  
 Schofer, H.S., Information Systems Specialist, Tel. 202-9611611  
 Stevenson, M., Maritime Information Specialist, Tel. 202-9611452

Archbald, H., Maritime Information Specialist, Tel. 202-9611452  
 Stout, A.M., Information Technician

**PERFORMING AGENCY:**

Maritime Information Committee, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C. 20418

Highway Research Board, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, D.C. 20418

**SPONSORING AGENCY:**

Maritime Administration, Department of Commerce, Main Commerce Building, Washington, D.C. 20230

STATUS: Active START DATE: July 1973 COMPL. DATE: June 1974 FUND TYPE: Contract CONTR. NO.: C-O-35498

The MARITIME RESEARCH INFORMATION SERVICE (MRIS) is a computer-based service for acquisition, selection, storage, retrieval, and dissemination of references to proposed, ongoing, and completed research and development projects and to technical reports and journal articles in the maritime field. A Bulletin is published semi-annually and contains abstracts of all selections during the previous six months. Every effort is made to provide the user with the necessary information for obtaining completed reports, or in the case of ongoing projects to provide the name and address of the sponsor or project manager, including addresses and telephone numbers when known.

018954

**STUDY OF RELIABILITY IN RAILROAD NETWORK OPERATIONS****INVESTIGATORS:**

Sussman, J., Assistant Prof. of Civ. Engineering  
 Maritime Administration

**PERFORMING AGENCY:**

Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

West, S.B., Tel. 202-4261658

STATUS: Obligated START DATE: Jan. 1971 COMPL. DATE: June 1973 TOTAL FUNDS: \$202363 FUND TYPE: Contract CONTR. NO.: DOT-FR-10006

**OBJECTIVES AND SCOPE:**

To identify and evaluate factors which affect railroad network reliability.

**APPROACH AND METHODS:**

Approaches to be used: (1) Simple mathematical models; (2) The collection and analysis of data on actual railroad operations; (3) Applied network simulation models.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

019706

**IMPROVEMENT OF AUTOMATIC COUPLING-UP PERFORMANCE IN MARSHALLING YARDS****INVESTIGATORS:**

Kerr, C.N.

**PERFORMING AGENCY:**

Canadian Institute for Guided Ground Transport

**SPONSORING AGENCY:**

Canadian National Railways, Montreal, Quebec Canada  
 Ministry of Transport, Canada, Ottawa, Ontario Canada  
 Queens University, Kingston, Ontario Canada

**OBJECTIVES AND SCOPE:**

This project will consider new yard design lay-outs for automatic hump yards.

**ACKNOWLEDGEMENT:**

Roads and Transportation Association of Canada

036103

**DESIGN OF A TECHNICAL SERVICES FACILITY FOR THE HIGH SPEED GROUND TEST CENTER, PUEBLO, COLORADO****PERFORMING AGENCY:**

Nelson, Haley, Patterson and Quirk, Incorporated, 2021 Clubhouse Drive, Greeley, Colorado 80631

**SPONSORING AGENCY:**

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

STATUS: TOTAL FUNDS: \$123433 FUND TYPE: Contract CONTR. NO.: DOT-FR-20058 CONTR. TYPE: FP

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

036281

**DEVELOP METHODS OF IMPROVING UTILIZATION OF GENERAL SERVICE FREIGHT CARS****PERFORMING AGENCY:**

Penn Central Transportation Company, 6 Penn Central Plaza, Philadelphia, Pennsylvania 19104

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Smith, R.J., Tel. 202-4260772

STATUS: Obligated START DATE: June 1972 TOTAL FUNDS: \$233108 FUND TYPE: Contract CONTR. NO.: DOT-FR-20081 CONTR. TYPE: CR

A working group will be formed to (1) study the existing system, (2) develop an effective demand forecasting system, (3) develop a supply forecasting system, (4) define optimum car distribution, and (5) install each system for testing.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

036356

**NATIONAL CONTAINER NETWORK FEASIBILITY STUDY****PERFORMING AGENCY:**

Reebie Associates, Greenwich, Connecticut 06830

**SPONSORING AGENCY:**

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

STATUS: Obligated START DATE: June 1972 TOTAL FUNDS: \$490000 FUND TYPE: Contract CONTR. NO. : DOT-FR-20065 CONTR. TYPE: CPFF

Analysis of TOFC-COFC Service, traffic flow identification, container network operating costs, network service differential criteria and network route and node specifications, network line, terminal and facility analysis, network investment requirements, network service package and profitability, network organization and funding requirements, analysis of network benefits.

ACKNOWLEDGEMENT:  
PR# RP-48

**038379  
ASSIGNMENT OF EMPTY RAILROAD FREIGHT CARS**

PERFORMING AGENCY:  
Decision Systems Associated, Incorporated, 11428 Rockville Pike, Rockville, Maryland 20852

SPONSORING AGENCY:  
Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

RESPONSIBLE INDIVIDUAL:  
West, J., Tel. 202-4261677

STATUS: Obligated START DATE: Oct. 1972 TOTAL FUNDS: \$200000 FUND TYPE: Contract CONTR. NO. : DOT-FR-30013 CONTR. TYPE: FFP

The contractor is required to develop a Computer Based Model for the assignment of empty railroad freight cars. The model will be developed after a detailed analysis of assignment requirements and based upon these requirements. The model will be tested and evaluated against actual class 1 railroad procedures and results.

ACKNOWLEDGEMENT:  
Federal Railroad Administration

**044568  
YARD AND TERMINAL SUBSYSTEM (YATS)**

INVESTIGATORS:  
Bryan, L.M., Tel. 314-6222075

PERFORMING AGENCY:  
Missouri Pacific Railroad, Missouri Pacific Building, 210 North 13th Street, St. Louis, Missouri 63103

SPONSORING AGENCY:  
Missouri Pacific Railroad, Missouri Pacific Building, 210 North 13th Street, St. Louis, Missouri 63103

RESPONSIBLE INDIVIDUAL:  
Shattuck, J.A., Tel. 314-6222376

STATUS: Active START DATE: July 1971 COMPL. DATE: Jan. 1975 FUND TYPE: In-House

YATS is a subsystem of Missouri Pacific's Transportation Control System (TCS) and is designed to increase the efficiency of railroad operations at major terminals. YATS will assist operations by maintaining a computerized car inventory, supporting local management information requirements, generating car classification work orders, relieving the clerical data entry burden, and providing a real-time, online data base for local operations analysis. YATS is being developed on a Digital Equipment Corporation (DEC) PDP-11 mini-computer.

ACKNOWLEDGEMENT:  
Missouri Pacific Railroad

**044569  
CARS: CAR ACTIVITY REGULARIZING SCHEDULER**

INVESTIGATORS:  
Fuller, J.H., Senior Systems Analyst, Tel. 314-6222566  
Keller, D.C., Senior Systems Analyst, Tel. 314-6222566

PERFORMING AGENCY:  
Missouri Pacific Railroad, Missouri Pacific Building, 210 North 13th Street, St. Louis, Missouri 63103

SPONSORING AGENCY:  
Missouri Pacific Railroad, Missouri Pacific Building, 210 North 13th Street, St. Louis, Missouri 63103

RESPONSIBLE INDIVIDUAL:  
Fuller, J.H., Senior Systems Analyst, Tel. 314-6222566

STATUS: Active START DATE: Jan. 1971 COMPL. DATE: Dec. 1974 FUND TYPE: In-House

The purpose of the CARS model is to simulate the over-the-road portion of the Missouri Pacific's on-line car scheduling system and to evaluate the data used to drive this on-line system. A pilot program which simulates car scheduling over a portion of the Missouri Pacific network is operational. Current and future efforts are directed towards insuring compatibility of the model with the on-line system and expanding the model's data base to include the entire Missouri Pacific system. The CARS model is made up of three major subprograms—the Preprocessor, the Simulator and the Post processor. The Preprocessor accepts train schedules and blocking policy as input and builds the scheduling files required by the Simulator. The Simulator runs the network for a specified period of time. It accepts car-dependent records as input and schedules these cars to the through and local train required to move them to their respective destinations. Statistics from the Simulator are bled off for analysis by the Postprocessor. The Postprocessor measures the efficiency of the scheduling data base by generating reports on yard and train performance and on transit time reliability. 800 REPORTS ISSUED: Yoakum, R.L.; Beaumont, L.H., Railroad Car Scheduling System Incorporating Car Scheduling, Missouri Pacific Railroad, Jan. 1972

ACKNOWLEDGEMENT:  
Missouri Pacific Railroad

**044570  
YARDS: YARD ACTIVITY REAL-TIME DECISION SIMULATOR**

INVESTIGATORS:  
Hamilton, G.E., Advisory Systems Analyst, Tel. 314-6222075

PERFORMING AGENCY:  
Missouri Pacific Railroad, Missouri Pacific Building, 210 North 13th Street, St. Louis, Missouri 63103

SPONSORING AGENCY:  
Missouri Pacific Railroad, Missouri Pacific Building, 210 North 13th Street, St. Louis, Missouri 63103

RESPONSIBLE INDIVIDUAL:  
Bryan, L.M., Tel. 314-6222075

STATUS: Active START DATE: July 1970 COMPL. DATE: Dec. 1973 FUND TYPE: In-House

YARDS is a man-computer interactive simulation model which reflects the interaction, conflict, activity and decision processes of a real or proposed yard. All decisions during simulation are man-made and are entered into the computer via CRT terminal. YARDS will be used primarily to study yard operations and to train personnel. YARDS is being developed on a DEC PDP-11 computer.

ACKNOWLEDGEMENT:  
Missouri Pacific Railroad

043413

**SHOCK-ABSORBING MATERIALS****INVESTIGATORS:**

Hoff, G.C. Fouche, L.E.

**PERFORMING AGENCY:**

Waterways Experiment Station, Army Corps of Engineers, PO Box 631, Vicksburg, Mississippi 39180

**SPONSORING AGENCY:**

Department of the Army, Department of Defense

STATUS: Active START DATE: July 1972 COMPL.  
DATE: June 1973 FUND TYPE: In-House

This project concerns the development of special materials which will act elastically or semielastically at loads up to 450 PSI but show no appreciable increase in stress level for increases in applied static load until strains in excess of 40 percent of the initial height of the test specimens are reached.

**ACKNOWLEDGEMENT:**

Science Information Exchange, ZQA 38021 2

043414

**ACQUISITION OF SHOCK, LOAD, AND CLIMATIC DATA DURING TRANSPORTATION AND STORAGE OF CONTAINERS****INVESTIGATORS:**

Barca, F.D.

**PERFORMING AGENCY:**

Army Natick Laboratories, Department of the Army, Natick, Massachusetts 01760

**SPONSORING AGENCY:**

Department of the Army, Department of Defense

The purpose of this project is to accumulate data on the conditions of shock and climate to which contents of cases and containers are subjected during shipment and during handling and storage.

**ACKNOWLEDGEMENT:**

Science Information Exchange, ZQA 54181 3

**011903****INVESTIGATE ENVIRONMENTAL CONTROL IN UNDERGROUND RAPID TRANSIT SYSTEMS****PERFORMING AGENCY:**

Institute for Rapid Transit, 1612 K Street, NW, Washington, D.C. 20006

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590 PROJ. NO. DC-MTD-7

**RESPONSIBLE INDIVIDUAL:**

Mora, J., Tel. 202-4260090

STATUS: Obligated    START DATE: Oct. 1970    COMPL. DATE: July 1973    TOTAL FUNDS: \$3003257    FUND TYPE: Grant    CONTR. NO.: DOT-UT-290

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, DC-06-0010

**019578****SURVEY TO DETERMINE POTENTIAL FOR IMPROVED RAIL ADVANCED VEHICLE SERVICE 212 PPS# 5.C.****PERFORMING AGENCY:**

Peat, Marwick, Mitchell and Company, 1025 Connecticut Avenue, NW, Washington, D.C. 20036

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

DeBoer, D., Tel. 202-4260771

STATUS: Obligated    START DATE: Aug. 1971    COMPL. DATE: Jan. 1972    TOTAL FUNDS: \$230813    FUND TYPE: Contract    CONTR. NO.: DOT-FR-20005    CONTR. TYPE: FFP

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR# 71-118

**036144****IMPROVED PASSENGER TRAIN (IPT) SERVICE IN THE U.S.****PERFORMING AGENCY:**

Mitre Corporation, Westgate Research Park, McLean, Virginia

**SPONSORING AGENCY:**

Office of Policy and International Affairs, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Miller, M., Tel. 202-4260783

STATUS:    TOTAL FUNDS: \$395000    FUND TYPE: Contract    CONTR. NO.: DOT-OS-20191

The study will examine the economic, technological and institutional factors associated with implementing and operating improved passenger train (IPT) service in the U.S. as compared with high speed Tracked Levitated Systems (air cushion or magnetic levitation suspension).

**ACKNOWLEDGEMENT:**

Office of Policy and International Affairs/OST

**036355****STUDY TO DEVELOP A PLAN AND TECHNIQUES TO MEASURE THE EFFECTIVENESS OF THE NATIONAL RAIL PASSENGER SERVICE****PERFORMING AGENCY:**

Ernst and Ernst, 1225 Connecticut Avenue, NW, Washington, D.C. 20036

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Ernst and Ernst, Tel. 202-4260808

STATUS: Obligated    START DATE: June 1972    COMPL. DATE: Mar. 1973    TOTAL FUNDS: \$130329    FUND TYPE: Contract    CONTR. NO.: DOT-FR-20068    CONTR. TYPE: CPFF

Research study to develop a plan and techniques to measure the effectiveness of the National Rail Passenger Service in accordance with the RFP dated May 24, 1972.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR# RP-43

**036731****IMPROVED PASSENGER TRAINS VS. TRACKED LEVITATION VEHICLES****PERFORMING AGENCY:**

Pan-Technology Consulting Corporation, 1771 N Street, NW, Washington, D.C. 20030

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Ditmeyer, S., Tel. 202-4261227

STATUS: Obligated    START DATE: Aug. 1972    COMPL. DATE: Oct. 1972    TOTAL FUNDS: \$104920    FUND TYPE: Contract    CONTR. NO.: DOT-FR-20080    CONTR. TYPE: FFP

Study and formulate information concerning freight interference and right-of-way availability of improved passenger trains vs. tracked levitation vehicles (Magnetic or air). Information is to be long range planning and budgetary for OST/FRA FY-74 budget and future projections of 1975, 1985, 1995 traffic preference.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR# 73-05

**036741****TRAVELER COMFORT/CHICAGO-ST. LOUIS, NEW YORK-MIAMI****INVESTIGATORS:**

Goldman, A.

**PERFORMING AGENCY:**

National Analysts, Incorporated, 1015 Chestnut Street, Philadelphia, Pennsylvania 19107

**SPONSORING AGENCY:**

Federal Railroad Administration

**OBJECTIVES AND SCOPE:**

To perform a study of the needs and desires of travelers in the Chicago-St. Louis Corridor and on the route between New York and Miami-Tampa.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR# 71-118

**036950****MULTIMODAL SHORT HAUL STUDIES****INVESTIGATORS:**

Perrine, C.H., SA, Tel. 617-4942510

**PERFORMING AGENCY:**

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

Office of Systems Development and Technology, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Hannon, R., Tel. 202-4264208

STATUS: Obligated START DATE: Dec. 1972 COMPL.  
DATE: June 1973 TOTAL FUNDS: \$300000 FUND  
TYPE: PPA CONTR. NO.: PPA-OS-329/1

This project is to provide R&D policy insights concerning comparisons between conventional (CTOL, Bus, Rail, Auto), improved (RTOL, IPT), and new technology (STOL, VTOL, TACV), in short haul intercity passenger transportation.

**ACKNOWLEDGEMENT:**

Office of Systems Development and Technology/OST, GWA-73-OS

**038055****DATA REPORTS****PERFORMING AGENCY:**

SofreRail, 37-39 Rue DeLa Bienfaisance, Paris-VIII France

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Lawson, K.L., Tel. 202-4262965

STATUS: Obligated START DATE: Oct. 1972 COMPL.  
DATE: Oct. 1974 TOTAL FUNDS: \$200000 FUND  
TYPE: Contract CONTR. NO.: DOT-FR-30006 CONTR.  
TYPE: FF

SofreRail will furnish data reports and access to High Speed Train Tests.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # 72-211

**038560****URBAN RAIL SUPPORTING TECHNOLOGY PROGRAM****INVESTIGATORS:**

Madigan, R.J., PER, Tel. 617-4942311

**PERFORMING AGENCY:**

Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Silien, J.S., Tel. 202-4260090

STATUS: Obligated START DATE: Sept. 1972 TOTAL  
FUNDS: \$6500000 FUND TYPE: PPA CONTR. NO.:  
PPA-UM-304/0

The Rail Programs Branch of the UMTA Office of Research, Development and Demonstrations is conducting research development and Demonstration programs directed towards the improvement of Urban Rail Transportation Systems. These programs will result in improved prototype vehicle and component designs, improved ways and structures and structural components, and in engineering design data on rail system component interaction. This PPA defines the role of TSC as System Manager for the necessary technical support to UMTA in these developmental areas.

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, GWA-73-UM

**038694****DEVELOPMENT OF A TRANSPORTATION PLAN FOR THE SACRAMENTO-SAN FRANCISCO BAY AREA CORRIDOR****PERFORMING AGENCY:**

California Business and Transportation Agency, 1120 N Street, Sacramento, California 95805

**SPONSORING AGENCY:**

Transportation Systems Center, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Watros, G.C., Tel. 617-4942741

STATUS: Obligated START DATE: Dec. 1972 COMPL.  
DATE: Dec. 1974 TOTAL FUNDS: \$125000 FUND  
TYPE: Contract CONTR. NO.: DOT-TSC-558 CONTR.  
TYPE: FFP

This contract will provide partial funding to the State of California for multimodal, inter-urban, transportation planning for the Sacramento-Stockton-San Francisco Bay Area Corridor and makes provision for the Department of Transportation to participate as active members on the Policy, Steering and Technical Resources Committees of this program. The study will provide the opportunity to the Department of Transportation to participate in an actual corridor study program involving state and local agencies and thereby gaining practical experience with the process of comprehensive planning and implementation of transportation development in an inter-urban corridor for future application to other intercity corridors.

**ACKNOWLEDGEMENT:**

Transportation Systems Center

**038719****REDUCTION OF CRIME ON TRANSIT PROPERTIES****PERFORMING AGENCY:**

Chicago Public Works Department, Chicago, Illinois

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Stearns, C., Tel. 202-4260090

STATUS: Obligated START DATE: June 1972 COMPL.  
DATE: Sept. 1972 TOTAL FUNDS: \$150000 FUND  
TYPE: Grant CONTR. NO.: IL-06-0023

Chicago has been selected as the site for this project. The Public Works Department has Assembled a task force comprised of transit and law enforcement officers in the Chicago area. The objectives are to limit and deter crime on transit vehicles, stations, and loading zones so as to reduce the widespread fear presently evident and thus remove a barrier to the use of public transit. The approach will be to develop and demonstrate, methods of and devices for discerning and reacting rapidly to criminal incidents occurring in transit vehicles, stations, and loading zones. First, the measures to be demonstrated will be selected and implementation will be planned. After approval of the plan, operation of the selected devices will be carried out to observe their effectiveness.

**ACKNOWLEDGEMENT:**

Urban Mass Transportation Administration, IL-06-0023

**038722****VANDALISM AND PASSENGER SECURITY (VAPS)****PERFORMING AGENCY:**

American Transit Association, 465 L'Enfant Plaza West, SW, Washington, D.C. 20024

**SPONSORING AGENCY:**

Urban Mass Transportation Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**

Morgan, P.H., Tel. 202-4264035

PASSENGER OPERATIONS

23A

STATUS: Obligated START DATE: May 1971 COMPL. DATE: May 1973 TOTAL FUNDS: \$194000 FUND TYPE: Grant CONTR. NO.: DC-06-0017

The objectives of this study are to: Establish the true national cost of transit property vandalism, Summarize and evaluate types of anti-vandalism and passenger security campaigns, techniques, and hardware, Determine the suitability of private police for transit property, protection as compared to public policy, and Design test to demonstrate the potentially affective elements of the above for reducing vandalism and reversing the decline in transit passenger security. The methods of approach will be to: assess national vandalism cost through detailed interviews with 25 large transit systems and mailed questionnaire to others, generate and evaluate demonstration projects through a committee with the Institute for Rapid Transit, and conduct demonstrations for the final report's recommendations.

ACKNOWLEDGEMENT: Urban Mass Transportation Administration, DC-06-0017

038728 FIVE YEAR PLAN FOR GROUND TRANSPORTATION

PERFORMING AGENCY: Mitre Corporation, Westgate Research Park, McLean, Virginia 22101

SPONSORING AGENCY: Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

STATUS: Obligated START DATE: Aug. 1971 COMPL. DATE: Nov. 1971 TOTAL FUNDS: \$40707 FUND TYPE: Contract CONTR. NO.: DOT-FR-30021 CONTR. TYPE: CR

The Contractor shall provide a study of Candidates for a Five Year Plan for Ground Transportation. The study will supercede and update MITRE Technical Report MTR-6036 provided under contract DOT-FR-10054. The study shall include: predictions of patronage and revenues for demonstration routes, refined estimates of costs for demonstration projects, Tracked Air Cushion Vehicle implementation schedule updating, and recommendations for improvement of Northeast Corridor Rail, Improved Passenger Trains, Air Cushioned Vehicle-Arctic Operations, and Suspended Vehicles' markets.

ACKNOWLEDGEMENT: Federal Railroad Administration, PR # 72-90



**018951**  
**STUDY TO EVALUATE AND COMPUTE APPROPRIATE RATES AND CHARGES FOR A DEMURRAGE SYSTEM**

**PERFORMING AGENCY:**  
 Reebie Associates, 12 Havemeyer Place, Greenwich, Connecticut 06830

**SPONSORING AGENCY:**  
 Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20591

**RESPONSIBLE INDIVIDUAL:**  
 Williams, J.H., Tel. 58

**STATUS:** Active    **START DATE:** June 1971    **COMPL. DATE:** July 1972    **TOTAL FUNDS:** \$183682    **FUND TYPE:** Contract    **CONTR. NO.:** DOT-FR-10038

**OBJECTIVES AND SCOPE:**

To evaluate and compute appropriate rates and charges for a demurrage system based upon the specification and analysis of relevant economic and financial factors, and to quantitatively assess the resultant effects upon rail carriers and the shipping public.

**ACKNOWLEDGEMENT:**  
 Federal Railroad Administration

**032669**  
**COMMODITY FLOW STUDY FOR TEXAS GULF PORTS**

**INVESTIGATORS:**  
 Dresser, G.B., Tel. 713-8451713

**PERFORMING AGENCY:**  
 Texas Transportation Institute, College Station, Texas

**SPONSORING AGENCY:**  
 National Oceanic and Atmospheric Administration, Sea Grant Office/Department of Commerce, Main Commerce Building, Washington, D.C. 20230    **PROJ. NO.** 59404

**STATUS:** Active    **START DATE:** Sept. 1970    **COMPL. DATE:** Sept. 1972    **TOTAL FUNDS:** \$30000

**OBJECTIVES AND SCOPE:**

The purpose of this study is to develop the methodology and determine the feasibility of implementing a program for the continuous collection of transport flow statistics for the Texas Gulf Ports. The study includes a careful investigation of the means, agencies and costs of implementing a continuous transportation study. One criteria for the design will include the possibility of integrating connecting land transportation data with currently collected waterborne data. The investigation is limited to the domestic origin of exports and the domestic destination of imports and is not designed to show the economic impact of waterborne commerce. Transportation flow statistics are essential for regional planning, sound administration and regulation of transportation services, contingency planning for natural disasters, alternative routing and other disruptions resulting from strikes, analysis of capital improvement needs and for market studies.

**APPROACH AND METHODS:**

Initial work on this study was begun in December 1970 with the major effort being made during June, July and August 1971. During the first phase necessary background research and data collection was accomplished and interviews conducted with a number of interested agencies and organizations. The second phase to be accomplished during the 1971-72 period will complete the work.

**PROGRESS AND RESULTS:**

(1) Defined a marine commodity flow statistics program and specified the requisite data elements. (2) Documented existing marine related commodity flow statistics collection programs. (3) Identified potential users and uses of a comprehensive marine commodity flow statistics program. (4) Interviewed the major Texas ports, Corps of Engineers, and Bureau of Customs on source documents, availability of data, disclosure restrictions, and feasibility of a continuing marine commodity flow statistics program.

**ACKNOWLEDGEMENT:**  
 Texas Transportation Institute

**036747**  
**RAILROAD ECONOMICS PLANNING AND MANAGEMENT SUPPORT**

**INVESTIGATORS:**  
 Troup, K.F., Tel. 617-4942795

**PERFORMING AGENCY:**  
 Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142

**SPONSORING AGENCY:**  
 Federal Railroad Administration, Department of Transportation, 400 7th Street, SW, Washington, D.C. 20590

**RESPONSIBLE INDIVIDUAL:**  
 Hagen, J., Tel. 202-4260933

**STATUS:** Obligated    **START DATE:** July 1972    **COMPL. DATE:** June 1973    **TOTAL FUNDS:** \$50000    **FUND TYPE:** PPA    **CONTR. NO.:** PPA-RR-313

TSC will support the Office of Economics and the Office of Policy and Planning of the Federal Railroad Administration in the preparation analysis, review, and conduct of the research and development programs within these organizations. The programs deal with pricing, cost, labor and operational considerations freight and passenger transportation of conventional railroad. Specifically, TSC will assist in future year program and budget planning cycles, assist in evaluation of proposals submitted against RFP's let by the FRA Office of Economics, and assist in the technical program management of research and development contracts within the Office of Economics.

**ACKNOWLEDGEMENT:**  
 Federal Railroad Administration, GWA-73-RR

**043387**  
**ILLINOIS CENTRAL NETWORK ANALYSIS**

**INVESTIGATORS:**  
 Hay, W.W., Professor  
 Reinschmidt, A.J.  
 Kim, S.J.

**PERFORMING AGENCY:**  
 Illinois University, Urbana, Department of Civil Engineering, Urbana, Illinois 61801

**SPONSORING AGENCY:**  
 Illinois Central Gulf Railroad, 135 East 11th Place, Chicago, Illinois 60605

**STATUS:** Active    **START DATE:** July 1971    **COMPL. DATE:** June 1972    **TOTAL FUNDS:** \$26713

Railroad transportation operations are characterized by having a large number of variables with extensive interactions between variables and, in most cases, analytical techniques such as linear programming, queuing theory, game theory, etc., do not provide realistic solutions. A Network Simulation Model will be applied to aid railroad management in determining the effects of changing facilities, operating policies, and traffic load on the performance of a railroad, thereby improving the overall system performance.

**ACKNOWLEDGEMENT:**  
 Science Information Exchange, AI 753 1

**043392**  
**IMPROVED MARKETS FOR WOOD IN WESTERN U.S. AND PACIFIC BASIN**

**INVESTIGATORS:**  
 Camp, H.W.    Harpole, G.B.

**PERFORMING AGENCY:**

Pacific Southwest Forestry & Range Expt Station, Department of Agriculture, Berkeley, California 94701

**SPONSORING AGENCY:**

Pacific Southwest Forest & Range Expt Station, Department of Agriculture, Berkeley, California 94701 PROJ. NO. 0000115

STATUS: Active START DATE: July 1972 COMPL. DATE: June 1973 FUND TYPE: In-House

The objectives are to increase efficiency of processing and marketing, and expand markets for western wood products; and provide western consumers with better wood products at lower cost.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 115 3

**043393****ENGINEERING SYSTEMS FOR UTILIZATION OF HEAVY TIMBER STANDS OF THE PACIFIC COAST INCLUDING ALASKA****INVESTIGATORS:**

Lysons, H.H.

**PERFORMING AGENCY:**

Pacific Northwest Forest & Range Expt Station, Department of Agriculture, Seattle, Washington 98105

**SPONSORING AGENCY:**

Pacific Northwest Forest & Range Expt Station, Department of Agriculture, Seattle, Washington 98105

STATUS: Active START DATE: July 1972 COMPL. DATE: June 1973 FUND TYPE: In-House

The objective is to improve the efficiency and mechanization of materials handling and transportation systems for forestry operations in heavy timber on difficult access areas with emphasis on harvesting by aerial methods while safeguarding watershed, soil, aesthetic and recreation values.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 125 4

**043394****TRANSPORTATION SYSTEMS AND THE MOVEMENT OF SMALL AND MEDIUM SIZED TIMBER ON MOUNTAINOUS TERRAIN****INVESTIGATORS:**

Gardner, R.B.

**PERFORMING AGENCY:**

Montana State University, Bozeman, Intermountain Forest & Range Experiment Station, Bozeman, Montana 59715

**SPONSORING AGENCY:**

Intermountain Forest & Range Experiment Station, Department of Agriculture, Bozeman, Montana 59715 PROJ. NO. 0000126

The objectives to develop engineering systems needed to economically meet forestry objectives in areas characterized by steep slopes, erodible soils and small-sized timber. Included are methods of harvest and transport, reestablishment of forests, and timber stand and watershed protection and improvement.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 126 3

**043395****HOUSING AND OTHER STRUCTURES****INVESTIGATORS:**

Bohannon, B.

**PERFORMING AGENCY:**

Wisconsin University, Madison, Forest Products Laboratory, Madison, Wisconsin 53706

**SPONSORING AGENCY:**

Forest Products Laboratory, Department of Agriculture, Madison, Wisconsin 53706

The objectives are to promote the more effective design and use of wood and wood-base materials in houses, light-frame and heavy construction by developing improved structural systems and components and improve principles of stress-grading for all types of wood structural elements.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 276 3

**043396****PACKAGING****INVESTIGATORS:**

Kurtenacker, R.S.

**PERFORMING AGENCY:**

Wisconsin University, Madison, Forest Products Laboratory, Madison, Wisconsin 53706

**SPONSORING AGENCY:**

Forest Products Laboratory, Department of Agriculture, Madison, Wisconsin 53706 PROJ. NO. 0000277

The objectives are to develop procedures for efficient utilization of wood, wood-base materials and composites in pallets and containers, emphasizing lower grades and lesser used species, and to integrate transportation environment and engineering analysis into containers to improve protection and reduce damage.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 277 3

**043397****EFFECT OF TRANSPORTATION RATES, FACILITIES, AND INSTITUTIONS UPON THE GRAIN MARKETING SYSTEM IN MONTANA****INVESTIGATORS:**

McConnen, R.J. Saintgeorge, G.

**PERFORMING AGENCY:**

Montana State University, Bozeman, Department of Agricultural Economics, Agricultural Experiment Station, Bozeman, Montana 59715

**SPONSORING AGENCY:**

Department of Agriculture, Montana Cooperative State Research Service, Montana PROJ. NO. 0002036

The objectives are to determine present railroad and truck rate structure for grain moving within and out of Montana; determine changes in railroad grain loadings and rates over past 40 years as compared with production; analyze movements of grain directly from farms and elevators, both by truck and railroad; determine handling methods, rates, pricing, origin, destination and uses for grain handled by truck from farm and elevator points in Montana; determine effects of barge services on Columbia upon truck and rail transportation in Montana; and determine effects of trends in transportation methods and rates on grain-pricing methods and institutions in Montana, with special attention to different kinds of wheat and other grains.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 2036 4

**043399****MARKET DEVELOPMENT FOR HARD RED SPRING AND DURUM WHEAT****INVESTIGATORS:**

Anderson, D.E.

**PERFORMING AGENCY:**

North Dakota State University, Department of Agricultural Economics, Agricultural Experiment Station Fargo, North Dakota 58103

**SPONSORING AGENCY:**

North Dakota State Government, Legislative Assembly, Bismark,  
North Dakota 58501 PROJ. NO. 0007897

The objectives are to determine historical market activity for Hard Red Spring and Durum wheat; identify and analyze barriers to development of alternative market outlets; and determine alternative remedies to implement market development programs.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 7897 4

**043401****GEOGRAPHIC DIFFERENTIALS IN RAILROAD RATES AND SERVICES: IMPLICATIONS FOR NEBRASKA AGRICULTURE****INVESTIGATORS:**

Anderson, D.G.

**PERFORMING AGENCY:**

Nebraska University, Lincoln, Agricultural Experiment Station, Lincoln, Nebraska 68508

**SPONSORING AGENCY:**

Department of Agriculture, Nebraska Cooperative State Research Service, Nebraska PROJ. NO. 0010489

The objectives are to determine the extent of geographic rate discrimination in transport of agricultural commodities; determine geographic availability of transport services; determine geographic rate/cost effects of innovations; relate cost to availability; and analyze geographic farm input price/transport rate pattern.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 10489 4

**043403****WASHINGTON'S WHEAT MARKETING PROGRAMS, CHANNELS AND PRACTICES****INVESTIGATORS:**

Casavant, K.L. Oroureke, A.D.

**PERFORMING AGENCY:**

Washington State University, Agricultural Experiment Station, Pullman, Washington 99163

**SPONSORING AGENCY:**

Department of Agriculture, Washington Cooperative State Research Service, Washington PROJ. NO. 0011247

The objectives are to ascertain the optimum locations and sizes of grain terminals and country elevators in Washington, provide an evaluation of alternative wheat marketing organizations for the state and analyze alternative wheat marketing programs for members of Washington's wheat industry.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 11247 4

**043404****NUMBER, SIZE AND LOCATION OF COTTON MARKETING FACILITIES FOR MORE EFFICIENT MARKETING OF LOUISIANA COTTON****INVESTIGATORS:**

Hudson, J.F.

**PERFORMING AGENCY:**

Louisiana State University, Agricultural Experiment Station, University Station, Baton Rouge, Louisiana 70803

**SPONSORING AGENCY:**

Department of Agriculture, Louisiana Cooperative State Research Service, Louisiana PROJ. NO. 0011816

The objectives are to determine the optimum number, size and location of cotton gins, oil mills and warehouses in Northeast Louisiana and to analyze and project the increased merchandising efficiency which can be obtained through the centralization of these marketing facilities.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 11816 4

**043405****NEW EQUIPMENT AND TECHNIQUES TO HANDLE, PACKAGE, TRANSPORT AND STORE PEACHES****INVESTIGATORS:**

Sims, E.T.

**PERFORMING AGENCY:**

Clemson University, Agricultural Experiment Station, Long Hall, Clemson, South Carolina 29631

**SPONSORING AGENCY:**

Department of Agriculture, South Carolina Cooperative State Research Service, South Carolina PROJ. NO. 0011875

The objectives are to develop and evaluate new equipment, materials and techniques for more efficient handling, packaging, transportation and storage of peaches; to evaluate the effects of such developments on peach quality and shelf-life; and to determine and analyze the economic feasibility of such developments.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 11875 4

**043406****ANALYTICAL DESIGN OF TRUSSED RAFTERS****INVESTIGATORS:**

Suddarth, S.K.

**PERFORMING AGENCY:**

Purdue University, Agricultural Experiment Station, Executive Building, Lafayette, Indiana 47907

**SPONSORING AGENCY:**

Department of Agriculture, Indiana Cooperative State Research Service, Indiana PROJ. NO. 0011923

The objectives are to discover quantitative relationships peculiar to precise stress analysis of wood frames including recognition of time-dependent effects and to incorporate the above into computerized, low-cost engineering design systems for trusses and related frames.

**ACKNOWLEDGEMENT:**

Science Information Exchange, GY 11923 4

025197

**EAST-WEST GATEWAY COORDINATING COUNCIL COMPREHENSIVE AREAWIDE RAILROAD CONSOLIDATION AND RELOCATION STUDY****PERFORMING AGENCY:**

East-West Gateway Coordinating Council, Suite 2110, 720 Olive Street, Saint Louis, Missouri 63101

**SPONSORING AGENCY:**

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

STATUS: START DATE: May 1971 COMPL. DATE: Apr. 1972  
TOTAL FUNDS: \$360000 FUND TYPE: Contract  
CONTR. NO. : DOT-FR-20023

This initial phase will be devoted to organizing the study and preparing the data needed to develop and evaluate alternative plans for consolidation and relocation of railroad operations in Metropolitan St. Louis.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration

036730

**URBAN RAILROAD RELOCATION: ESTIMATION OF NATIONWIDE NEEDS AND METHODOLOGY FOR FUTURE RELOCATION STUDIES****PERFORMING AGENCY:**

Stanford Research Institute, 333 Ravenswood Avenue, Menlo Park, California 94025

**SPONSORING AGENCY:**

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

STATUS: Obligated START DATE: June 1972 COMPL. DATE: Sept. 1973  
TOTAL FUNDS: \$199927 FUND TYPE: Contract  
CONTR. NO. : DOT-FR-20037 CONTR. TYPE: CPFF

Identify relocation parameters and criteria, make preliminary assessment of nationwide railroad problem, review existing and potential methods of relocation analysis, develop tentative benefit-cost methodology, make field investigation of relocation problems, make survey of urban areas, make cost benefit analysis allocate costs to public and private sectors, draft relocation study handbook, demonstrate handbook and prepare final versions.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # RP-31

036738

**IMPLEMENTATION OF THE FEDERAL RAIL SAFETY AND TECHNOLOGY RESEARCH****INVESTIGATORS:**

Morris, R.E.

**PERFORMING AGENCY:**

Westinghouse Air Brake Company, 1200 18th Street, NW, Washington, D.C. 20036

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Regan, L.G., Tel. 202-4261510

STATUS: Obligated START DATE: Sept. 1971 COMPL. DATE: June 1972  
TOTAL FUNDS: \$63094 FUND TYPE: Contract  
CONTR. NO. : DOT-FR-20008 CONTR. TYPE: CPFF

Professional services with expertise in rail safety R&D planning and control to assist the FRA in implementation of the railroad safety and technology research program.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # RP-8

038650

**ECONOMIC ABSTRACT OF LIGHT DENSITY RAIL LINES OPERATIONS****INVESTIGATORS:**

Banks, R.L., President

**PERFORMING AGENCY:**

Banks (RL) and Associates, Incorporated, 900 17th Street, NW, Washington, D.C. 20006

**SPONSORING AGENCY:**

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

**RESPONSIBLE INDIVIDUAL:**

Regan, LG, Tel. 202-4261510

STATUS: Obligated START DATE: Dec. 1972 COMPL. DATE: June 1973  
TOTAL FUNDS: \$34915 FUND TYPE: Contract  
CONTR. NO. : DOT-FR-30020 CONTR. TYPE: CPFF

The Contractor shall prepare and present an oral briefing for the Federal Railroad Administration in the first week of January 1973 and will make available the personnel of the study team for the seminar to be held January 10, and January 11, 1973 in Boulder, Colorado. The Seminar shall be in accordance with the prepared program "Symposium on Economic and Public Policy Factors Influencing Light Density Rail Line Operation". At the briefing and the seminar, the study team shall be available to discuss their approach of the Techniques for costing purposes.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # RP-18

038788

**NATIONAL CONFERENCE ON ECONOMIC AND PUBLIC POLICY FACTORS AFFECTING LOW DENSITY RAIL LINE OPERATIONS****INVESTIGATORS:**

McCellan, J.

**PERFORMING AGENCY:**

Colorado University, Boulder, 130 Academy Building, 970 Aurora Avenue, Boulder, Colorado 80302

**SPONSORING AGENCY:**

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

STATUS: Obligated START DATE: Jan. 1973 COMPL. DATE: Apr. 1973  
TOTAL FUNDS: \$5000 FUND TYPE: Contract  
CONTR. NO. : DOT-FR-30040

The Contractor shall host the National Conference on Economic and Public Policy Factors Low Density Rail Line Operations.

**ACKNOWLEDGEMENT:**

Federal Railroad Administration, PR # PR-3029

# Subject Term Index

This Subject Term Index includes all of the subject terms that have been assigned to the abstracts listed in this issue of the RRIS Bulletin. 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.

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