FAST Facility for Accelerated Service Testing TECHNICAL NOTE

SIX-AXLE LOCOMOTIVE MINI-TEST ON FAST

by

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SUMMARY

This report is the fifth in a series of technical notes proceeding from the Rail Lubrication Study conducted by the Association of American Railroads on the FAST track (Facility for Accelerated Service Testing) at the Transportation Test Center (TTC). A comprehensive summary report of the study will be prepared following completion of all phases of testing in August 1984.

Historically, FAST has been operated with only four-axle (type B-B) locomotives. Experiment plans have specified this as a requirement to prevent introduction of additional variables into the test environment. With the onset of the FAST Lubrication Study, many test requirements were waived to allow a full matrix of test requirements to be met. This included the operation of a very limited number of laps (9 total) using six-axle power.

During August of 1984--near the end of the Trackside Lubricator Tests--a 4-locomotive test consist was on site for other testing. It was composed of two 6-axle and two 4-axle locomotives. Since the effects of six-axle power on track have been of concern to many railroad representatives, the presence of the locomotives was seen as an ideal opportunity to conduct a mini-test in order to gain additional insight into six-axle track-train dynamics. Through the cooperation of the Electro-Motive Division (EMD) of General Motors, the test consist, composed of an SDP-40 and an SD-50 (both C-C type six-axle units) and two F7's (A and B, both B-B type 4-axle units), was made available for operations on FAST. This Technical Note documents the activities and findings of the Six-Axle Locomotive Test on FAST.

The express intent of the test was to quantify differences in lateral loads between six- and four-axle power, using rail force data obtained on a 5° curve under dry and lubricated conditions. As a baseline, FAST's regular power combination--two GP-38's and two GP-40's--was also operated.

Several important aspects must be stressed relating to the load data presented in this report:

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- The results of this mini-test are based on a very small sample size and therefore cannot serve as statistically correct values.

- Results are based on data collected at one location only (high rail, 5° curve) and therefore cannot be considered representative of, nor have they been verified by, trends which might be observed in other track load environments.

- The duration of the test was not sufficient to provide valid indications of the long-term effects that six-axle locomotives would have on rail wear, fastener deflection, and tie life.

As was expected, however, the six-axle locomotives did apply significantly higher lateral curve forces than the four-axle locomotives. Results from the lubricated runs demonstrated that mild lubrication of the gage face slightly increased lateral forces for both six-axle and four-axle locomotives, as well as for the train consist. Excessive lubrication; i.e., grease, present on both the gage face and the top of rail, increased lateral curve forces for all vehicle types even more.

Despite the limited statistical significance of the data obtained, there was sufficient difference between six-axle and four-axle results to indicate that an extended test of six-axle power on FAST would provide essential information on wear, fastener fatigue, and lubrication data not now available.

TEST DESCRIPTION

Figure 1 shows a layout of the FAST track, including the locations of the trackside lubricator installation and the six-axle test zone in Section 3. The 5° curve on which the test zone was situated has a superelevation of 4", which, at the normal FAST train speed of 45 mph, will result in a 3" underbalance situation, the full amount allowed by FRA Track Safety Standards. It should be noted that many railroads do not operate at a full 3" underbalance condition as a routine matter.

Primary lubrication for the lubricated runs was provided by the trackside lubricator located in Section 22, approximately 4,000' from the measurement site (Figure 1). Two laps (12 and 13) were planned to investigate whether excessive lubrication does indeed result in increased lateral forces. Because the trackside lubricator works only during a train passage, and because the planned total test laps would be insufficient to produce the desired level of lubrication, the lubrication level was artificially increased for laps 12 and 13 by applying grease with a brush to obtain the "overlubricated" condition.

Force data were obtained by means of an existing FAST strain gage circuit installed on the high rail near tie 1850, at about the 2/3 point in the 5° curve. The circuit, which senses lateral/vertical rail bending, is situated in a welded-rail segment with no abnormal track geometry present. Resulting data from each train pass were recorded on magnetic tape as well as being plotted (real time) on strip chart recorders. Strip chart data, including lateral and vertical forces for each lap, are presented in Appendix A. Note on these that, although various chart speeds had been selected for the convenience of field personnel in observing data, the vertical scale is the same throughout the series of plots presented.

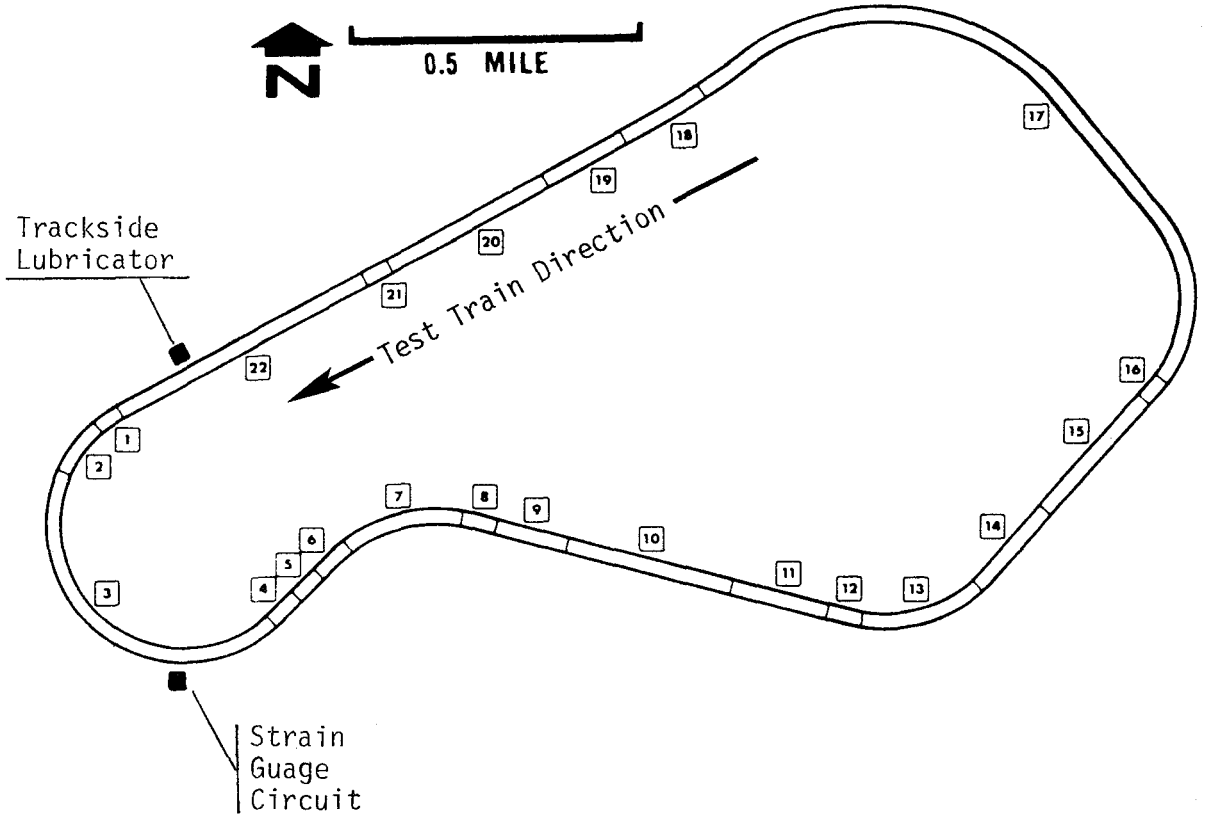


FIGURE 1. FAST TRACK LAYOUT, SHOWING LUBRICATOR AND MEASUREMENT SITE.

Most operation of the trains over the rail force measurement site was in the Notch 4 to Notch 6 positions. Run #485, only, was made in "Run-8" (full throttle) to insure full tractive forces.

One operating variable, sanding, needs to discussed. The locomotives normally used on FAST have manual sanding and sand was not applied. Sand application on the SD-50 is automatic and, at speeds over 5 mph, no sand can be applied manually. Presumably, no sanding should have occurred, ever, because the 6-axle mini-test was not run in full throttle mode over the test zone. However, because no monitoring setup was available to continually check the sand system, the possibility of an isolated sanding event cannot be entirely ruled out.

For all test laps, whether power was supplied by the regular FAST locomotive combination or the EMD test combination, trailing tonnage was supplied by the routine FAST consist plus 16 empty flatcars at the rear of the train. The first five loaded cars, being the same for all laps, were used as a standard for comparison of various load data. All operation was in the counterclockwise direction.

The test scenario was as follows:

- Start test with dry rail.
- Operate consist with "normal" FAST 4-axle EMD power: 2-GP38, 2-GP40
- Gather data for 5 laps as follows:

  - Lap 1 - 30 mph
  - Laps 2 & 3 - 45 mph
  - Laps 4 & 5 - 45 mph with power braking to ensure locomotives were under full power over instrumentation area.

- Stop consist, change power.
- Operate consist with six-axle and four-axle power as follows:

  - 1st locomotive: EMD - SD 50, 6-axle
  - 2nd locomotive: EMD - SDP 40, 6-axle
  - 3rd and 4th locomotives: EMD - F7A and F7B, 4-axle

- Gather data for 8 additional laps as follows:

- Lap 6	30 mph	dry rail
- Laps 7 & 8	45 mph	dry rail
- Lap 9	35 mph	dry rail
- Laps 10 & 11	45 mph	low lubrication
- Lap 12	45 mph	over-lubrication simulated by hand application with a brush.
- Laps 13 & 14	45 mph	high lubrication level.

- Additional test laps were scheduled but not run due to time limitations.

Figure 2 shows the normal FAST consist while Figure 3 shows the consist with both six- and four-axle power.

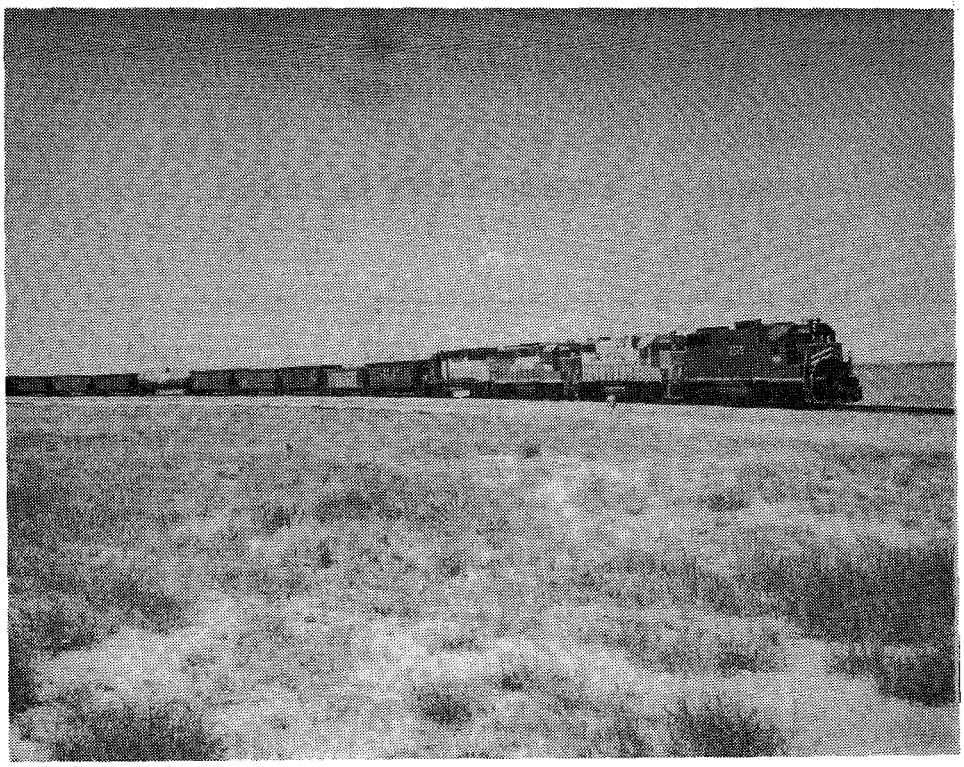


FIGURE 2. PHOTO OF 4-AXLE FAST POWER.

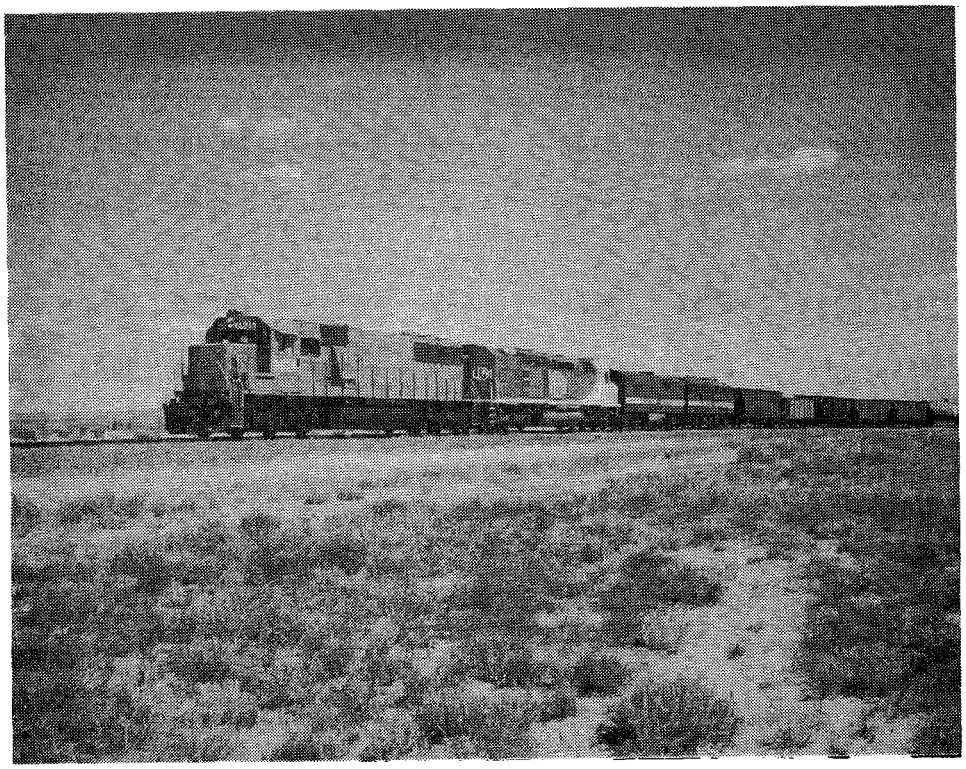


FIGURE 3. PHOTO OF 6-AXLE POWER

DISCUSSION OF RESULTS

Table 1 summarizes the lateral load digital data for each lap.

TABLE 1. LATERAL FORCES IN POUNDS.

Train Speed (mph)	Lap #	Rail Condition	1st Five Loaded Cars		4 FAST Locos		6-Axle Locos		4-Axle (F-7) Locos	
			Max	Mean	Max	Mean	Max	Mean	Max	Mean
30	1	Dry	12000	N/A	13600	6308	---	----	---	----
45	2	Dry	7491	3681	11740	5921	---	----	---	----
45	3	Dry	6724	4188	10440	5353	---	----	---	----
45	4	Dry	6724	4512	12980	5563	---	----	---	----
45	5	Dry	7200	N/A	12680	5165	---	----	---	----
30	6	Dry	10970	3798	-----	----	17700	8548	11620	6009
45	7	Dry	5662	3976	-----	----	17990	9015	10030	5972
45	8	Dry	5839	3897	-----	----	17646	8882	7727	5272
35	9	Dry	6252	3148	-----	----	19700	9049	9673	3819
45	10	Low Lube	6075	3796	-----	----	18760	9408	8140	5132
45	11	Lube	6320	3828	-----	----	18050	8730	7609	4910
45	12	High Lube	8553	4439	-----	----	19940	9963	12560	6864
45	13	High Lube	7373	4312	-----	----	18520	9536	10740	6252

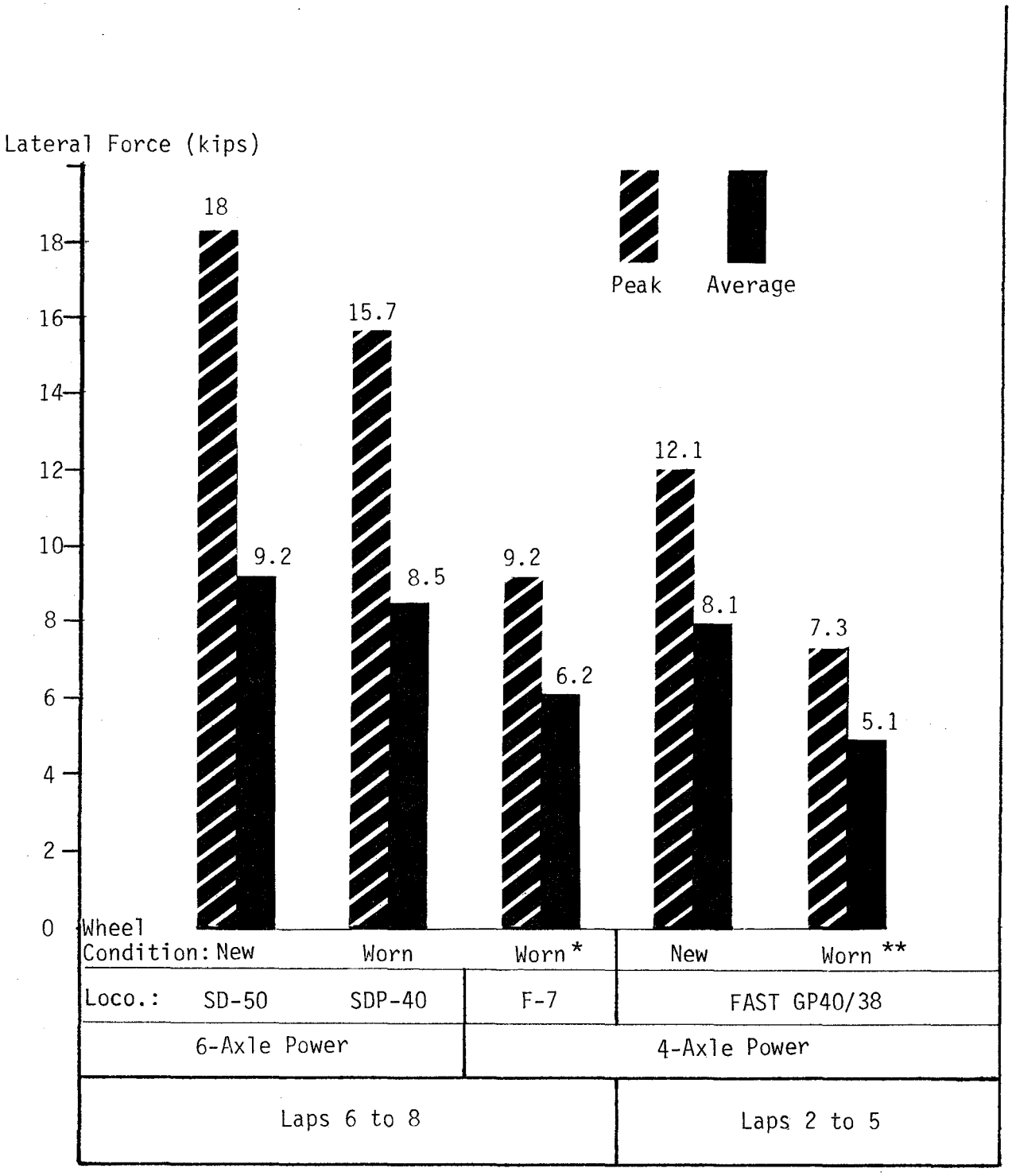
Table 2 is a summary for all steady state 45 mph runs using mean lateral forces. The above summary can also be used to show the difference in lateral forces for 4-axle and 6-axle locomotives. This is shown in Table 3 and represented graphically in Figure 4. The dry rail GP40/GP38 consist mean lateral forces were very close to the dry rail F7 (4-axle) power, thus only the six-axle/F-7 power consist will be compared to allow data from the same lap to be compared. The truck design of the F7 and GP40/GP38 consist is very similar. The one new locomotive in the GP40/GP38 FAST consist (Unit #3) did have higher forces and will be discussed later.

TABLE 2. SUMMARY OF MEAN LATERAL FORCES (POUNDS) AT 45 MPH.

Rail Condition	Normal FAST Train Cars	Normal FAST Train Locos	Six-Axle Power Consist Cars	Six-Axle Power Consist 6-Axle Locos	Six-Axle Power Consist 4-Axle Locos
Dry	4127	5500	3936	8948	5622
Lubed (Last 3 Laps only)	----	----	4193	9409	6008
Increase Over Dry:			6%	5%	7%

TABLE 3. SUMMARY OF MEAN FORCES (POUNDS) AT 45 MPH.

	Dry	Lubed
Mean Lateral Force - 4-Axle Power	5622	6008
Mean Lateral Force - 6-Axle Power	8948	9409
Increase of 6-Axle Mean Forces Over 4-Axle Forces	59%	57%



* Two-unit average. ** Three-unit average.

FIGURE 4. DIFFERENCES IN LATERAL FORCES FOR 4-AXLE AND 6-AXLE LOCOMOTIVES.

Table 4 is a summary for all "normal" 45 mph runs, using mean peak lateral forces.

TABLE 4. SUMMARY OF PEAK FORCES (POUNDS) AT 45 MPH.

Rail Condition	Normal FAST Train Cars	Normal FAST Train Locos	Six Axle Power Consist Cars	Six Axle Power Consist 6 Axle Locos	Six Axle Power Consist 4 Axle Locos
Dry	7034	11960	5917	18443	9143
Lubed (Last 3 Laps)	----	----	7432	18836	10303
Increase Over Dry:			25%	2%	13%

The effect of 6-axle power on peak lateral forces is shown in Table 5. Again, the values shown are for comparison between relatively new 6-axle power and older (F7) 4-axle power - thus, not all such comparisons between 6- and 4-axle locomotives will show this high a difference. The one new four-axle unit in the FAST consist had peak lateral forces (dry) of up to 13,000 lbs. This would have shown an increase in lateral forces for 6-axle over 4-axle of 42% instead of 102%. Since only one 4-axle locomotive with new wheels was available, most data are based on forces generated by the older 4-axle power.

TABLE 5. SUMMARY OF PEAK FORCES (POUNDS) - LATERAL.

	Dry	Lubed
Peak Lateral Force - 4-Axle Power	9143	10303
Peak Lateral Force - 6-Axle Power	18443	18836
Increase of 6-Axle Peak Forces Over 4-Axle Forces	102%	83%

Examination of laps 12 and 13, which were operated under significantly higher lubrication levels than laps 10 & 11, indicates that excessive lubrication will undesirably increase lateral forces.

Table 6 details the difference in lateral forces under dry, (laps 7-8), low lubrication (laps 10-11) and high lubrication (lap 12).

TABLE 6. LATERAL FORCE CHANGES (POUNDS) WITH VARIOUS LUBE LEVELS.

Rail Condition	Cars		Six-Axle Power		Four-Axle Power	
	Peak	Mean	Peak	Mean	Peak	Mean
Dry	5750	3936	17815	8948	8878	5622
Low Lube	5222	3812	18405	9069	7874	5021
(Increase over dry)	-8%	-3%	3%	1%	-10%	-10%
Over Lubrication	8553	4439	19940	9963	12560	6864
(Increase over dry)	48%	13%	12%	11%	41%	22%

The L/V forces for each lap for the first 40 ± axles are shown in Appendix B. The peak and mean for the leading axles of each locomotive are summarized in Table 7.

TABLE 7. L/V RATIOS - AVERAGE FOR LEADING AXLES.

Lap	FAST 4-Axle Power		6-Axle Power		F7 4-Axle Power	
	Average	Peak	Average	Peak	Average	Peak
1	.355	.475	----	----	----	----
2	.257	.347	----	----	----	----
3	Questionable Data		----	----	----	----
4	.215	.404	----	----	----	----
5	.212	.427	----	----	----	----
6	----	----	.452	.522	.338	.439
7	----	----	.425	.481	.239	.268
8	----	----	.391	.452	.181	.245
9	----	----	.496	.568	.229	.357
10	----	----	.414	.466	.179	.253
11	----	----	.406	.474	.175	.243
12	----	----	.454	.508	.273	.360
13	----	----	.429	.487	.231	.294

NOTES:

4-Axle Locos: Average for axle 1 and 3, all locos.

6-Axle Locos: Average for axle 1 and 4, all locos.

As with the lateral forces, the peak L/V ratios tend to increase with lubrication, but only in significant amounts for laps 12 and 13, which were the overlubricated runs. Likewise, the L/V for six axle power was higher than for four-axle power.

The peak L/V values for the comparison standard, the first five loaded cars in the FAST consist, were very close to those of the six-axle power. One of the FAST locomotives (SCL #6642) was new to FAST; therefore, its wheels have a newer wheel profile. Figure 5 shows the two profiles. The peak lateral force levels for the SCL unit (Unit #3, Appendix A, laps 1-5) were always much higher than the other 3 locomotives. This is especially notable on lap 5 of Appendix A.

This discussion has concentrated on peak and mean lateral force levels. In the case of six axle power, peak forces are always obtained from the lead axle of each truck. Examination of Appendix A, plots for laps 9-13, will verify this. The remaining two axles of each truck apply significantly less force. In the case of four-axle power, the lead axle of each truck does not provide the peak force in all cases, as shown for lap 4 in Appendix A.

No dangerous or adversely high peak forces or L/V were observed during this test. It must be noted that for the entire train of 85 cars and 4 locomotives (approximately 360 axles), only 4 occurrences of forces significantly higher than the average occurred when six-axle power was used. Although higher than average, no immediate damage was observed. A longer term controlled test would be required to determine detrimental effects (if any) of six-axle power on rail wear and fastener life (rail rollover), along with the ability of lubrication to reduce higher wear from these forces. Track that has been properly constructed and maintained; i.e., sound ties, proper spiking and gage, should not suffer failure from these higher forces.

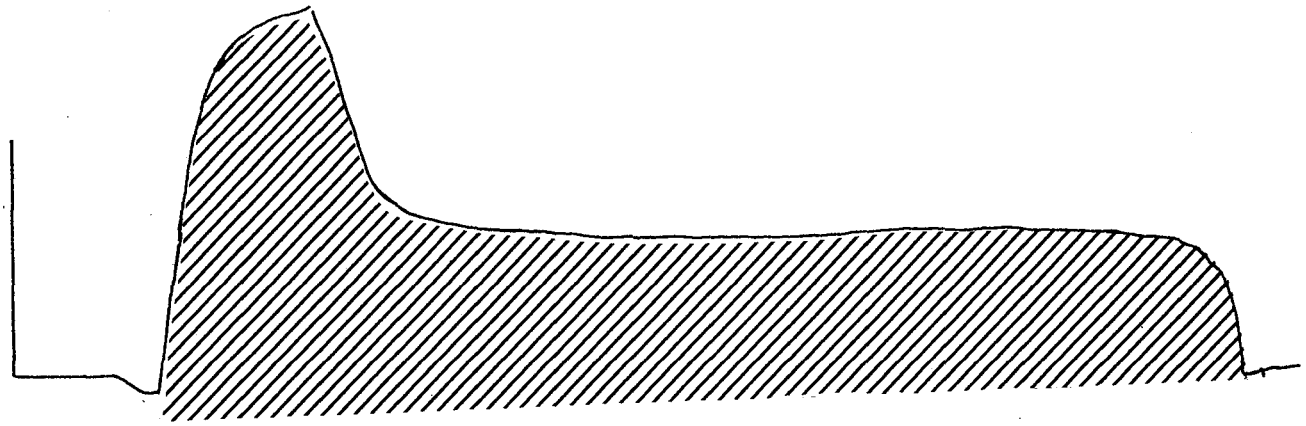
CONCLUSIONS

Lateral forces on the high rail of curves are a cause for several track problems, including rail wear, fastener fatigue, and rail rollover. The use of six-axle power over four-axle power will increase these lateral forces to some extent.

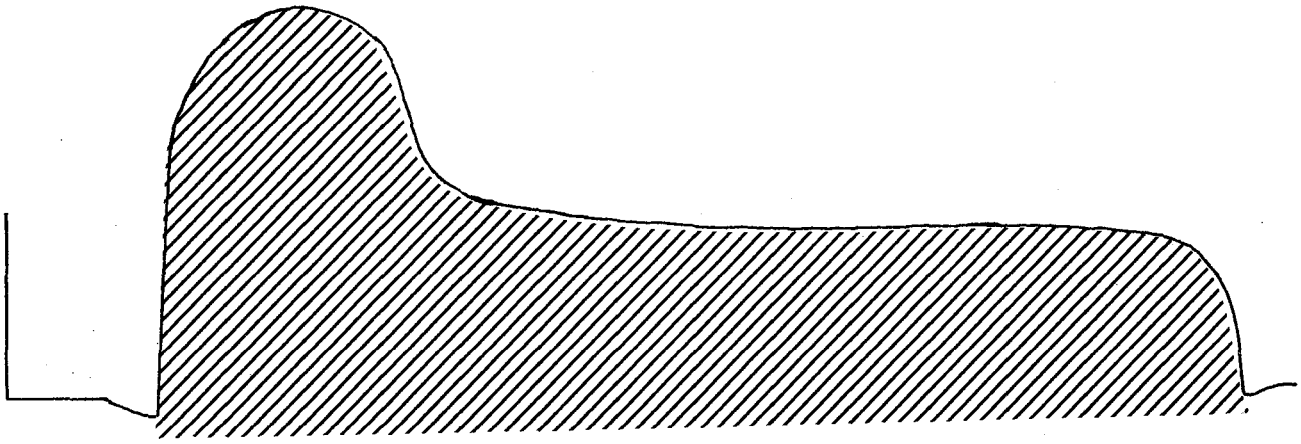
To combat wear in rails and wheels, gage face lubrication is often applied. By not allowing excessive lubrication to be applied, the peak lateral forces for six-axle locomotives will be increased very little, in the neighborhood of 2% (refer to Table 4), while mean lateral forces will rise only 5-6%. Table 6 shows that overlubrication significantly increases forces the most on four-axle locomotives and cars. At FAST, gage face lubrication has been shown to be a powerful agent in reducing rail and wheel wear.

If six-axle power is already being operated, savings in rail wear may be experienced with little increase in lateral forces by judicious application of lubrication. Additional testing will be required to determine the actual amount of this saving and the long-term effects of these higher forces on other track components. A much larger number of test runs will be required to obtain a more statistically significant data base.

Additional test items would include monitoring of wheel wear, change in wheel profile, along with subsequent changes in forces and train handling differences.



Typical FAST Locomotive Wheel Profile

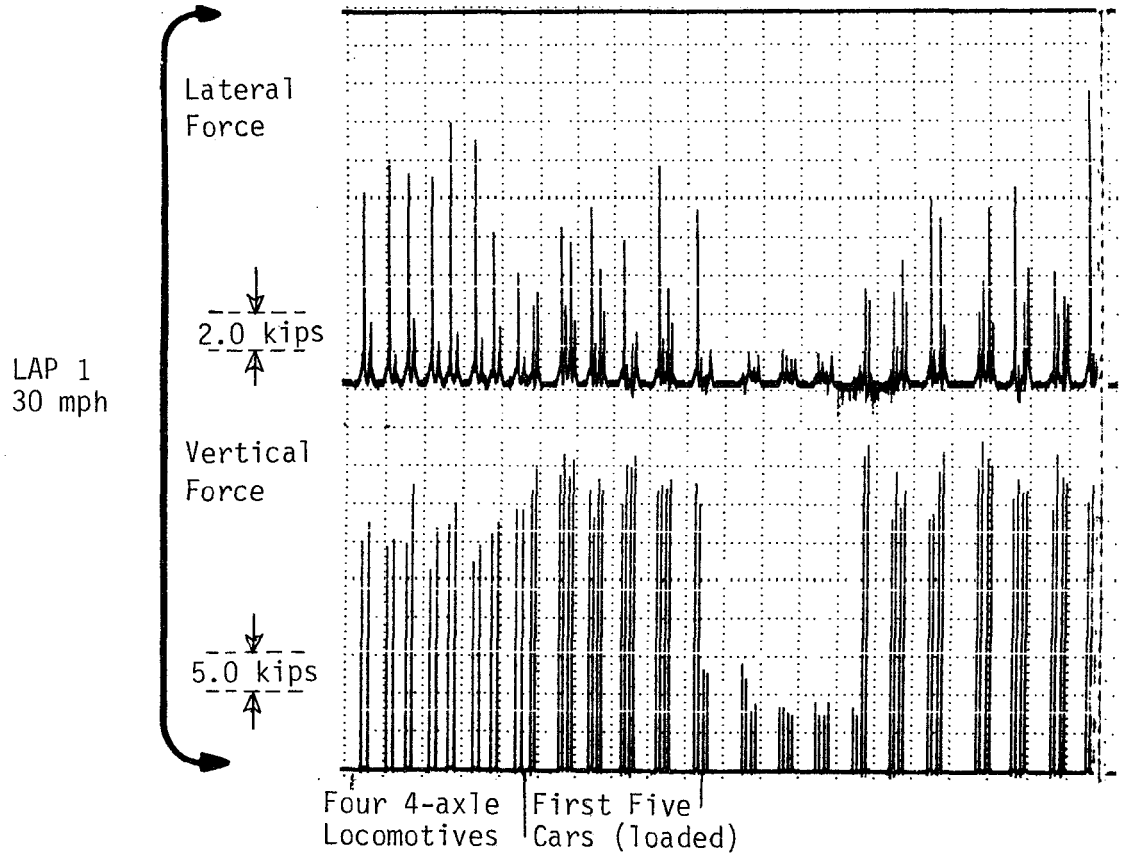


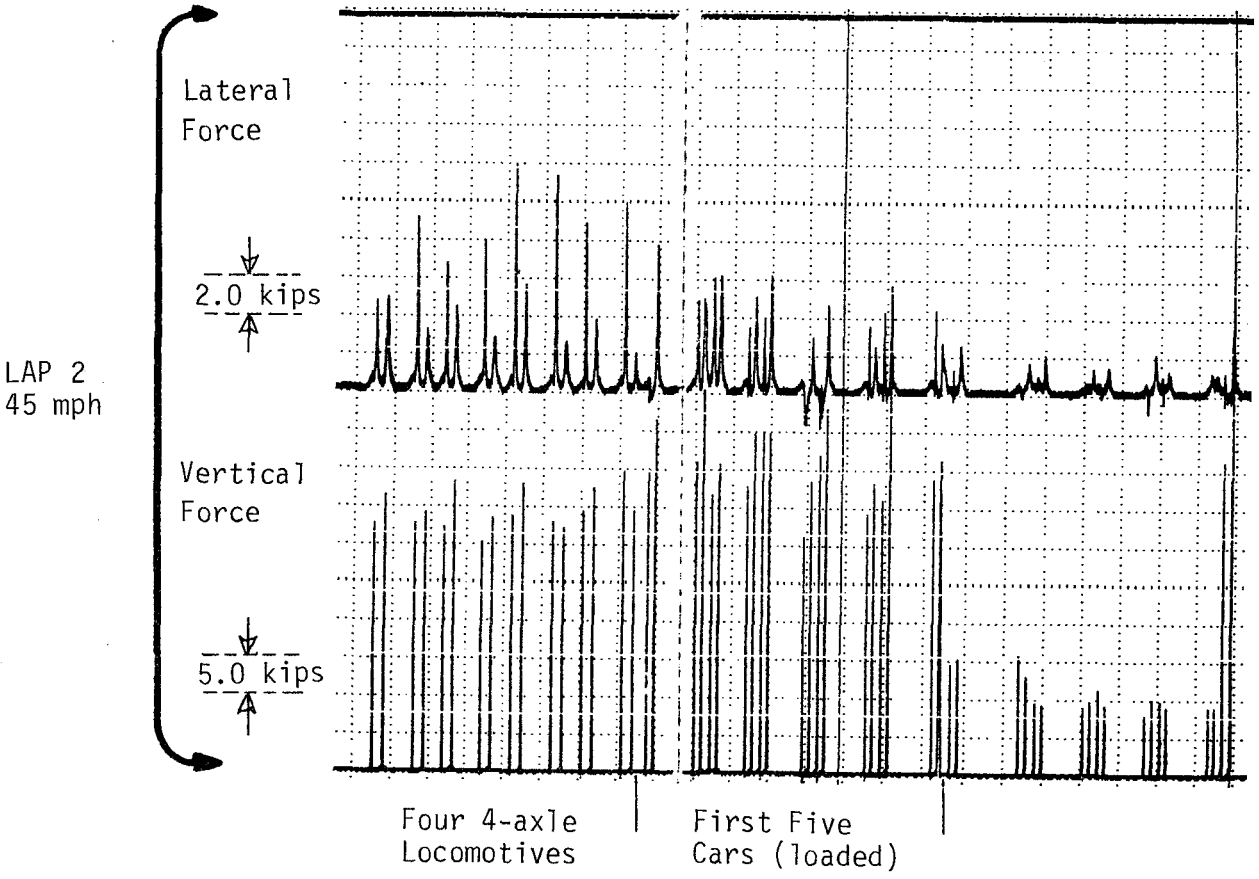
New GP-40 Locomotive Wheel Profile

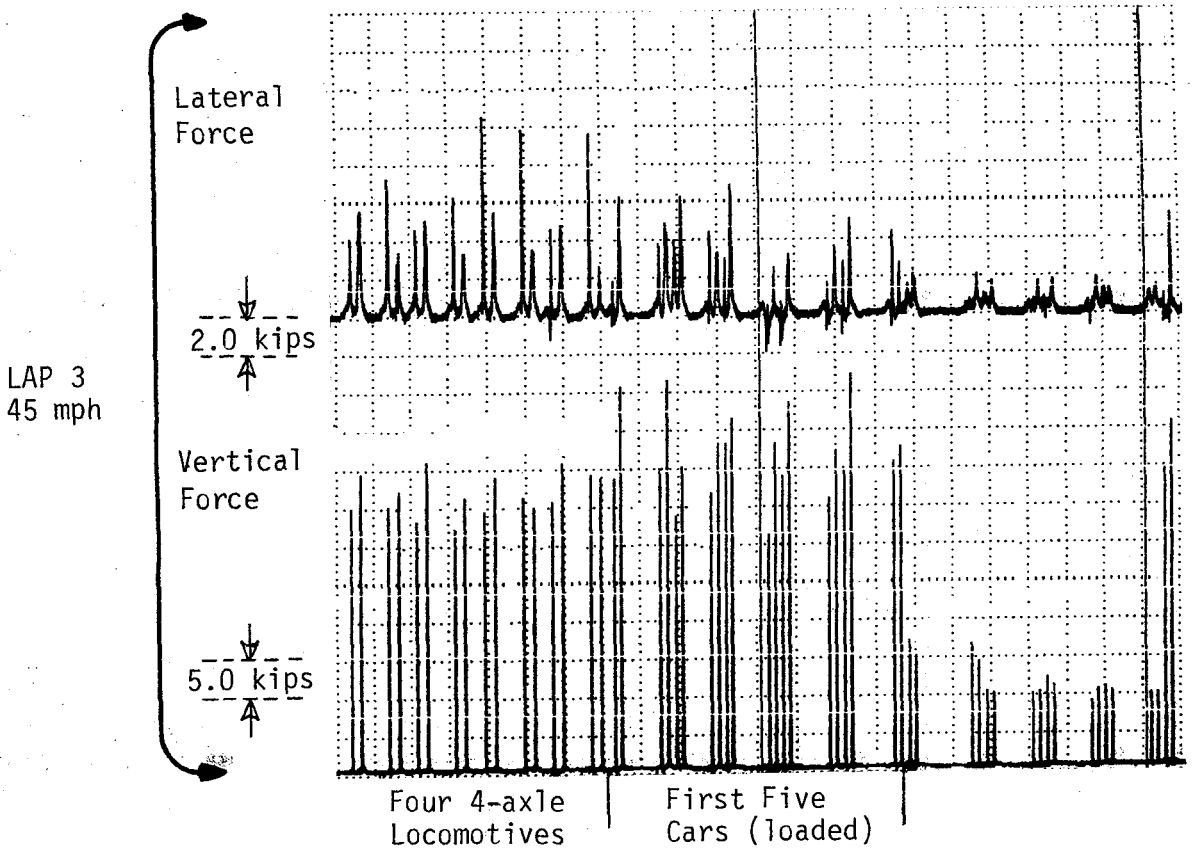
FIGURE 5. COMPARISON OF TYPICAL FAST WHEEL PROFILE AND NEW GP-40 LOCOMOTIVE WHEEL PROFILE.

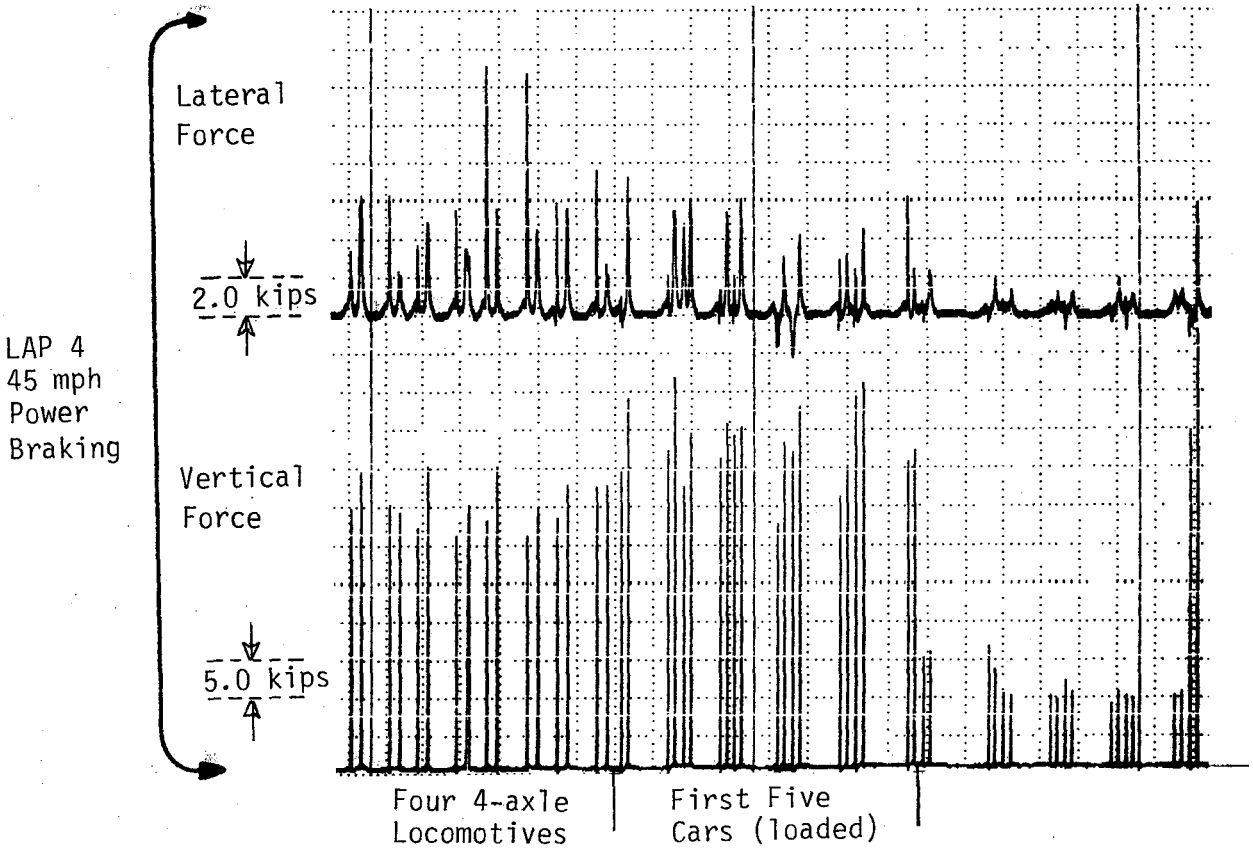
APPENDIX A

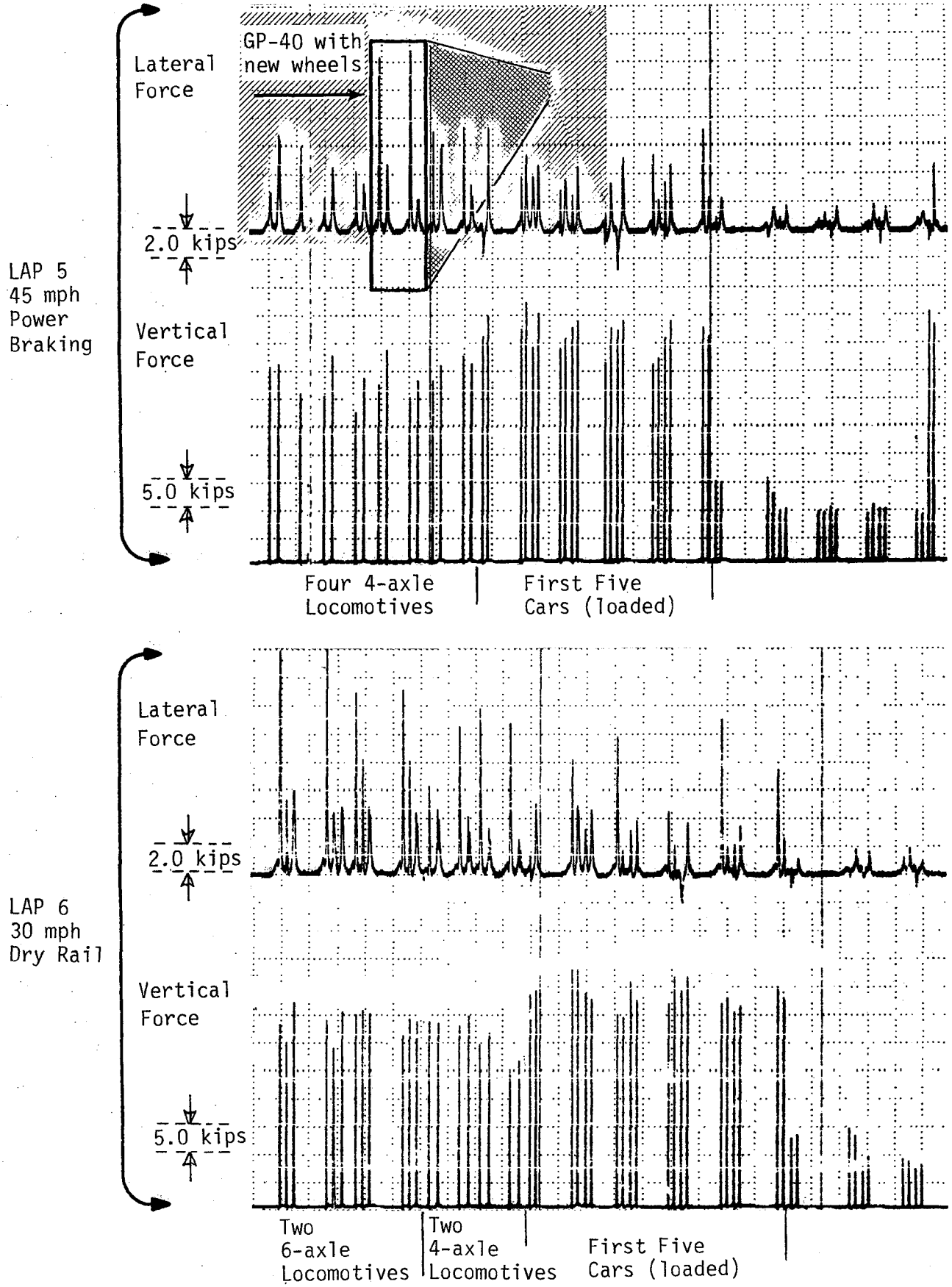
STRIP CHARTS FOR ALL LAPS, 1 THROUGH 13

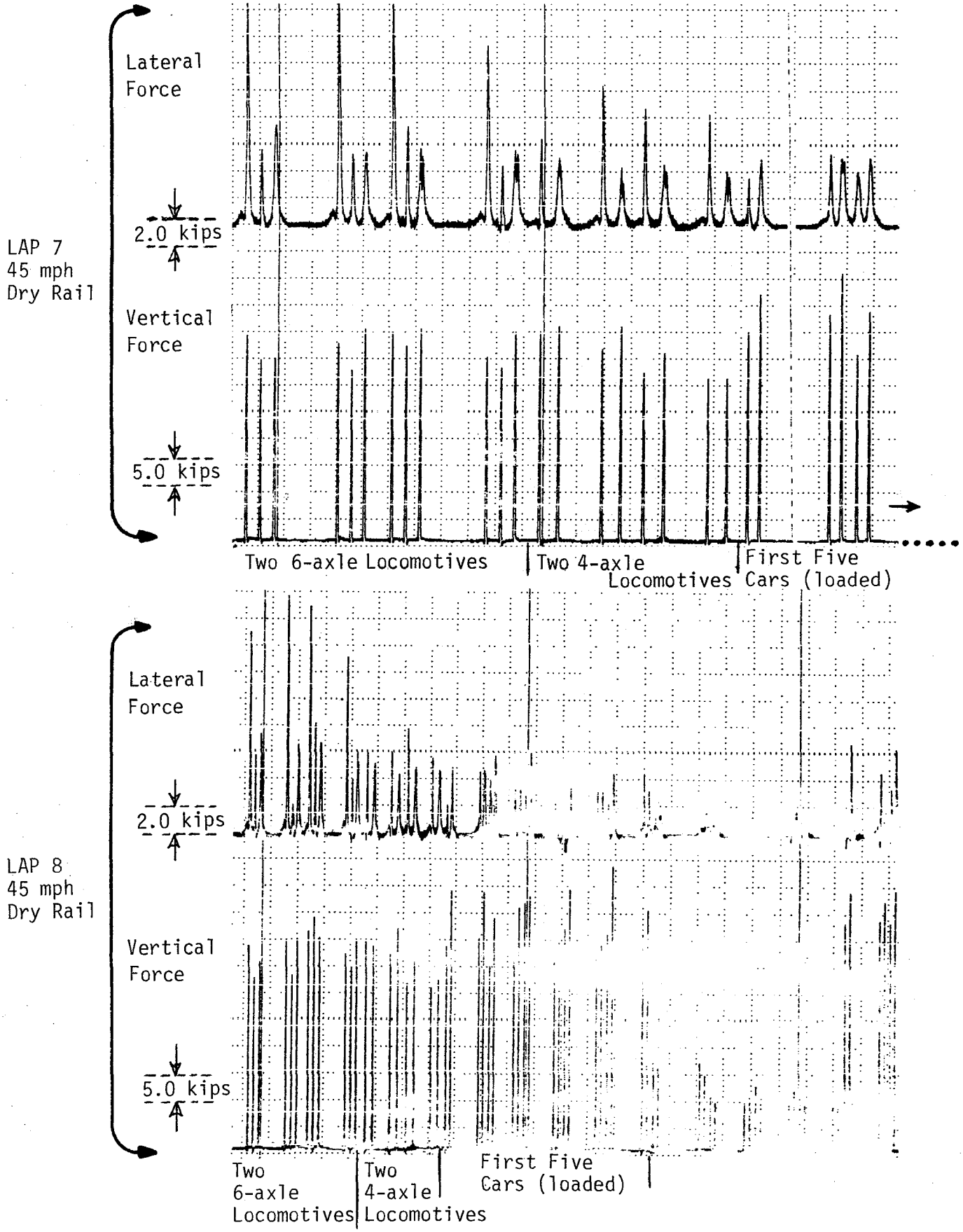

LAP 1
30 mph
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Four 4-axle
Locomotives
First Five
Cars (loaded)

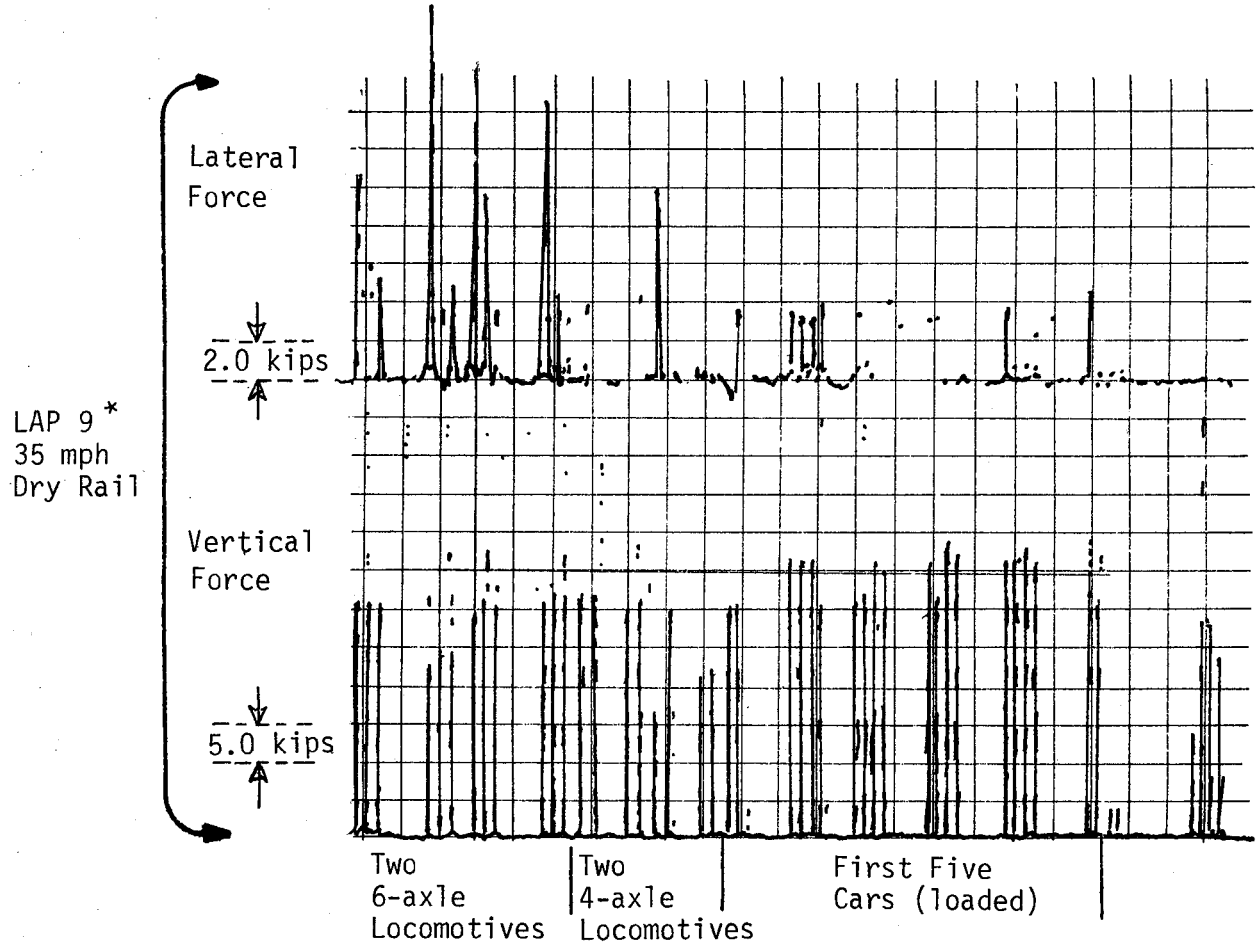

LAP 2
45 mph
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Four 4-axle
Locomotives
First Five
Cars (loaded)


LAP 3
45 mph
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Four 4-axle
Locomotives
First Five
Cars (loaded)


LAP 4
45 mph
Power
Braking
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Four 4-axle
Locomotives
First Five
Cars (loaded)

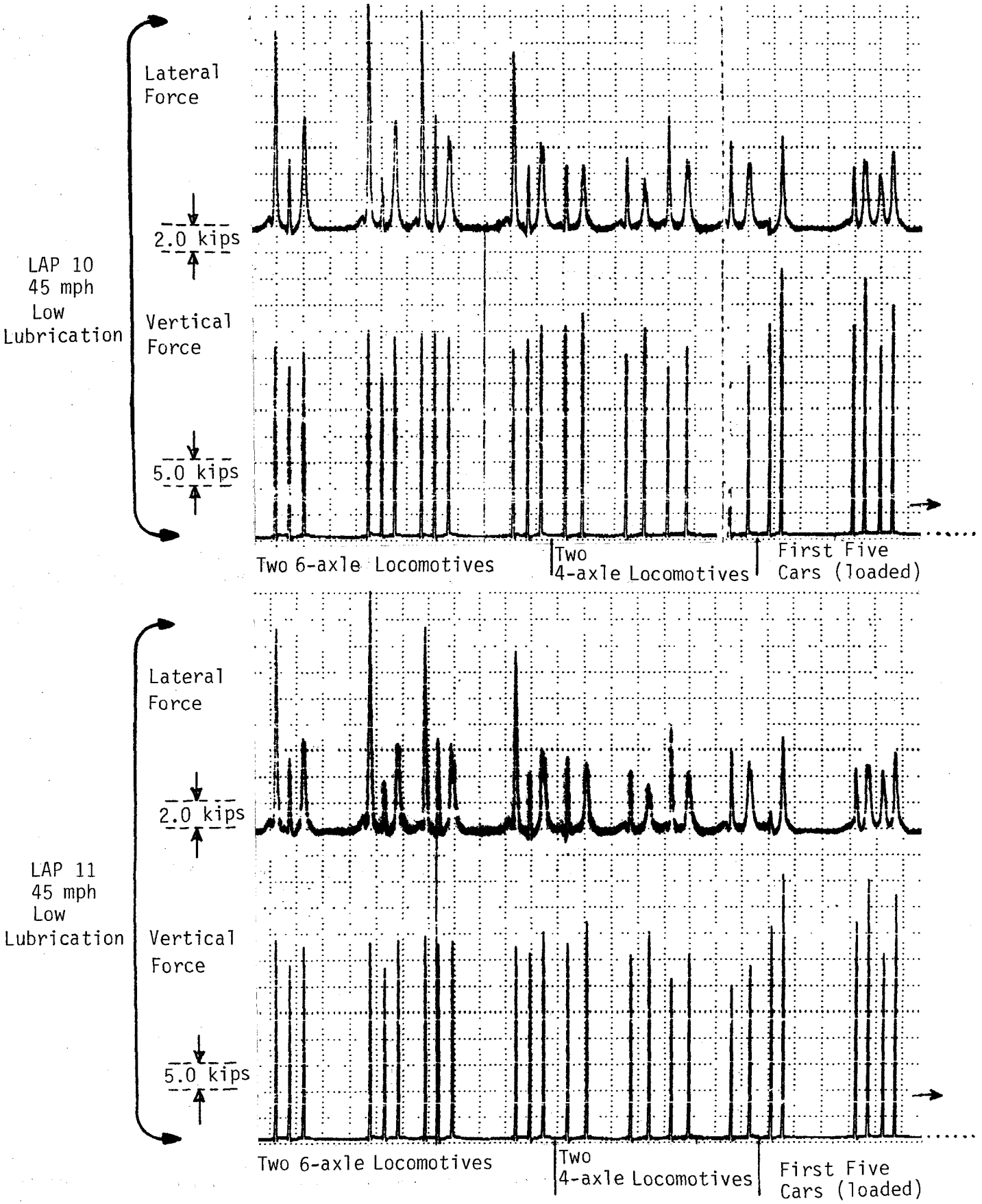

LAP 5
45 mph
Power
Braking
Lateral
Force
GP-40 with
new wheels
2.0 kips
Vertical
Force
5.0 kips
Four 4-axle
Locomotives
First Five
Cars (loaded)
LAP 6
30 mph
Dry Rail
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Two
6-axle
Locomotives
Two
4-axle
Locomotives
First Five
Cars (loaded)

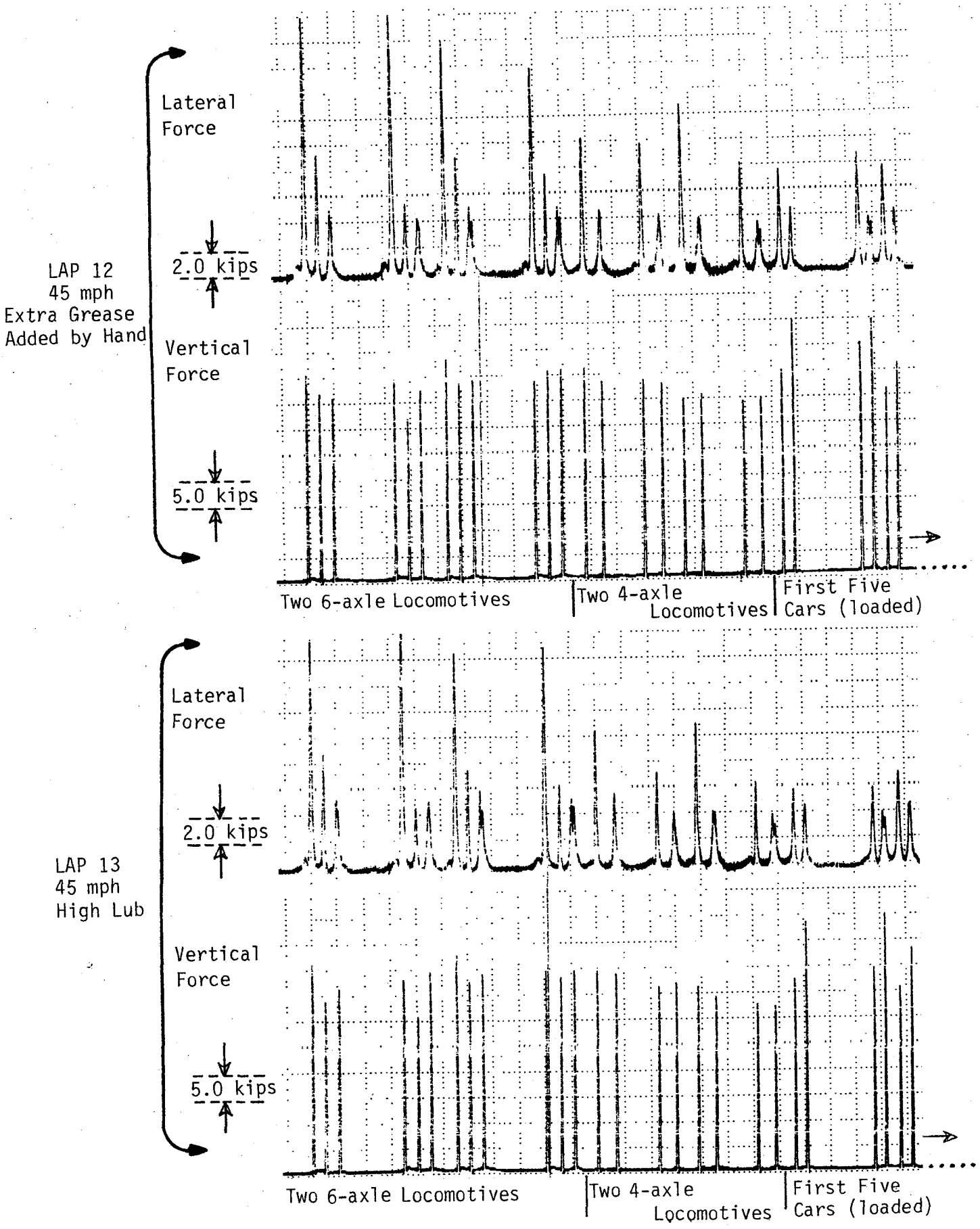

LAP 7
45 mph
Dry Rail
Lateral Force
2.0 kips
Vertical Force
5.0 kips
Two 6-axle Locomotives
Two 4-axle Locomotives
First Five Cars (loaded)
LAP 8
45 mph
Dry Rail
Lateral Force
2.0 kips
Vertical Force
5.0 kips
Two 6-axle Locomotives
Two 4-axle Locomotives
First Five Cars (loaded)



* Chart pen failure-

Values approximated by Traceover.


LAP 10
45 mph
Low
Lubrication
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Two 6-axle Locomotives
Two
4-axle Locomotives
First Five
Cars (loaded)
LAP 11
45 mph
Low
Lubrication
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Two 6-axle Locomotives
Two
4-axle Locomotives
First Five
Cars (loaded)


LAP 12
45 mph
Extra Grease
Added by Hand
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Two 6-axle Locomotives
Two 4-axle
Locomotives
First Five
Cars (loaded)
LAP 13
45 mph
High Lub
Lateral
Force
2.0 kips
Vertical
Force
5.0 kips
Two 6-axle Locomotives
Two 4-axle
Locomotives
First Five
Cars (loaded)

APPENDIX B

L/V RATIO FOR ALL LAPS, 1 THROUGH 13
(COMPUTER LISTINGS)

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 36
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.305556
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF1.UDB

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02H

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF2.UDB

L/V Ratio

BIN NO	TIME-(SEC)	ENG UNIT		BIN NO	TIME-(SEC)	ENG UNIT
			(4-Axle Loco's)			
1	0.000000E+00	0.335997E+00	Loco.#1	1	0.000000E+00	0.137339E+00
2	0.909091E-01	0.890691E-01		2	0.909091E-01	0.122509E+00
3	0.181818E+00	0.400827E+00		3	0.181818E+00	0.275062E+00
4	0.272727E+00	0.454676E-01		4	0.272727E+00	0.671739E-01
5	0.363636E+00	0.372849E+00	Loco.#2	5	0.363636E+00	0.204880E+00
6	0.454545E+00	0.776692E-01		6	0.454545E+00	0.109790E+00
7	0.545455E+00	0.418421E+00		7	0.545455E+00	0.256779E+00
8	0.636364E+00	0.491635E-01		8	0.636364E+00	0.757510E-01
9	0.727273E+00	0.427505E+00	Loco.#3	9	0.727273E+00	0.347926E+00
10	0.818182E+00	0.752273E-01		10	0.818182E+00	0.139480E+00
11	0.909091E+00	0.474843E+00		11	0.909091E+00	0.337166E+00
12	0.100000E+01	0.766446E-01		12	0.100000E+01	0.609102E-01
13	0.109091E+01	0.256367E+00	Loco.#4	13	0.109091E+01	0.249132E+00
14	0.118182E+01	0.881291E-01		14	0.118182E+01	0.942464E-01
15	0.127273E+01	0.167005E+00		15	0.127273E+01	0.245858E+00
16	0.136364E+01	0.367158E-01		16	0.136364E+01	0.520588E-01
17	0.145455E+01	0.111660E+00	Cars (loaded)	17	0.145455E+01	0.118192E-01
18	0.154545E+01	0.118911E+00	Car #1	18	0.154545E+01	0.172942E+00
19	0.163636E+01	0.213171E+00		19	0.163636E+01	0.113345E+00
20	0.172727E+01	0.965673E-01		20	0.172727E+01	0.102131E+00
21	0.181818E+01	0.192437E+00	Car #2	21	0.181818E+01	0.158590E+00
22	0.190909E+01	0.806785E-01		22	0.190909E+01	0.146495E+00
23	0.200000E+01	0.252449E+00		23	0.200000E+01	0.836285E-01
24	0.209091E+01	0.606641E-01		24	0.209091E+01	0.110301E+00
25	0.218182E+01	0.153271E+00	Car #3	25	0.218182E+01	0.844283E-01
26	0.227273E+01	0.103049E+00		26	0.227273E+01	0.137536E+00
27	0.236364E+01	0.215424E+00		27	0.236364E+01	-0.382337E-01
28	0.245455E+01	0.223030E-01		28	0.245455E+01	0.657619E-01
29	0.254545E+01	0.490665E-01	Car #4	29	0.254545E+01	0.281153E-02
30	0.263636E+01	0.645636E-01		30	0.263636E+01	0.100749E+00
31	0.272727E+01	0.314100E+00		31	0.272727E+01	0.994075E-01
32	0.281818E+01	0.613988E-01		32	0.281818E+01	0.591552E-01
33	0.290909E+01	0.132772E+00	Car #5	33	0.290909E+01	0.112128E+00
34	0.300000E+01	0.823218E-01		34	0.300000E+01	0.125281E+00
35	0.309091E+01	0.242446E+00		35	0.309091E+01	0.106225E+00
36	0.318182E+01	0.375215E-01		36	0.318182E+01	0.590682E-01
				37	0.327273E+01	0.153323E+00
				38	0.336364E+01	-0.154634E-01
				39	0.345454E+01	0.744534E-01
				40	0.354545E+01	0.167405E+00

LAP #1

LAP #2

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF3,UDB

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 37
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.297297
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF4,UDB

L/V Ratio

(4-Axle Loco's)

Cars (loaded)

BIN NO	TIME-(SEC)	ENG UNIT
1	0.000000E+00	0.243908E-01
2	0.909091E-01	0.110859E+00
3	0.181818E+00	0.134633E+00
4	0.272727E+00	0.203170E+00
5	0.363636E+00	0.825317E-01
6	0.454545E+00	0.137721E+00
7	0.545455E+00	0.120576E+00
8	0.636364E+00	0.194340E+00
9	0.727273E+00	0.865658E-01
10	0.818182E+00	0.306384E+00
11	0.909091E+00	0.138866E+00
12	0.100000E+01	0.269152E+00
13	0.109091E+01	0.856965E-01
14	0.118182E+01	0.125757E+00
15	0.127273E+01	0.114993E+00
16	0.136364E+01	0.243625E+00
17	0.145455E+01	0.608483E-01
18	0.154545E+01	0.130218E+00
19	0.163636E+01	0.131542E+00
20	0.172727E+01	0.988277E-01
21	0.181818E+01	0.942857E-01
22	0.190909E+01	0.162524E+00
23	0.200000E+01	0.150695E+00
24	0.209091E+01	0.116249E+00
25	0.218182E+01	0.720806E-01
26	0.227273E+01	0.146641E+00
27	0.236364E+01	0.140957E+00
28	0.245455E+01	0.593797E-01
29	0.254545E+01	0.518041E-01
30	0.263636E+01	0.544701E-01
31	0.272727E+01	0.672133E-01
32	0.281818E+01	0.842516E-01
33	0.290909E+01	0.777887E-01
34	0.300000E+01	0.988355E-01
35	0.309091E+01	0.106348E+00
36	0.318182E+01	0.101941E+00
37	0.327273E+01	0.563445E-01
38	0.336364E+01	0.695860E-01
39	0.345454E+01	0.333124E-01
40	0.354545E+01	0.826209E-01

Loco.#1 — Loco.#2 — Loco.#3 — Loco.#4

Car #1 — Car #2 — Car #3 — Car #4 — Car #5

LAP #3

BIN NO	TIME-(SEC)	ENG UNIT
1	0.000000E+00	0.902357E-01
2	0.909091E-01	0.153476E+00
3	0.181818E+00	0.173964E+00
4	0.272727E+00	0.510881E-01
5	0.363636E+00	0.109774E+00
6	0.454545E+00	0.118696E+00
7	0.545455E+00	0.174936E+00
8	0.636364E+00	0.899521E-01
9	0.727273E+00	0.397632E+00
10	0.818182E+00	0.135305E+00
11	0.909091E+00	0.404478E+00
12	0.100000E+01	0.115117E+00
13	0.109091E+01	0.170817E+00
14	0.118182E+01	0.144904E+00
15	0.127273E+01	0.199958E+00
16	0.136364E+01	0.618166E-01
17	0.145455E+01	0.150945E+00
18	0.154545E+01	0.150813E+00
19	0.163636E+01	0.123958E+00
20	0.172727E+01	0.118164E+00
21	0.181818E+01	0.154458E+00
22	0.190909E+01	0.133818E+00
23	0.200000E+01	0.114288E+00
24	0.209091E+01	0.117072E+00
25	0.218182E+01	0.126901E+00
26	0.227273E+01	0.135195E+00
27	0.236364E+01	0.814654E-01
28	0.245455E+01	0.659379E-01
29	0.254545E+01	0.798522E-01
30	0.263636E+01	0.882998E-01
31	0.272727E+01	0.811832E-01
32	0.281818E+01	0.740272E-01
33	0.290909E+01	0.751207E-01
34	0.300000E+01	0.935714E-01
35	0.309091E+01	0.150695E+00
36	0.318182E+01	0.535273E-01
37	0.327273E+01	-0.109873E-01

LAP #4

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 37
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.297297
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF5.UDB

L/V Ratio

	IN NO	TIME-(SEC)	ENG UNIT
(4-Axle Loco's)			
Loco.#1	1	0.000000E+00	0.721007E-01
	2	0.909091E-01	0.175204E+00
	3	0.181818E+00	0.193511E+00
	4	0.272727E+00	0.375655E-01
Loco.#2	5	0.363636E+00	0.707650E-01
	6	0.454545E+00	0.115441E+00
	7	0.545455E+00	0.147074E+00
	8	0.636364E+00	0.781063E-01
Loco.#3	9	0.727273E+00	0.378222E+00
	10	0.818182E+00	0.12[illegible]884E+00
	11	0.909091E+00	0.427455E+00
	12	0.100000E+01	0.52[illegible]098E-01
Loco.#4	13	0.109091E+01	0.21[illegible]755E+00
	14	0.118182E+01	0.166075E+00
	15	0.127273E+01	0.196515E+00
	16	0.136364E+01	0.776846E-01
Cars (loaded)	17	0.145455E+01	-0.869819E-02
Car #1	18	0.154545E+01	0.161703E+00
	19	0.163636E+01	0.973340E-01
	20	0.172727E+01	0.111810E+00
Car #2	21	0.181818E+01	0.920763E-01
	22	0.190909E+01	0.985430E-01
	23	0.200000E+01	0.64[illegible]919E-01
	24	0.209091E+01	0.822[illegible]7E-01
Car #3	25	0.218182E+01	0.530974E-01
	26	0.227273E+01	0.10[illegible]967E+00
	27	0.236364E+01	0.281656E-01
	28	0.245455E+01	0.751127E-01
Car #4	29	0.254545E+01	-0.352153E-01
	30	0.263636E+01	0.111012E+00
	31	0.272727E+01	0.144486E+00
	32	0.281818E+01	0.53[illegible]329E-01
Car #5	33	0.290909E+01	0.802349E-01
	34	0.300000E+01	0.103438E+00
	35	0.309091E+01	0.164222E+00
	36	0.318182E+01	0.517578E-01
	37	0.327273E+01	-0.233249E-01

LAP #5

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION : DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 38
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.289474
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF6.UDB

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION : DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF7.UDB

L/V Ratio

BIN NO	TIME-(SEC)	ENG UNIT		BIN NO	TIME-(SEC)	ENG UNIT
			(6-Axle Loco's)			
1	0.000000E+00	0.481330E+00		1	0.000000E+00	0.423237E+00
2	0.909091E-01	0.177535E+00		2	0.909091E-01	0.160448E+00
3	0.181818E+00	0.162313E+00	Loco.#1	3	0.181818E+00	0.207898E+00
4	0.272727E+00	0.527163E+00		4	0.272727E+00	0.481261E+00
5	0.363636E+00	0.154172E+00		5	0.363636E+00	0.161009E+00
6	0.454545E+00	0.133429E+00		6	0.454545E+00	0.129023E+00
7	0.545455E+00	0.371923E+00		7	0.545455E+00	0.415149E+00
8	0.636364E+00	0.226946E+00		8	0.636364E+00	0.191360E+00
9	0.727273E+00	0.110859E+00	Loco.#2	9	0.727273E+00	0.119669E+00
10	0.818182E+00	0.429399E+00		10	0.818182E+00	0.383920E+00
11	0.909091E+00	0.234266E+00		11	0.909091E+00	0.128327E+00
12	0.100000E+01	0.963493E-01	(4-Axle Loco's)	12	0.100000E+01	0.120694E+00
13	0.109091E+01	0.188646E+00		13	0.109091E+01	0.160122E+00
14	0.118182E+01	0.102226E+00	Loco.#3	14	0.118182E+01	0.111627E+00
15	0.127273E+01	0.322291E+00		15	0.127273E+01	0.278342E+00
16	0.136364E+01	0.670083E-01		16	0.136364E+01	0.941538E-01
17	0.145455E+01	0.404377E+00		17	0.145455E+01	0.260254E+00
18	0.154545E+01	0.657197E-01	Loco.#4	18	0.154545E+01	0.109517E+00
19	0.163636E+01	0.439364E+00		19	0.163636E+01	0.260706E+00
20	0.172727E+01	0.468365E-01	Cars (loaded)	20	0.172727E+01	0.958479E-01
21	0.181818E+01	0.278962E-01		21	0.181818E+01	0.103256E+00
22	0.190909E+01	0.123507E+00	Car #1	22	0.190909E+01	0.104115E+00
23	0.200000E+01	0.185653E+00		23	0.200000E+01	0.119643E+00
24	0.209091E+01	0.105716E+00		24	0.209091E+01	0.101096E+00
25	0.218182E+01	0.628416E-01		25	0.218182E+01	0.137826E+00
26	0.227273E+01	0.117279E+00	Car #2	26	0.227273E+01	0.113693E+00
27	0.236364E+01	0.279371E+00		27	0.236364E+01	0.146362E+00
28	0.245455E+01	0.269946E-01		28	0.245455E+01	0.827261E-01
29	0.254545E+01	0.708875E-01		29	0.254545E+01	0.105233E+00
30	0.263636E+01	0.964709E-01	Car #3	30	0.263636E+01	0.120042E+00
31	0.272727E+01	0.114342E+00		31	0.272727E+01	0.945823E-01
32	0.281818E+01	0.442039E-01		32	0.281818E+01	0.317610E-01
33	0.290909E+01	-0.347928E-01		33	0.290909E+01	0.503579E-01
34	0.300000E+01	0.857316E-01	Car #4	34	0.300000E+01	0.513012E-01
35	0.309091E+01	0.301700E+00		35	0.309091E+01	0.803397E-01
36	0.318182E+01	0.456557E-01		36	0.318182E+01	0.866046E-01
37	0.327273E+01	0.533990E-01		37	0.327273E+01	0.925486E-01
38	0.336364E+01	0.916892E-01	Car #5	38	0.336364E+01	0.113771E+00
				39	0.345454E+01	0.126908E+00
				40	0.354545E+01	0.637636E-01

LAP #6

LAP #7

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D028

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 35
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.314286
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF8.UDB

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION : DRS:D028

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 28
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.392857
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF9.UDB

L/V Ratio

BIN NO	TIME-(SEC)	ENG UNIT		BIN NO	TIME-(SEC)	ENG UNIT
			(6-Axle Loco's)			
1	0.000000E+00	0.378474E+00		1	0.000000E+00	0.505920E+00
2	0.909091E-01	0.174875E+00		2	0.909091E-01	0.200804E+00
3	0.181818E+00	0.207743E+00	Loco.#1	3	0.181818E+00	0.158462E+00
4	0.272727E+00	0.452306E+00		4	0.272727E+00	0.568254E+00
5	0.363636E+00	0.507395E-01		5	0.363636E+00	0.128184E+00
6	0.454545E+00	0.159436E+00		6	0.454545E+00	0.143589E+00
7	0.545455E+00	0.408905E+00		7	0.545455E+00	0.461657E+00
8	0.636364E+00	0.184476E+00		8	0.636364E+00	0.285765E+00
9	0.727273E+00	0.161723E+00	Loco.#2	9	0.727273E+00	0.973225E-01
10	0.818182E+00	0.355159E+00		10	0.818182E+00	0.451928E+00
11	0.909091E+00	0.108512E+00		11	0.909091E+00	0.199077E+00
12	0.100000E+01	0.127871E+00	(4-Axle Loco's)	12	0.100000E+01	0.743147E-01
13	0.109091E+01	0.143308E+00		13	0.109091E+01	0.128184E+00
14	0.118182E+01	0.120180E+00	Loco.#3	14	0.118182E+01	0.566182E-01
15	0.127273E+01	0.160706E+00		15	0.127273E+01	0.194840E+00
16	0.136364E+01	0.938074E-01		16	0.136364E+01	0.301091E-01
17	0.145455E+01	0.245707E+00		17	0.145455E+01	0.357744E+00
18	0.154545E+01	0.126673E+00	Loco.#4	18	0.154545E+01	0.539888E-01
19	0.163636E+01	0.174443E+00		19	0.163636E+01	0.237997E+00
20	0.172727E+01	0.135100E+00	Cars (loaded)	20	0.172727E+01	0.109757E-01
21	0.181818E+01	0.107527E+00		21	0.181818E+01	-0.167273E-01
22	0.190909E+01	0.999716E-01	Car #1	22	0.190909E+01	0.100986E+00
23	0.200000E+01	0.109328E+00		23	0.200000E+01	0.153668E+00
24	0.209091E+01	0.912814E-01		24	0.209091E+01	0.801808E-01
25	0.218182E+01	0.157294E+00		25	0.218182E+01	0.740957E-01
26	0.227273E+01	0.128005E+00	Car #2	26	0.227273E+01	0.926826E-01
27	0.236364E+01	0.104878E+00		27	0.236364E+01	0.153472E+00
28	0.245455E+01	0.881329E-01		28	0.245455E+01	0.257044E-01
29	0.254545E+01	0.105433E+00				
30	0.263636E+01	0.129980E+00	Car #3			
31	0.272727E+01	0.641879E-01				
32	0.281818E+01	0.345673E-01				
33	0.290909E+01	0.628699E-01				
34	0.300000E+01	0.708984E-01	Car #4			
35	0.309091E+01	0.789623E-01				
			Car #5			

Car Data Cut
Short by Process

LAP #8

LAP #9

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF10.UDB

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION: DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF11.UDB

L/V Ratio

BIN NO	TIME-(SEC)	ENG UNIT		BIN NO	TIME-(SEC)	ENG UNIT
			(6-Axle Loco's)			
1	0.000000E+00	0.411040E+00		1	0.000000E+00	0.395442E+00
2	0.909091E-01	0.151430E+00		2	0.909091E-01	0.151887E+00
3	0.181818E+00	0.228067E+00	Loco.#1	3	0.181818E+00	0.186290E+00
4	0.272727E+00	0.465857E+00		4	0.272727E+00	0.474236E+00
5	0.363636E+00	0.104472E+00		5	0.363636E+00	0.102958E+00
6	0.454545E+00	0.203334E+00		6	0.454545E+00	0.163731E+00
7	0.545455E+00	0.413952E+00		7	0.545455E+00	0.389919E+00
8	0.636364E+00	0.206559E+00		8	0.636364E+00	0.177864E+00
9	0.727273E+00	0.169721E+00	Loco.#2	9	0.727273E+00	0.136686E+00
10	0.818182E+00	0.366846E+00		10	0.818182E+00	0.363815E+00
11	0.909091E+00	0.118047E+00		11	0.909091E+00	0.115976E+00
12	0.100000E+01	0.146420E+00	(4-Axle Loco's)	12	0.100000E+01	0.125313E+00
13	0.109091E+01	0.110704E+00		13	0.109091E+01	0.144186E+00
14	0.118182E+01	0.106623E+00	Loco.#3	14	0.118182E+01	0.108026E+00
15	0.127273E+01	0.142869E+00		15	0.127273E+01	0.121235E+00
16	0.136364E+01	0.800670E-01		16	0.136364E+01	0.764999E-01
17	0.145455E+01	0.253372E+00		17	0.145455E+01	0.243267E+00
18	0.154545E+01	0.128741E+00	Loco.#4	18	0.154545E+01	0.109692E+00
19	0.163636E+01	0.206374E+00		19	0.163636E+01	0.195398E+00
20	0.172727E+01	0.138811E+00	Cars (loaded)	20	0.172727E+01	0.144524E+00
21	0.181818E+01	0.109872E+00		21	0.181818E+01	0.117426E+00
22	0.190909E+01	0.137305E+00	Car #1	22	0.190909E+01	0.142604E+00
23	0.200000E+01	0.108954E+00		23	0.200000E+01	0.108817E+00
24	0.209091E+01	0.106348E+00		24	0.209091E+01	0.997830E-01
25	0.218182E+01	0.141447E+00		25	0.218182E+01	0.118196E+00
26	0.227273E+01	0.126640E+00	Car #2	26	0.227273E+01	0.128080E+00
27	0.236364E+01	0.115187E+00		27	0.236364E+01	0.141346E+00
28	0.245455E+01	0.903533E-01		28	0.245455E+01	0.105633E+00
29	0.254545E+01	0.499858E-01		29	0.254545E+01	0.717516E-01
30	0.263636E+01	0.123416E+00	Car #3	30	0.263636E+01	0.134916E+00
31	0.272727E+01	0.837604E-01		31	0.272727E+01	0.862935E-01
32	0.281818E+01	0.363298E-01		32	0.281818E+01	0.264082E-01
33	0.290909E+01	0.716322E-01		33	0.290909E+01	0.000000E+00
34	0.300000E+01	0.749787E-01	Car #4	34	0.300000E+01	0.643338E-01
35	0.309091E+01	0.945979E-01		35	0.309091E+01	0.884146E-01
36	0.318182E+01	0.763196E-01		36	0.318182E+01	0.609913E-01
37	0.327273E+01	0.507823E-01		37	0.327273E+01	0.431272E-01
38	0.336364E+01	0.914552E-01	Car #5	38	0.336364E+01	0.952511E-01
39	0.345454E+01	0.766493E-01		39	0.345454E+01	0.112477E+00
40	0.354545E+01	0.643565E-01		40	0.354545E+01	0.485785E-01

LAP #10

LAP #11

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION : DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF12,UDB

TRANSPORTATION TEST CENTER
DATA REDUCTION SYSTEM

VERSION : DRS:D02B

LISTING OF MAIN ARRAY: 2
EFFECTIVE DATA POINTS: 40
SAMPLE RATE(PTS/SEC) : 11
FREQ RESOLUTION (HZ) : 0.275000
MAIN ARRAY STATUS : -3
ASSOCIATED FILENAME :RLF13,UDB

L/V Ratio

BIN NO	TIME-(SEC)	ENG UNIT		BIN NO	TIME-(SEC)	ENG UNIT
			(6-Axle Loco's)			
1	0.000000E+00	0.485979E+00		1	0.000000E+00	0.422943E+00
2	0.909091E-01	0.248060E+00		2	0.909091E-01	0.260500E+00
3	0.181818E+00	0.120659E+00	Loco.#1	3	0.181818E+00	0.140848E+00
4	0.272727E+00	0.508684E+00		4	0.272727E+00	0.487720E+00
5	0.363636E+00	0.161739E+00		5	0.363636E+00	0.141855E+00
6	0.454545E+00	0.118887E+00		6	0.454545E+00	0.124474E+00
7	0.545455E+00	0.410623E+00		7	0.545455E+00	0.383968E+00
8	0.636364E+00	0.224815E+00		8	0.636364E+00	0.196105E+00
9	0.727273E+00	0.106021E+00	Loco.#2	9	0.727273E+00	0.121282E+00
10	0.818182E+00	0.409508E+00		10	0.818182E+00	0.420474E+00
11	0.909091E+00	0.180893E+00		11	0.909091E+00	0.159985E+00
12	0.100000E+01	0.929744E-01	(4-Axle Loco's)	12	0.100000E+01	0.112235E+00
13	0.109091E+01	0.248725E+00		13	0.109091E+01	0.248520E+00
14	0.118182E+01	0.115715E+00	Loco.#3	14	0.118182E+01	0.130845E+00
15	0.127273E+01	0.249516E+00		15	0.127273E+01	0.191848E+00
16	0.136364E+01	0.103671E+00		16	0.136364E+01	0.106288E+00
17	0.145455E+01	0.360626E+00		17	0.145455E+01	0.294525E+00
18	0.154545E+01	0.996534E-01	Loco.#4	18	0.154545E+01	0.111849E+00
19	0.163636E+01	0.234830E+00		19	0.163636E+01	0.191586E+00
20	0.172727E+01	0.852764E-01	Cars (loaded)	20	0.172727E+01	0.967500E-01
21	0.181818E+01	0.188029E+00		21	0.181818E+01	0.152516E+00
22	0.190909E+01	0.935714E-01	Car #1	22	0.190909E+01	0.980824E-01
23	0.200000E+01	0.191459E+00		23	0.200000E+01	0.144593E+00
24	0.209091E+01	0.695855E-01		24	0.209091E+01	0.722114E-01
25	0.218182E+01	0.212576E+00		25	0.218182E+01	0.194974E+00
26	0.227273E+01	0.102763E+00	Car #2	26	0.227273E+01	0.105139E+00
27	0.236364E+01	0.205884E+00		27	0.236364E+01	0.204663E+00
28	0.245455E+01	0.547602E-01		28	0.245455E+01	0.600346E-01
29	0.254545E+01	0.104115E+00		29	0.254545E+01	0.109161E+00
30	0.263636E+01	0.118164E+00	Car #3	30	0.263636E+01	0.121135E+00
31	0.272727E+01	0.951878E-01		31	0.272727E+01	0.138109E+00
32	0.281818E+01	0.505158E-01		32	0.281818E+01	0.505798E-01
33	0.290909E+01	0.736278E-01		33	0.290909E+01	0.779711E-01
34	0.300000E+01	0.643338E-01	Car #4	34	0.300000E+01	0.871521E-01
35	0.309091E+01	0.128923E+00		35	0.309091E+01	0.149927E+00
36	0.318182E+01	0.604450E-01		36	0.318182E+01	0.567436E-01
37	0.327273E+01	0.911239E-01		37	0.327273E+01	0.996055E-01
38	0.336364E+01	0.927867E-01	Car #5	38	0.336364E+01	0.107351E+00
39	0.345454E+01	0.134753E+00		39	0.345454E+01	0.975797E-01
40	0.354545E+01	0.582135E-01		40	0.354545E+01	0.624145E-01

LAP #12

LAP #13

LATERAL/VERTICAL (L/V) RATIOS PER AXLE, BY LAP.

FAST Facility for Accelerated Service Testing TECHNICAL NOTE

The Facility for Accelerated Service Testing (FAST) is located at the Transportation Test Center (TTC), Pueblo, Colorado. It is operated by the Association of American Railroads (AAR) in cooperation with the Federal Railroad Administration (FRA) and the railroad companies and supply industry to conduct accelerated testing of track and mechanical components and systems.

The FAST Program is controlled by a policy committee composed of representatives from FRA, AAR, and the railroad industry. Its policies are implemented through the FAST organization at the TTC. The AAR FAST Technical Manager is responsible for the overall design of the experiments to be conducted at FAST, and the FAST Operations Manager implements the approved experiments in the field in cooperation with the AAR experiment supervisors.

The FAST Track is a specially constructed 4.8-mi* loop divided into 22 sections where specified combinations of track components and structures are installed for testing. It contains 2.2 mi of tangent, 0.4 mi of 3° curve, 0.3 mi of 4° curve, and 1.1 mi of 5° curve; the remaining 0.8 mi is in transitional spirals.

Mechanical components are tested in the FAST consist, which is made up of 4-axle locomotives normally hauling a 75-car, 9,500-ton train. Cars are available from a pool of about 90 cars assigned to FAST. The majority are 100-ton hopper or gondola cars, and the remainder are 100-ton capacity tank cars and laden trailer-on-flat-cars.

A "test run" begins in the afternoon, continues all night, and ends the next morning (five days a week). Each run makes approximately 120 laps of the FAST loop and produces approximately 1 million gross tons (MGT) on the track and about 600 mi on the cars, an accelerated service of about 10 times normal revenue operations in any given period of time.

To ensure uniform wear potential on track and mechanical components, direction of running is reversed each day; the whole consist is turned end-for-end every two days. Blocks of cars are shifted systematically within the consist on a 22-day cycle.

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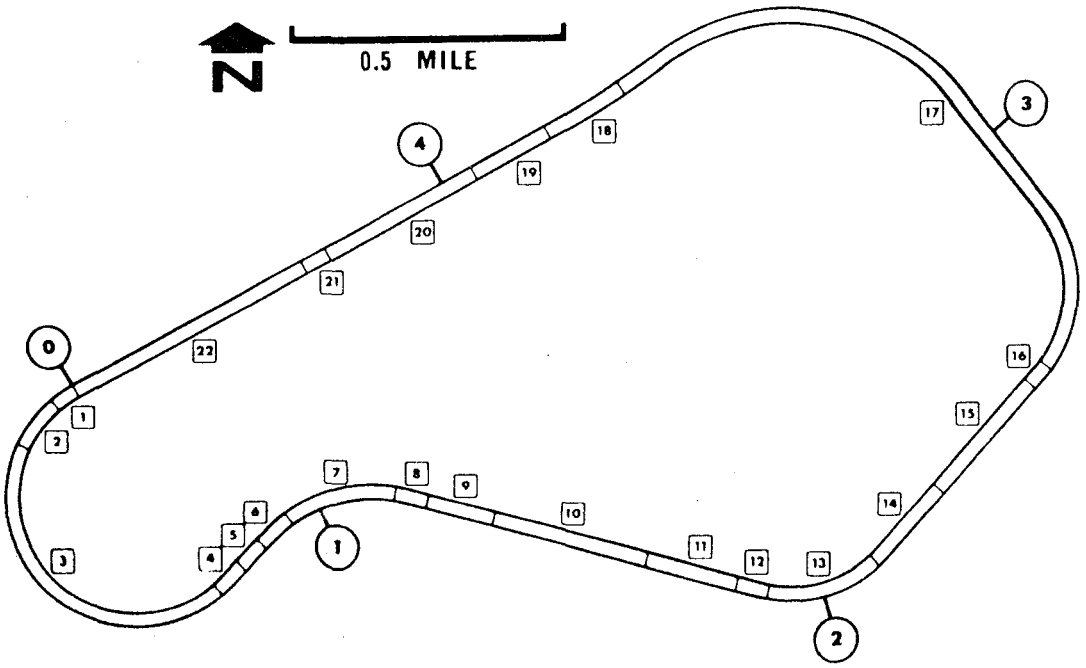
*Metric Conversions:

1 mi = 1.6094 km
1 ton = 0.907 Mg
1 MGT = 0.907 MGMg



THE FAST TRACK