ENSCO PUB. NO. DOT-FR-99-05

HIGH CANT DEFICIENCY OPERATION OF THE TALGO TRAIN ON THE PACIFIC NORTHWEST CORRIDOR

VOLUME I of III

EXECUTIVE SUMMARY

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ASSESSMENT OF VEHICLE/TRACK INTERACTION FOR SAFETY CONSIDERATIONS

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Prepared by:

E.T. Sherrock
and
B.T. Whitten

ENSCO, INC.
APPLIED TECHNOLOGY AND ENGINEERING DIVISION
5400 Port Royal Road
Springfield, VA 22151

EXECUTIVE SUMMARY

The U.S. Federal Railroad Administration (FRA), Amtrak, the Burlington Northern Santa Fe Railway (BNSF), and the Departments of Transportation for the states of Washington and Oregon, in an effort to improve rail passenger service on the Pacific Northwest Corridor, have initiated a co-operative program to reduce travel time between Portland, Oregon and Blaine, Washington that is competitive with other modes of transportation. The approach taken for reducing trip time is to maintain the maximum authorized speed for the route of 79 mph but to minimize speed reductions in curves by operating at higher cant deficiencies.

One aspect of the program is the use of the Talgo train, with its tilting passenger cars, to provide increased passenger comfort and accommodate higher speeds and cant deficiencies in curves. Under rules applicable at program inception, Amtrak petitioned the FRA to grant a temporary waiver of compliance with §213.57(b) of Section 49 of the Code of Federal Regulations (this section, in 1997, limited the curving speeds to those which produce no more than 3 inches of cant deficiency) to test a Talgo train at curve speeds producing up to eight inches of cant deficiency. The FRA approved Amtrak's petition, docketed H-97-3, for the purpose of test and demonstration, subject to several conditions, including pre-revenue test runs to be conducted **over the proposed track section** to evaluate the vehicle/track interaction response of each Talgo train vehicle type, including the selected locomotives.

This program involved the following key elements:

- Preliminary Safety Considerations - to establish required safety criteria and guidelines with respect to clearance, signal spacing/stop distance and grade crossing evaluations; to confirm test and operational safety at higher cant deficiencies.
- Track Condition Surveys - to evaluate and confirm the adequacy of track geometry and gage restraint over all tracks being considered for higher cant deficiency operations.
- Wayside Instrumented Curve Tests - to evaluate the impact of high cant deficiency operation on track loading and to provide initial evaluation of safety of operation prior to full scale corridor tests.
- Cant Deficiency (Vehicle Accelerations) Tests - to establish safe curving limits over the corridor.
- Criteria to Support High Speed Passenger Rail - to determine and propose technical criteria on which to quantify impacts of high speed on track maintenance

The test director, in consultation with FRA, coordinated with Amtrak and BNSF to agree upon procedures that ensured safety during all aspects of testing. BNSF, in concert with Amtrak, ensured that clearances for the operation at train speeds that develop more than three inches of cant deficiency were investigated and that no combination of train speed and track superelevation or curvature violated the clearance envelope. Amtrak, in concert with BNSF, determined that the signal spacing was adequate for operation of the trainset at test speeds (Test speeds were determined such that they did not exceed speeds producing up to 8 inches of cant deficiency without exceeding 79 mph). Where train speeds exceeded current maximum authorized passenger train speeds, each public and private highway-rail crossing equipped with active warning devices were either provided a minimum warning time of 20 seconds or were flagged or barricaded. Each public or private highway-road crossing not equipped with active warning devices were flagged or barricaded either when test speeds were 10 mph or greater than those previously used for revenue service or if the necessary sight distance was obstructed. The permitees of private crossings were notified of the test.

A BNSF track geometry inspection car was run over the test zone in May 1997 and the FRA's T-10 track inspection vehicle was operated over the test zone between 14 July and 18 July, 1997. Results of the geometry test were part of the criteria used to determine which curves would be tested and at what speeds the trainset would go through the selected curves. A survey of the test zone by the FRA's Gage Restraint Measurement System Test (GRMS), originally scheduled to take place within 60 days prior to the beginning of the testing, was not completed due to scheduling conflicts.

Test curves were selected to evaluate the impact of high cant deficiency operation on track loading and to provide initial evaluation of safety of operation prior to full scale corridor tests. Three (3) test curves were instrumented at locations in the spiral and curve body in order to measure lateral force (L), vertical force (V), and the L/V ratio on both the high and low rails as each axle of a given trainset passed by. Two (2) of the instrumented curves were located within two miles of each other on the northern (Seattle - Blaine) segment of the corridor. A third curve, located in the southern (Seattle - Portland) portion of the corridor, was used to monitor test train loadings during full corridor test runs at the increased cant deficiency levels. All three curves were also used to monitor loadings resulting from normal revenue traffic.

The test train, which consisted of Talgo coach cars, an F40PH locomotive and an F59PH locomotive, performed a series of runs over the test curves while operating at increasing speeds (and cant deficiencies). The initial baseline run was conducted at a 3" cant deficiency, corresponding to current operations, with subsequent runs made at 4, 5, 6, 7, and 8" of cant deficiency. Sufficient runs were made at each speed to ensure an adequate representation of the loading environment. Carbody accelerations were monitored on the test trainset using floor mounted accelerometers located on each of the locomotives and on the Talgo Bistro coach car.

Key results from this phase of the test included the following:

- The lateral forces measured as each wheel passed by each curve location, and the wheel L/V ratios, did not exhibit strong trends as a function of cant deficiency. For all test runs, at cant deficiencies up to 8 inches, values remained well within acceptable limits for each vehicle.
- The low rail wheels of the Talgo coach cars unloaded approximately 47% under dynamic conditions at 8 inches cant deficiency while the low rail wheels of both locomotives unloaded approximately 56% at 8 inches cant deficiency.
- Consideration of the accelerometer measurements made on the test trainset during the special curve tests lead to a re-evaluation of the safety limits used in the assessment of vehicle overturning. This had a direct impact on the cant deficiency runs made in the second phase of the test.
- The Talgo trainset generated lower levels of L/V ratios during the high cant deficiency tests than those generated by freight trains currently operating on the Pacific Northwest corridor.

- Maximum values of L/V ratios determined for the Talgo trainset fell below values associated with wheel climb/rail overturning limits.

Cant deficiency runs were conducted over the entire route (end-to-end) between Portland and Blaine. Candidate curves for high cant deficiency operation were identified by field inspection and analysis of curve records, track charts, and geometry car data. The analysis considered the impacts of road crossings, signals, bridges, turnouts, station stops, speed limits, yards and other factors to arrive at candidate curves and a specific desired cant deficiency for each curve.

Using the curve list, a series of test runs at successively higher cant deficiency (4, 5, 6, 7, and 8 inches) was made. Carbody accelerations were monitored on the same trainset used for the special curve tests in the manner previously described. Lateral accelerations were used to give an indication of the safety margin from vehicle overturn when traveling through spirals and curves at elevated cant deficiencies. Testing was accomplished in incremental curving speeds that permitted a step-by-step analysis of dynamic responses during and at the conclusion of each test run. The decision to proceed to the next level of cant deficiency or speed was based on this analytical process and was subject, in every case, to the approval of the onboard FRA test monitor. After each test sequence, the data was analyzed to determine which curves could be safely tested at the next higher speed.

Key results from this phase of the test include the following:

- In all cases, the locomotives reached acceleration safety limits before the Talgo coach car.
- Safety criteria were met at speeds which produced 7 inches of cant deficiency in all but 44 curves, distributed throughout the test zone.
- Safety criteria were met at speeds producing 6 inches of cant deficiency in all but 31 curves, distributed throughout the test zone.

This report is presented in three volumes. The organization of material is as follows:

- Volume I contains details of the overall test program. Results presented in this volume are those directly related to safety, necessary in the preparation of a waiver.
- Volume II details the collection and analysis of wayside force measurements taken for the Talgo trainset as well as for other typical revenue service equipment. Results presented in this volume of the report pertain to the effects of high cant deficiency operation on track loading.
- Volume III describes the study of maintenance issues with consideration of results from this study.

HIGH CANT DEFICIENCY OPERATION OF THE TALGO TRAIN ON THE PACIFIC NORTHWEST CORRIDOR

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HIGH CANT DEFICIENCY OPERATION OF THE TALGO TRAIN ON THE PACIFIC NORTHWEST CORRIDOR

1.0 INTRODUCTION

In an effort to improve rail passenger service on the Pacific Northwest Corridor, competitive with other modes of transportation, Amtrak, the Burlington Northern Santa Fe Railway (BNSF), and the Departments of Transportation for the states of Washington and Oregon have initiated a co-operative program to reduce travel time between Portland, Oregon and Blaine, Washington. Amtrak operates the passenger service on the Pacific Northwest Corridor; the BNSF owns the trackage between Portland and Blaine. The program includes efforts to reduce the number of civil speed restrictions, upgrade signaling protection at most grade crossings, and to utilize the Talgo train, with its tilting passenger cars, to provide increased passenger comfort and accommodate higher speeds and cant deficiencies in curves. The approach taken for reducing trip time is to maintain the maximum authorized speed for the route of 79 mph but to minimize speed reductions in curves by operating at higher cant deficiencies.

Under rules applicable at program inception, Amtrak petitioned the Federal Railroad Administration (FRA) to grant a temporary waiver of compliance with §213.57(b) of Section 49 of the Code of Federal Regulations (this section, in 1997, limited the curving speeds to those which produce no more than 3 inches of cant deficiency) to test a Talgo train at curve speeds producing up to eight inches of cant deficiency. Upon successful completion of these tests, Amtrak requested a permanent waiver for revenue service at the highest safe cant deficiency, as determined by the preliminary testing, not exceeding eight inches. The FRA has the responsibility to evaluate any candidate train to ensure that safety levels are maintained in a revenue service environment.

The FRA approved Amtrak's petition, docketed H-97-3, for the purpose of test and demonstration, subject to several conditions, including pre-revenue test runs to be conducted **over the proposed track section** to evaluate the vehicle/track interaction response of each Talgo train vehicle type, including the selected locomotives. When appropriate, the FRA has employed the measurement of carbody lateral accelerations over the track section to indicate wheel unloading based on safety limits determined from previous tests, technical data, and analysis. Among other factors, final approval was contingent on the assessment of the vehicle/track interaction response confirming a reasonable margin of safety from derailment.

The pre-revenue test program was a co-operative effort among Amtrak, the FRA, the BNSF, and the state DOTs of Washington and Oregon. ENSCO, Inc. was contracted by the FRA Office of Research and Development to provide test and evaluation support to the FRA Office of Safety. Amtrak, BNSF and ENSCO developed a test plan to run the Talgo trainset at cant deficiencies, in steps, up to 8 inches on track between Portland and Blaine. This would allow speed increases of 5 to 25 mph above the current operating speeds on several curves.

1.1 BACKGROUND

The FRA has performed high cant deficiency tests on several passenger trains using instrumented wheelsets to directly measure wheel/rail forces for comparison to derailment safety criteria. Of the derailment mechanisms investigated, side-to-side vertical load transfer data from these tests have shown that the vehicle overturning criterion which prevents wheel lift is the most restrictive for passenger vehicles operating on strong track in curves.

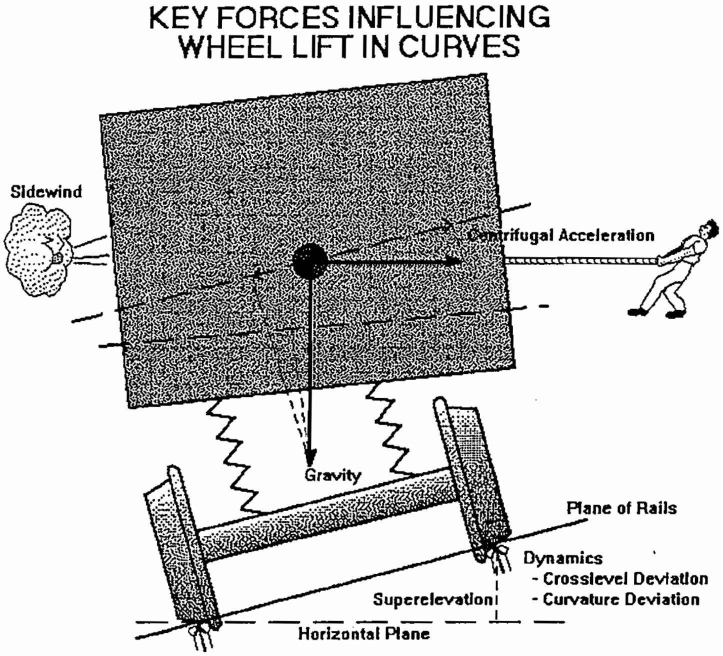

Figure 1.1: Forces Acting Upon a Curving Vehicle

As shown to the left in **Figure 1.1**, the forces acting on a curving vehicle include the lateral inertial forces from centrifugal force, acting at the center of gravity, side-wind forces acting at the center of pressure, and, with superelevated track, a restoring moment due to vehicle weight acting through the center of gravity. The overturning criterion limits the amount of unloading of any low rail wheel to no more than 60% in a steady-state condition and to no more than 80% for transient peak occurrences. These unloadings include the combined effects of cant deficiency (or centrifugal force) and crosswind loading, together with suspension deflections, all of which contribute to the overturning moment on the vehicle in a curve.

Percentage contributions to the total wheel unloading due to cant deficiency forces and due to wind forces are calculated separately and added. The maximum cant deficiency satisfying the steady-state overturning criterion for a particular vehicle with a given maximum crosswind can be determined analytically from a knowledge of the suspension characteristics, mass distribution and vehicle surface area.

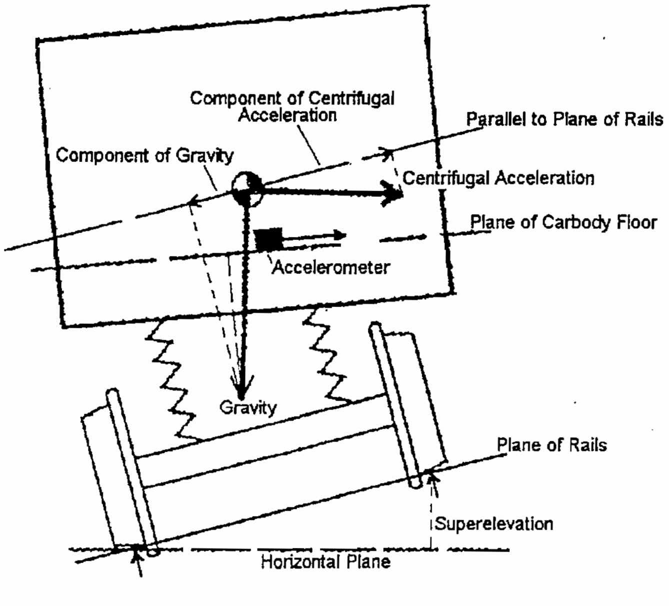

Figure 1.2: Measurement of Accelerations on a Curving Vehicle

For each vehicle, a relationship between load transfer and carbody lateral acceleration can be determined through static lean measurements and computations. This relationship accounts for the specific suspension characteristics and inertial properties (mass distribution, c.g. locations, etc.) of the vehicle, and, in particular, determines the lateral translation and roll characteristics of the carbody as a function of cant deficiency (the unbalanced lateral acceleration parallel to the plane of the rail heads).

Through this relationship, accelerometer measurements on the carbody can be used to determine vertical load transfer for assessment against the safety criterion. Specifically, the measurement of carbody **lateral** acceleration (parallel to the carbody floor) can be related to the acceleration parallel to the plane of the rail heads and thus to the overturning moment.

A relationship between carbody lateral acceleration and wheel unloading must be developed for each vehicle type. For motive power on the Talgo train, the General Motors' Electro-Motive Division (EMD) F40PH and F59PH locomotives were selected. Thus, for this test, to assess the performance of the Talgo coach car, the F40PH locomotive and the F59PH locomotive on the Northwest Corridor track, limits for steady-state, peak, and peak-to-peak lateral accelerations were initially calculated based on known vehicle characteristics and on previous test data.[1,2,3]

The following limits were established as the initial safety criteria to indicate a reasonable safety margin from vehicle overturn.

TABLE 1.1: INITIAL SAFETY LIMITS FOR HIGH CANT DEFICIENCY TESTS

Parameter	Measurement	Talgo Coach	F40PH, F59PH Locomotive
Lateral Acceleration	Steady State	0.10 g	0.18 g
Lateral Acceleration	Zero to Peak	0.20 g	0.31 g
Lateral Acceleration	Peak-to-Peak, 1 second window	0.50 g	0.50 g
Vertical Acceleration	Peak-to-Peak, 1 second window	0.60 g	0.60 g

Limits for lateral and vertical peak-to-peak accelerations set forth in the new high speed track standards are also indicated. The peak-to-peak acceleration limits, considered at the request of the FRA, are recommended to reduce the risk of very poor or unsafe ride quality.

1.2 TEST OBJECTIVE

The purpose of this test was to assess the safe performance of the Talgo trainset operating on Pacific Northwest Corridor track between Portland and Blaine, at cant deficiencies up to 8 inches; the test provided a basis for establishing the intended speed profile for the Talgo trainset in revenue service over this track section.

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[1] *High Cant Deficiency Test of the F40PH Locomotive and The Prototype Banking Amcoach*, Rep. No. DOT-FR-83-03, prepared by ENSCO, P. Boyd & W. Jordan, January 1983.

[2] *CONEG, Tilt and Turbo Train Test and Evaluation, Volume II, Data Analysis Report: Cant Deficiency Train Evaluation Program*, prepared for Amtrak by ENSCO, P. Boyd & C. Tinto, January 1989.

[3] *Cant Deficiency Test Safety Monitoring Using Accelerometer Measurements*, Rep. No. DOT-FRA/ORD-89/05, prepared for FRA ORD by ENSCO, P. Boyd, August 1989.

1.3 TEST PROGRAM OVERVIEW

A BNSF geometry car and the FRA T-10 geometry car were independently run over the test zone prior to the commencement of the testing. Results of the geometry tests were, in part, used to determine which curves were tested.

Carbody accelerations were monitored on the Talgo trainset, which consisted of Talgo coach cars, the F40PH locomotive and the F59PH locomotive, while operating at speeds in curves for which cant deficiencies reached 8 inches. Lateral accelerations were used to give an indication of the safety margin from vehicle overturn when traveling through spirals and curves at elevated cant deficiencies; sufficient safety margin was included for the potential of side-winds during passenger operation. Body accelerations were also used to assess the ride environment with respect to passenger safety within the coach car.

Three test curves were instrumented at locations in the spiral and curve body in order to measure lateral force (L), vertical force (V), and the L/V ratio on both the high and low rails as each axle of a given trainset passed by. Two of the instrumented curves, located within two miles of each other in the Seattle - Blaine segment of the corridor, were used to monitor test train loadings during a series of runs made at increasing speeds that resulted in a range of 3" to 8" cant deficiency. The third curve, located in the Seattle - Portland portion of the corridor, was used to monitor test train loadings during full corridor test runs at the increased cant deficiency levels. All three curves were also used to monitor loadings resulting from current traffic.

The test train performed a series of runs over the test curves, at increasing speeds (and cant deficiencies). The initial baseline run was conducted at a 3" cant deficiency, corresponding to current operations, with subsequent runs made at 4, 5, 6, 7, and 8" of cant deficiency. During these tests, instrumentation onboard the test train (See Section 3.1) measured the lateral and vertical accelerations of the locomotive and coach cars. Sufficient runs were made at each speed to ensure an adequate representation of the loading environment.

Cant deficiency runs were conducted over the entire route (end-to-end) between Portland and Blaine. Results of the recently conducted track surveys were used in a detailed curve study to identify candidate curves for high cant deficiency tests. Using the curve list, a series of test runs at successively higher cant deficiency (4, 5, 6, 7, and 8 inches) was made. Floor-mounted lateral accelerometers on each locomotive and the coach car were used to address the safety criterion of vehicle overturning. Using the same instrumentation as that used in the tests conducted over the test curves, steady-state and peak accelerations were continuously recorded and monitored. If, during any test run, lateral carbody accelerations exceeded predetermined safety limits, the track location at which the exception occurred was noted, and, in subsequent test runs, the track location was approached at speeds for which the cant deficiency was below that at which the exception was recorded

Testing was accomplished in incremental curving speeds that permitted a step-by-step analysis of dynamic responses during and at the conclusion of each test run. The decision to proceed to the next level of cant deficiency or speed was based on this analytical process and was subject, in every case, to the approval of the onboard FRA test monitor. After each test sequence, the data was analyzed to determine which curves could be safely tested at the next higher speed.

Candidate curves for high cant deficiency operation were identified by field inspection and analysis of curve records, track charts, and geometry car data. The most current information from the geometry car was used to determine current track geometry. The analysis considered the impacts of road crossings, signals, bridges, turnouts, station stops, speed limits, yards and other factors to arrive at candidate curves and a specific desired cant deficiency for each curve. Clearances and regulated speeds have been factored into the analysis and crossing starts and stopping distances have been analyzed. Problem areas were identified, accounted and factored into the speed profile/curve list shown in **Appendix A.**

1.4 TEST RESPONSIBILITIES/PERSONNEL

Test personnel included responsible parties from Amtrak, BNSF, and representatives from both Washington and Oregon States' Department of Transportation.

Test measurement and evaluation personnel are given below:

Test Director	Ed Lombardi	Amtrak
FRA Test Monitor	Dave Jamieson	FRA Office of Safety
BNSF/Wayside Test Director	John Leeper	BNSF
Crossing Start Safety	Johnny Johnson	Amtrak
	Jeffrey Schultz	Washington State DOT
Train Operations/Preparation	Kurt Laird	Amtrak
Train Operation/Test Speed	Joe Albinger	BNSF
	Ed Quicksall	Amtrak
Instrumentation/Data Reduction	Brian Whitten	ENSCO
	Allan Zarembski	ZETA-TECH
Data Analysis	Brian Whitten	ENSCO
	Allan Zarembski	ZETA-TECH
Analysis Oversight	Magdy El-Sibaie	FRA Office of R&D
Reporting	Brian Whitten	ENSCO, ZETA-TECH

ENSCO, under contract with the FRA Office of Research and Development, was responsible for test instrumentation, data acquisition, analysis, and reporting. Under subcontract to ENSCO, ZETA-TECH Associates, Inc. took responsibility for the wayside instrumentation of the test curves, and analysis of wayside data.

The FRA Test Monitor had ultimate authority in terms of proceeding with the next level of testing during both the wayside and the cant deficiency testing after review of the data from the previous test run.

2.0 TEST PREPARATION

2.1 TEST ZONE

The test zone was broken into two main segments. The southern segment between Portland OR and Seattle WA is approximately 180 miles long, consisting of double track. The northern segment of the test zone is between Seattle and Blaine WA (the Canadian border), a section measuring close to 120 miles in length. The track between Seattle and Blaine is made up of approximately 25 miles of double track with the remainder being single track. Within these two sections, there are approximately 382 route curves, with curvatures ranging from 0.3° to 12.0°, superelevated to a maximum of 5.9 inches. For the test, the Talgo test consist traversed the test zone curves at target speeds up to 25 mph higher than present operating speeds. Details of the test zone, including a record of the curves and the planned speed profiles for the test, are given in **Appendix A**.

2.2 TRACK GEOMETRY INSPECTION

A BNSF geometry car, Car #85, was run over the test zone in May 1997. The FRA's T-10 track inspection vehicle was operated over the test zone between 14 July and 18 July, 1997. Results of the geometry test were part of the criteria used to determine which curves would be tested and at what speeds the trainset would go through the selected curves.

A survey of the test zone by the FRA's Gage Restraint Measurement System Test (GRMS) was originally scheduled to take place within 60 days prior to the beginning of the testing. Due to scheduling conflicts, this survey was not done before the testing of the Talgo trainset commenced.

2.3 TEST CONSIST

The test consist was made up of one Talgo trainset, one F40PH locomotive and one F59PH locomotive. The Talgo trainset consisted of 13 cars - 9 coach cars, 1 bistro, 1 diner and 2 end cars. The two different locomotives were used in order to study the types of locomotives that would be used with the Talgo trainset during revenue service. Each locomotive was used for motive power and equipped with accurate, operable speed indicating devices. The arrangement of the consist varied, with the position of the locomotives being dictated by the particular test run, an aspect of the test that will be addressed in subsequent sections.

2.4 CURVE SPEED DETERMINATION

Results of track geometry surveys provided the measurements of curvature and superelevation necessary to determine the speed profiles used over the test sections. BNSF, in concert with Amtrak, ensured that clearances for trainset operation at speeds that develop more than three inches of cant deficiency had been investigated and no combination of train speed and track superelevation or curvature existed that would have violated the clearance envelope.

Amtrak, in concert with BNSF, determined that the signal spacing was adequate for operation at all test speeds. It was intended that test speeds produce up to 8 inches of cant deficiency, in accordance with the incremental cant deficiencies, but in no case exceed 79 mph.

2.5 GRADE CROSSING PROTECTION

Test train speeds exceeded current maximum authorized passenger train speeds in a number of locations. Train speeds were set such that each public and private highway-rail crossing equipped with active warning devices provided a minimum warning time of 20 seconds. Each public or private highway-road crossing not equipped with active warning devices were either flagged or barricaded if test speeds were 10 mph or greater than those previously used for revenue service and if the necessary sight distance was inhibited. Private crossings, which are obviously very low traffic, were not flagged or barricaded, but the permittee was notified. The crossing lists included in **Appendix A** outline the crossings that were protected.

2.6 WAYSIDE TEST INSTRUMENTATION

The initial series of tests for the effect of increased cant deficiencies was made on a set of two test curves on the Seattle - Blaine segment of the corridor, curve #74 (~ 5 degrees) and curve #76 (~ 3 degrees). These two curves, located within two miles of each other, allowed for a single test run to cover both curves.

A third curve, curve #34 (~ 5 degrees) on the Seattle - Portland segment near Puyallup WA, was instrumented in order to evaluate current traffic (current traffic was measured at the other test sites as well). This site was also used during the full corridor test runs to measure the test train loadings at the increased cant deficiency levels.

The three test curves were instrumented, using wayside mounted lateral and vertical force instrumentation to measure Lateral force (L), Vertical force (V), and the L/V ratio, a key safety indicator, as each axle of the trainset passed by. Each of the test curves were instrumented at two locations, one location being in the spiral of the curve and the other being in the body of the curve, to measure L and V on both the high and low rails. For each of the cited test curves, the following instrumentation was used:

- Lateral force strain gage measurement arrays, comprised of 4 CEA-Series type strain gages; 1 array mounted on each rail in both the spiral and the body of the curve for a total of 4 arrays
- Vertical force strain gage measurement arrays, comprised of 8 CEA-Series type strain gages; 1 array mounted on each rail in both the spiral and the body of the curve for a total of 4 arrays
- Wheel sensors, 1 located before curve, 1 located after curve
- Signal conditioning unit with bridge excitation, signal amplifier, filter, channel multiplexer
- PC computer for triggering, digital recording data storage and display
- 120 VAC portable generator

Upon instrumentation of the curves, the test train performed a series of runs over the two northern test curves, at increasing speeds (and cant deficiencies). The initial baseline runs were made at 3" cant deficiency, corresponding to current operations, with subsequent runs at 4, 5, 6, 7, and 8" of cant deficiency. During these tests, instrumentation onboard the test train (see Section 2.7) measured the lateral and vertical accelerations of the locomotives and the coach car.

2.7 VEHICLE TEST INSTRUMENTATION

Portable ride quality meters, or ridemeters, were used to measure the lateral accelerations of both locomotives and the Talgo coach car. One ridemeter accelerometer box was positioned on the **floor** of the F40PH locomotive cab, along the car's **center-line** near the leading axle of the car (corresponding to the south end of the consist), just forward of the cab bulkhead. The position of this ridemeter is illustrated in **Figure 2.1**. A second ridemeter was positioned in the same manner on the **floor** of the cab of the F59PH locomotive and is shown in **Figure 2.2**. The third ridemeter, provided by Amtrak, was positioned on the **floor** of a Talgo coach car in the passenger compartment, along the car's **center-line** over the leading truck (at the north end of the car), as shown in **Figure 2.3**.

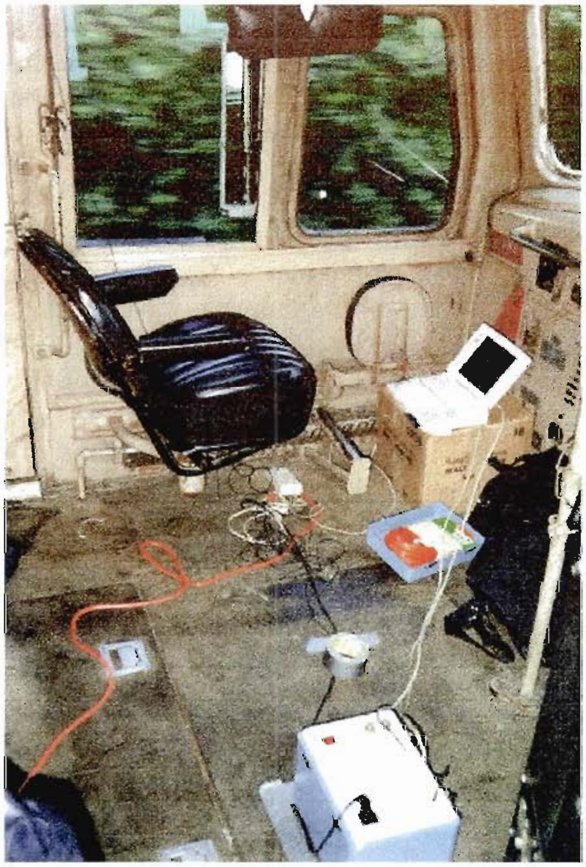

Figure 2.1: Portable Ride Quality Measurement System on F40PH Locomotive

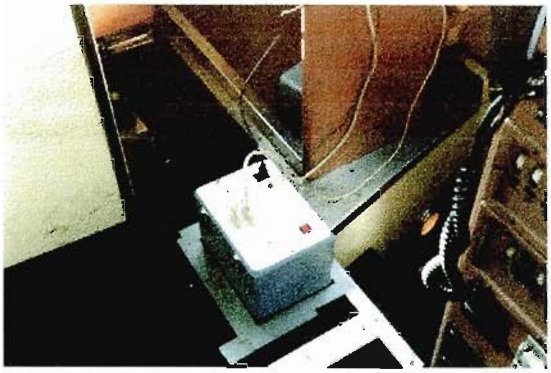

Figure 2.2: Portable Ride Quality Measurement System on F59PH Locomotive

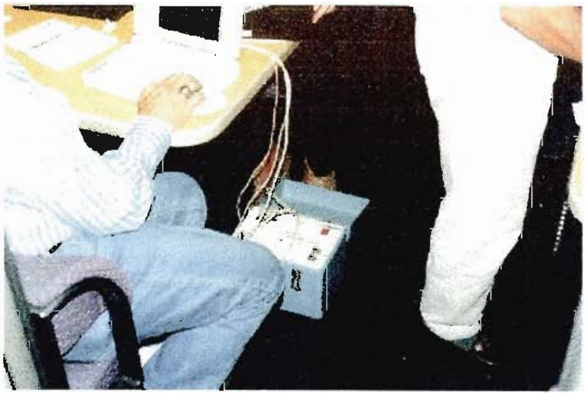

Figure 2.3: Portable Ride Quality Measurement System on Talgo Coach Car

The arrangement of the ridemeters described above was changed for a few of the mainline, or end-to-end, cant deficiency tests. The dampers on one of the coach cars, Car 7, were removed in order to test the effect of the dampers on the tilt angle of the Talgo coach car. The ridemeter located in the F59PH locomotive was moved to this car for 3 of the test runs (these test runs will be identified in Section 4.1). The ridemeter was positioned on the floor over the centerline of the trailing truck (the truck at the south end of the car) and is shown in **Figure 2.4**.

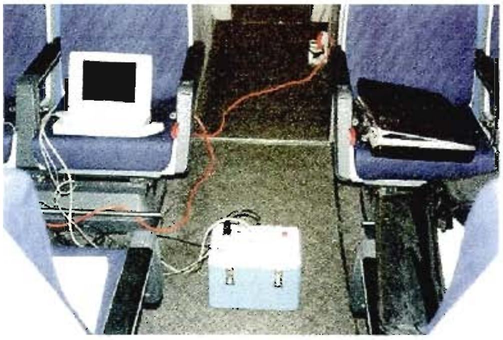

Figure 2.4: Portable Ride Quality Measurement System on Talgo Coach Car With Dampers Removed

The GPS antenna for each ridemeter was placed on the roof of the respective car where satellite information could be received and confirmed; the antenna cable was fed through the observer's window for each locomotive and through the "split" in the bellows between the coach cars. Static calibrations were made to verify correct operation of each ridemeter before and after the test runs.

GPS coordinates for milepost locations on the corridor were compiled from data gathered by the FRA's T10 track inspection vehicle. This data was preserved in a "track milepost coordinates" computer file and placed in each ridemeter to help in the identification of track locations at which acceleration peaks were observed during the test runs. The GPS receiver in each ridemeter provided the moving location (latitude and longitude) of the test consist continuously during each test run.

Each ridemeter was set to digitally sample at a rate of 200 samples per second. The ridemeter was used to digitally record and display the carbody accelerations in real time over the duration of the trip; the ridemeter also recorded and displayed the vehicle location and vehicle speed at which these accelerations were measured. Over the test zone, data recording was done in "blocks". Data collection was suspended at station stops, at times when the test train was stopped or times at which the train was traveling at relatively low speeds.

2.8 SAFETY CONSIDERATIONS

The test director, in consultation with FRA, coordinated with Amtrak and BNSF to include such procedures that ensured safety during the testing. Amtrak and BNSF mutually approved the procedures specified in the Test Plan that included the stop-test criteria, the listing of highway/road crossings and warning devices where speeds of the test train were higher than those used in current revenue service, the statement that the clearance envelope would not be exceeded, and a list of curves that indicated the curve location, degree of curvature, minimum elevation, present speed, and proposed speeds for each level of cant deficiency. FRA's Office of Safety Assurance and Compliance included the Test Plan in its submission to FRA's Safety Board for consideration of approval to conduct the testing.

To assure safety during the tests, the following procedures were followed:

on-board were limited to test personnel from the State DOTs, BNSF, Amtrak, and FRA.

b) Contractor or sub-contractor employees on or near the track for the purposes of installing, monitoring, or removing track-mounted test apparatus or conducting other on-track work in connection with the test, complied with the BNSF on-track safety program in accordance with the FRA's Roadway Worker Protection Rule, 49 CFR 214. In accordance with stipulations of the BNSF Contractor Safety Orientation Program, contractor firms submitted a Safety Action Plan to the BNSF project representative.

c) The test trainset was equipped in the locomotive control compartments with accurate, operable speed indicating devices, confirmed by wayside instrumentation.

d) There was voice communication devices used by the carrier Test Director and test train enginemen that was continuously operative during each test run. In addition, there was voice communication between the Wayside Test Director and the onboard Test Director for the full duration of the wayside tests.

e) Where test and demonstration train speeds exceeded current maximum authorized passenger train speeds, each public and private highway-rail crossing were either equipped with active warning devices that provided a minimum warning time of 20 seconds, or were flagged or barricaded. Each public or private highway-road crossing not equipped with active warning devices were flagged or barricaded when test speeds were 10 mph or greater than those previously used for revenue service and if the necessary sight distance was inhibited. Private crossings which were isolated and obviously subject to very low traffic were not flagged or barricaded, but the permittees were notified.

f) No one boarded or disembarked the test consist without the knowledge of the Test Director except at planned station stops.

g) No one was permitted to work under the test consist unless given authorization by the Test Director and all BNSF/Amtrak safety rules were observed.

h) All persons wore hard hats, safety glasses, steel toe safety shoes and safety vests while on the track.

I) The Amtrak conductor was always the first one off and the last one on when the test consist stopped for instrumentation checks.

2.9 TEST SCHEDULE

The following is a chronological sequence of the events surrounding the test.

- BNSF's geometry car, Car #85, was run over the test zone in May 1997.
- FRA's T-10 geometry car was operated over the test zone between 14 July and 18 July, 1997.
- Instrumentation was installed on curves north of Seattle, Curve #74 and Curve #76, and curve south of Tacoma, WA, Curve #34, during week of 28 July.
- Portable ride quality measurement instrumentation was installed on Talgo test train,

Seattle Station, morning of 5 August.

- Data collection commenced on 5 August (see **Table 2.1** for summary of data collection schedule).
- Instrumentation removed from train, Seattle Station, afternoon of 14 August.

TABLE 2.1: SCHEDULE OF DATA COLLECTION

Date	Target Cant Deficiency	Direction	Depart	Arrive
8/5/97*	0" - 6"	northbound/ southbound	Seattle WA	Seattle WA
8/6/97*	6" - 8"	northbound/ southbound	Seattle WA	Seattle WA
8/7/97	4"	northbound	Seattle WA	Blaine WA
8/7/97	6"	southbound	Blaine WA	Seattle WA
8/11/97	7"	northbound	Seattle WA	Blaine WA
8/11/97	7"	southbound	Blaine WA	Seattle WA
8/12/97	4"	northbound	Seattle WA	Portland OR
8/12/97	6"	southbound	Portland OR	Seattle WA
8/13/97	7"	southbound	Seattle WA	Portland OR
8/13/97	8"	northbound	Portland OR	Seattle WA
8/14/97	8"	northbound	Seattle WA	Bellingham WA
8/14/97	7 1/2"	southbound	Bellingham WA	Seattle WA

* Test runs on this date consisted of multiple "back and forth" runs through test curves north of Seattle

3.0 SPECIAL CURVE TESTS

Volume II of this report details the collection and analysis of wayside force measurements taken for the Talgo trainset as well as for other typical revenue service equipment. Results presented in this section pertain to those directly related to safety issues.

Test curves were selected to evaluate the impact of high cant deficiency operation on track loading and to provide initial evaluation of safety of operation prior to full scale corridor tests. Curves most suitable for track force measurement instrumentation were identified, and two (2) curves on the northern segment of the corridor (Seattle - Blaine) were selected for special curve tests. A third curve was also selected on the southern segment of the corridor (Portland - Seattle) to examine loading generated by existing traffic and by the Talgo trainset during the full corridor cant deficiency tests.

The test curve sites were selected based on the following criteria:

- a required combination of curvature between 3 and 5 degrees, superelevation in the range of 3 to 5 inches, and suitable approach conditions to achieve cant deficiencies of 8 inches for vehicle speeds under 79 mph;
- representative track conditions and geometry for the BNSF Northwest Corridor;
- accessibility to both curve body and spiral site locations, with the spiral instrumentation typically located south of the curve body;
- corridor location involving a traffic mix of required types, including freight trains and regular Amtrak traffic.

Three test locations were chosen, with two north of Seattle, in the Mt. Vernon area, and one location south of Seattle, between Puyallup and Tacoma. The test site characteristics are given (from North to South) in **Table 3.1.**

TABLE 3.1: SELECTED TEST CURVES FOR WAYSIDE INSTRUMENTATION

Curve No.	MP	Location	Curvature	Super-Elevation	Present Speed	Comments
76	76.5	Seattle-Blaine, ~18 miles south of Bellingham	3° 3' 3.05°	5.02"	60 mph	single track
74	74.5	Seattle-Blaine, ~20 miles south of Bellingham	5° 6' 5.1°	4.30"	45 mph	good access, single track, curvature/ crosslevel taken from latest T10 surveys 970715, 970716, 7/16/97
34	34.6X	Seattle-Portland, between Puyallup and Tacoma	4° 12' 4.2°	3.94"	47 mph	good access, double track, wayside instrumentation on northbound track #2, curvature/crosslevel taken from T10 surveys 970714, 7/14/97

Of the curves selected for wayside instrumentation, special test runs were made over the two test curves, #74 and #76, on the Seattle - Blaine corridor. These curves were within two miles of each other and allowed for a single test run to cover both sets of sites. The geographical layout of these two curves is shown to the right in **Figure 3.1a** using GPS data gathered by the ridemeters during the special tests. The wayside force measurement locations in these curves are shown in **Figures 3.1b,c**.

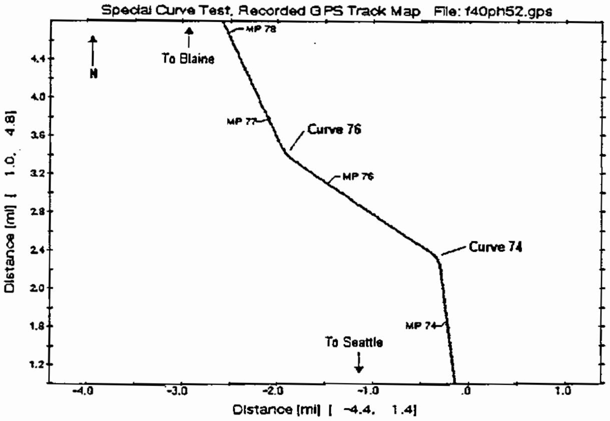

Figure 3.1a: Location of Test Curves

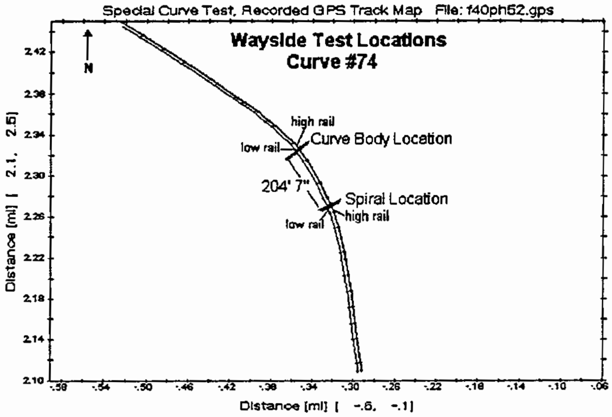

Figure 3.1b: Location of Wayside Force Measurements, Curve #74

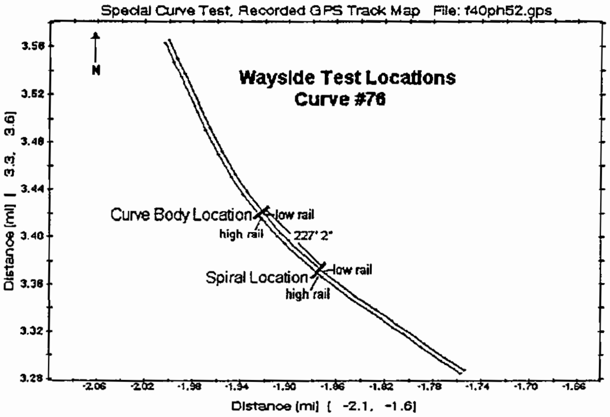

Figure 3.1c: Location of Wayside Force Measurements, Curve #76

The Talgo trainset configuration for these special curve tests is shown in **Figure 3.2**, with a single locomotive at each end of the consist. During northbound test runs (curve #74 followed by curve #76), the F59PH locomotive led the consist; during southbound runs (curve #76 followed by curve #74), the F40PH locomotive was the leading vehicle. For each test run, there were 22 axles which passed each wayside instrumented test site.

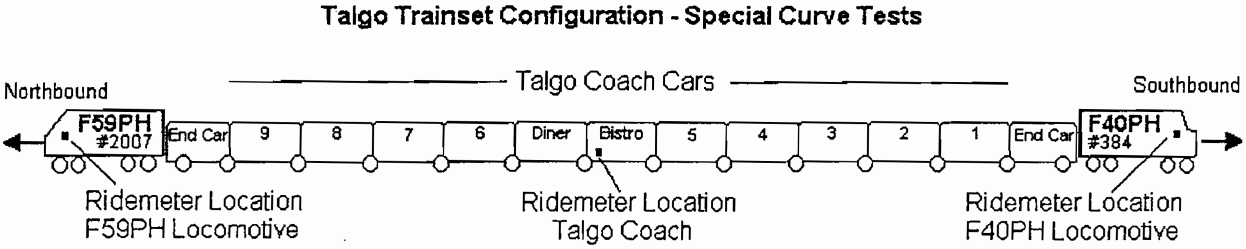

Figure 3.2: Configuration of Trainset Used in Special Curve Tests

During a two day period, the test train performed a series of runs over the test curves, at increasing speeds and cant deficiencies as shown in the table below.

TABLE 3.2: SUMMARY OF RUNS OVER TEST CURVES

Date	Direction	Speed Through Curve #74 (mph)	Speed Through Curve #76 (mph)	Intended Cant Deficiency	Average Cant Deficiency Through Curve #74	Average Cant Deficiency Through Curve #76
8/5/97	N	34	48	0	-0.1	0.3
8/5/97	S	44	60	3	2.5	2.6
8/5/97	N	44	60	3	3.1	2.7
8/5/97	S	47	63	4	4.3	3.2
8/5/97	N	47	63	4	3.3	3.4
8/5/97	S	51	67	5	4.6	3.4
8/5/97	N	51	67	5	4.9	4.8
8/5/97	S	51	67	5	5.2	5.0
8/5/97	N	53	70	6	5.9	4.6
8/5/97	S	53	70	6	6.1	5.4
8/5/97	N	53	70	6	5.0	4.9
8/5/97	S	53	70	6	5.8	5.0
8/6/97	N	53	70	6	5.5	5.3
8/6/97	S	53	70	6	6.0	5.7
8/6/97	N	56	73	7	7.0	6.6
8/6/97	S	56	73	7	7.1	6.1
8/6/97	N	56	73	7	6.9	6.4
8/6/97	S	56	73	7	6.9	5.9
8/6/97	N	56	73	7	6.7	6.2
8/6/97	S	56	73	7	7.0	5.3
8/6/97	N	56	73	7	7.3	6.1
8/6/97	S	58	75	8	8.1	6.6
8/6/97	N	58	75	8	7.0	6.5
8/6/97	S	58	75	8	7.6	6.2

Lateral accelerations on the carbodies of the Talgo coach car, F40PH locomotive, and F59PH locomotive were recorded during each test run. Since the track curvature and superelevation of curves #74 and #76 were well known, cant deficiency was calculated based on the measured vehicle speed within each curve as follows:

$$U = \frac{v^2}{1451.21}D - E$$

U = *cant deficiency* [*inches*]
v = *forward speed* [*mph*]
D = *track curvature* [°]
E = *track superelevation* [*inches*]

The values used in determining cant deficiency are given in **Table 3.3**.

TABLE 3.3: CURVE MEASUREMENTS FOR TEST CURVES #74 AND #76

Survey/Measurement	Curve #74		Curve #76	
	Avg Curvature	Avg Crosslevel	Avg Curvature	Avg Crosslevel
T10 Survey #970715, 7/15/97	-5°5' -5.08°	-4.26"	+3°3' +3.05°	+5.04"
T10 Survey #970716, 7/16/97	+5°6' +5.10°	+4.33"	-3°2 '-3.03°	-5.00"
Hand measurement, point location	4.875°	4.0"	3.25°	5.125"
Values used for cant deficiency	5.1°	4.3"	3.05°	5.02"

3.1 WAYSIDE TEST RESULTS

Wayside strain gage instrumentation recorded the dynamic lateral and vertical force components reacted by each rail at point locations in the spiral and body of curves #74 and #76 as each wheel of the Talgo trainset passed by. A typical measurement made at the spiral location in curve #76 on the high rail as the train traveled southbound is shown in **Figure 3.3**. Lateral and vertical force peaks are observed as each wheel, in turn, of the leading F40PH locomotive passes the measurement location followed by the wheels of the Talgo coach cars (only 5 of the 14 Talgo wheels are shown).

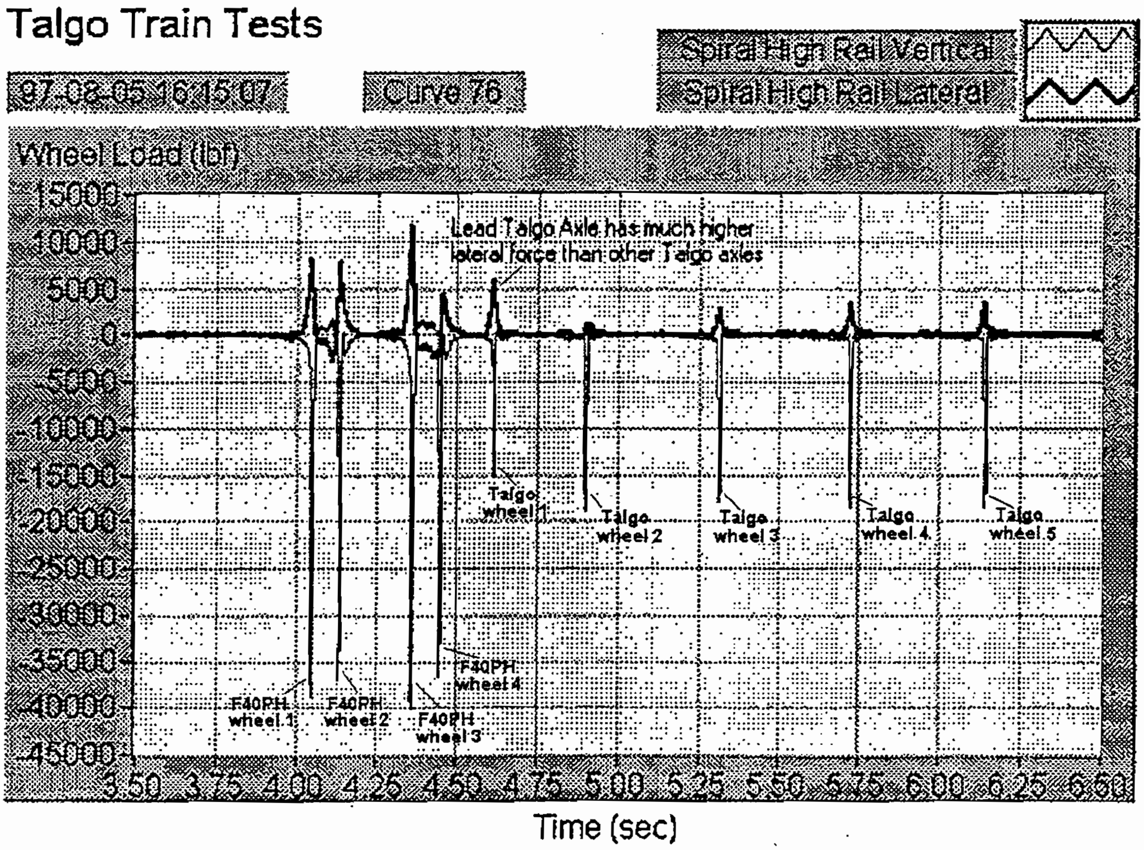

Figure 3.3: Wayside Force Measurement Trace, Spiral Location, Curve #76

For each wheel of the train, attention was paid to the levels of dynamic lateral force, L, exerted on each rail, and on the decrease in vertical load, V, on the low rail (wheel unloading) as cant deficiency increased. L/V ratios for each wheel on each rail were also determined at the measurement locations. The extreme values measured during all special curve tests at the 4 instrumented locations in curves #74 and #76 are given in **Table 3.4**.

TABLE 3.4: SUMMARY OF WAYSIDE FORCE MEASUREMENTS OVER TEST CURVES

Vehicle	Parameter	Value	Average Cant Deficiency	Track Location	Wheel Location	Direction of travel
Talgo	V min	8,610 lbs [~51% unloading]	6.2"	low rail, curve #76	between diner & bistro cars	south
	L max	10,268 lbs	6.8"	high rail, curve #74	between cars 4 & 5	north
	L/V max	0.59	5.7	low rail, curve #76	trailing end car adjacent F59PH	south
F40PH	V min	14,782 lbs [~58% unloading]	7.6"	low rail, curve #74	trailing axle adjacent end car	south
	L max	14,965 lbs	6.4"	high rail, spiral, curve #76	axle 3, leading locomotive	south
	L/V max	0.51	5.4"	low rail, spiral, curve #76	leading axle	south
F59PH	V min	14,455 lbs [~59% unloading]	6.1"	low rail, curve #76	leading axle	north
	L max	18,860 lbs	5.3"	high rail, curve #74	leading axle	north
	L/V max	0.53	7.6"	low rail, curve #74	axle 2, trailing locomotive	south

The lateral forces measured at each wheel and the wheel L/V ratios did not exhibit strong trends as a function of cant deficiency. For all test runs, at cant deficiencies up to 8 inches, values remained well within acceptable limits for each vehicle.

The vertical load transfer from the low rail wheels to the high rail wheels for each vehicle was examined as a function of cant deficiency to assess the wheel unloading and overturning characteristics. In **Figure 3.4**, the vertical force measurements averaged over 10 wheels under the Talgo coach cars on the high rail and on the low rail respectively from both curves #74 and #76 have been plotted as a function of cant deficiency. The average of the high and low rail values have also been plotted to indicate the nominal wheel loads under static level conditions. The trends show the low rail wheels unloading from a nominal value of about 17,000 lb to a value of about 9,000 lb at 8 inches cant deficiency, which corresponds to a wheel unloading of about 47%.

A similar plot is presented for the F40PH locomotive in **Figure 3.5**, taking the average of the vertical force measurements for the 4 wheels on the high and low rails respectively. The trends show the low rail wheels unloading from a nominal value of 35,000 lb to a value of about 15,500 lb at 8 inches cant deficiency, corresponding to a wheel unloading of about 56%. Similar results are obtained for the F59PH locomotive, shown in **Figure 3.6**.

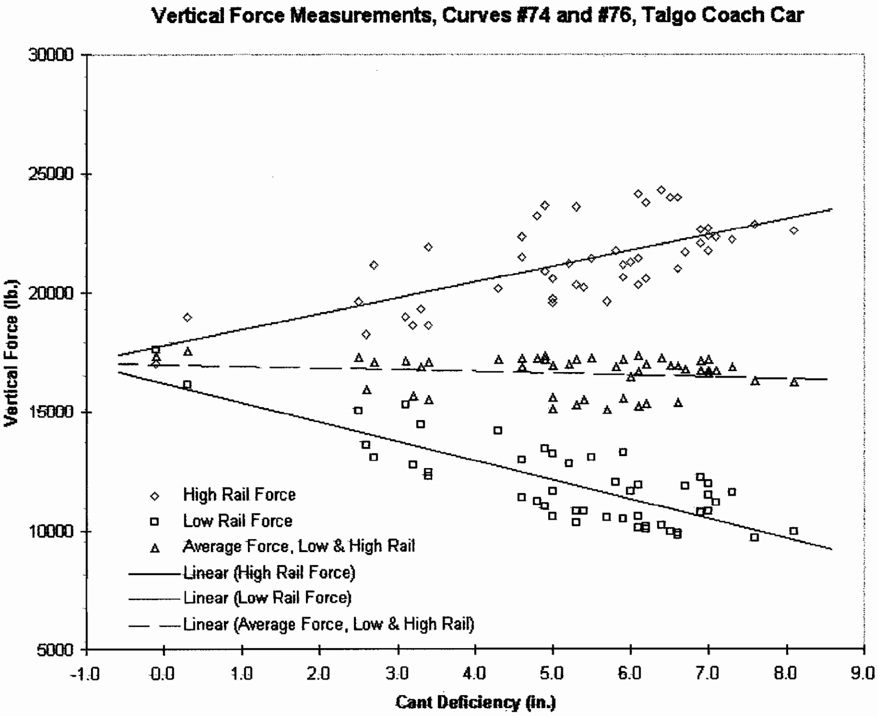

Figure 3.4: Vertical Load Transfer, Talgo Coach Car

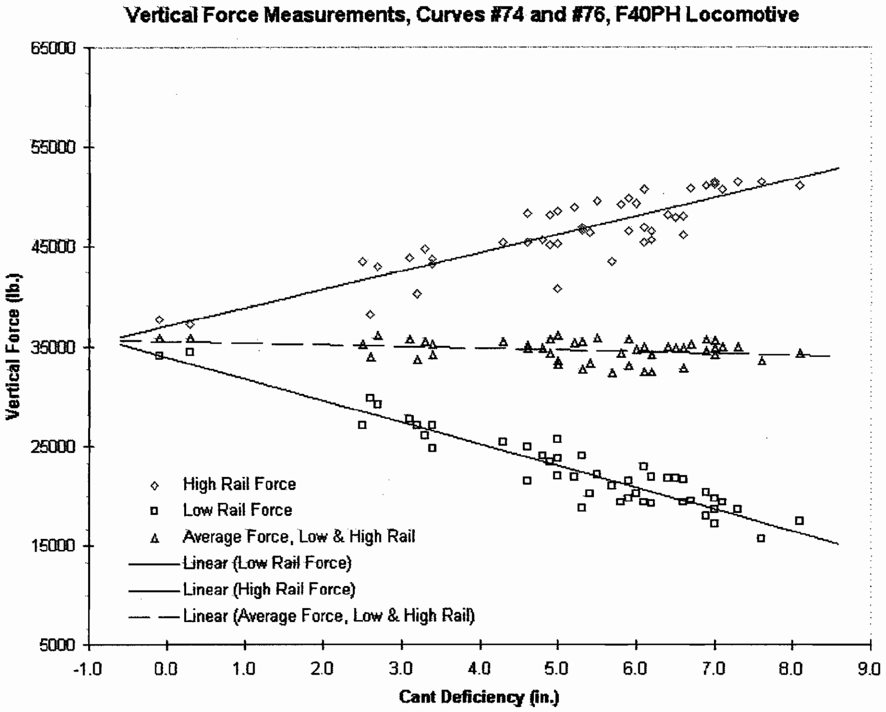

Figure 3.5: Vertical Load Transfer, F40PH Locomotive

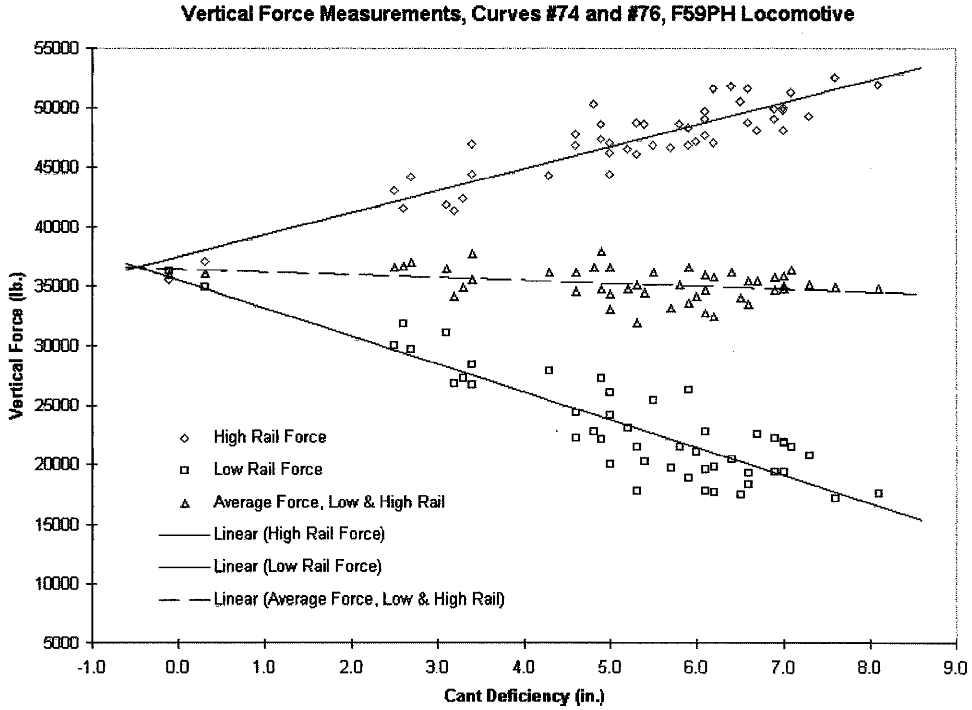

Figure 3.6: Vertical Load Transfer, F59PH Locomotive

3.2 ONBOARD ACCELERATION TEST RESULTS, TALGO COACH CAR

For each test run, the steady-state and peak lateral accelerations measured on the floor of the Talgo coach car while in the full body of curves #74 and #76 are plotted in **Figures 3.7a,b** as a function of average cant deficiency.

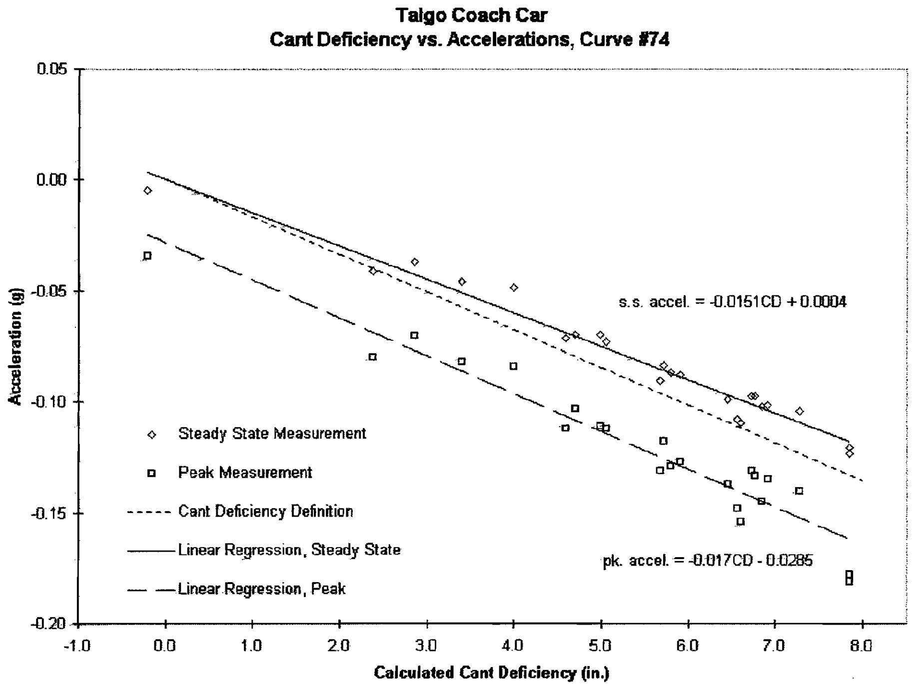

Figure 3.7a: Lateral Accelerations in Curve #74, Talgo Coach Car

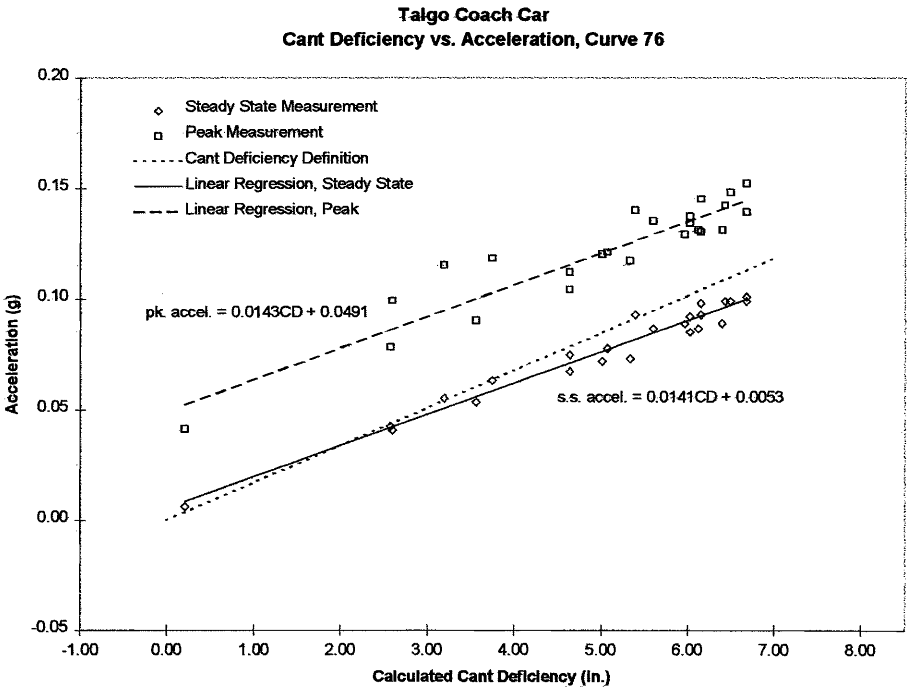

Figure 3.7b: Lateral Accelerations in Curve #76, Talgo Coach Car

Cant deficiency in each case is calculated using the measured vehicle speed from the ridemeter data at the time and location where the steady-state and peak lateral accelerations were measured. A linear regression (best-fit) line has been placed through both the steady-state and peak acceleration data to establish the trends as cant deficiency increases. Note that curves #74 and #76 are in opposite sense (left and right curves), such that the measured lateral accelerations as cant deficiency increases are opposite in sign.

In both curves, the scatter of data about the regression line for the measured steady-state accelerations is small, as expected. The steady-state lateral acceleration experienced on the floor of any vehicle is directly related to the average cant deficiency and can be used as a measure of cant deficiency if the tilt of the carbody with respect to the plane of the rails is known. Moreover, the steady-state test results derived at one curve can be applied to all curves if expressed as functions of cant deficiency. For the Talgo coach car, this is confirmed in that the increase in steady-state lateral acceleration with cant deficiency is very nearly the same for curves #74 and #76. In both curves, the maximum steady-state lateral acceleration on the floor of the coach car approaches a magnitude of 0.13g at 8 inches cant deficiency.

The peak or transient measurements are the extremes which can result from the effects of vehicle dynamics and track perturbations superimposed on the steady state measurements. The peak measurements depend on track geometry and are unique to each curve. In addition, there is more scatter of data about the regression line for peak accelerations versus cant deficiency because of the vehicle dynamics. For the Talgo coach car, the scatter is more evident in curve #76, giving some indication that this curve may have a higher content of track geometry perturbations than curve #74. Peak accelerations measured in either curve did not exceed a magnitude of 0.18g for the Talgo coach.

Also shown in each figure is a dotted line derived from the definition of average cant deficiency, that being the steady-state lateral acceleration that would be measured on the axle of any vehicle (in the plane of the rails) for a given cant deficiency. Cant deficiency, by definition, is the amount of crosslevel or superelevation that must be added in order to exactly balance the lateral acceleration produced in the plane of the rails when curving by an opposite component of gravitational acceleration. The difference between the steady-state lateral acceleration measured on the body floor of the Talgo coach at a given cant deficiency and that which would be measured on the axle (the definition of cant deficiency) is due to the tilt or roll of the coach body with respect to the axle.

For the Talgo coach, at any cant deficiency, the magnitude of the steady-state lateral acceleration measured on the coach floor is always less than that on the axle (the dotted line). This indicates that the body has tilted into the curve, as designed, such that a higher component of gravitational acceleration has been subtracted from the curving acceleration. For each point, the difference between the measured steady-state acceleration and the dotted line is a measure of the body tilt. The body tilt angle for each test run in each curve as determined from this difference is plotted as a function of cant deficiency in **Figure 3.8**. As noted, the Talgo coach body tilts or leans into the curve in each case.

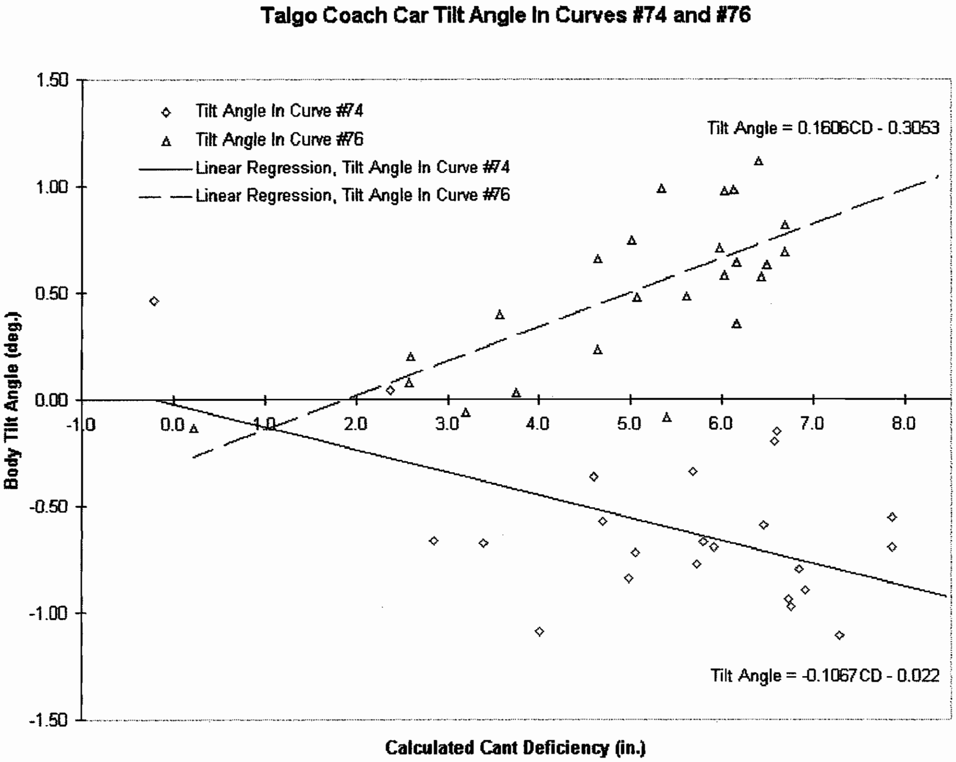

Figure 3.8: Carbody Tilt Angle versus Cant Deficiency, Talgo Coach Car

The scatter in the data results from the measurement accuracy for small tilt angles; a 0.01g difference between the measured acceleration on the coach floor and that expected on the axle by definition corresponds to a tilt angle of 0.57 degrees. A linear regression (best-fit) line is shown for each direction of tilt (the coach tilts in the opposite sense for curves #74 and #76) to indicate the trend of tilt angle as cant deficiency increases. The maximum tilt angle determined for the Talgo coach car in any test run was 1.2 degrees.

For all cant deficiencies, the magnitude of body tilt was lower than expected. The safety limits established for steady-state and transient lateral accelerations measured on the coach floor were computed with correction factors applied that were based on higher body tilt angles for a given cant deficiency. As a result of these special curve tests, the safety limits were re-evaluated as discussed in the following sections.

3.2.1 Re-Evaluation of Acceleration Safety Limits for the Talgo Coach Car

The suspension movements of the passive-tilt Talgo coach, like a conventional coach car, are driven by the inertial body forces, and the floor accelerometer measurements can be used to indicate vertical load transfer. Unlike the conventional car, however, the steady- state lateral acceleration at the floor of the Talgo is less than at the axle because the gravitational offset due to the body tilt opposes the lateral acceleration of curving as shown in **Figure 3.9.**

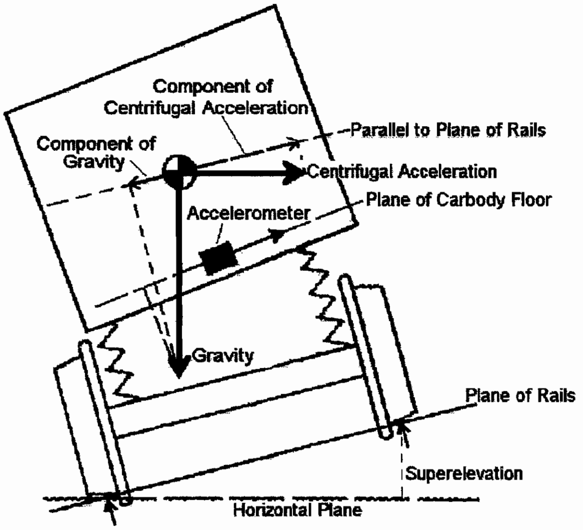

Figure 3.9: Measurement of Accelerations on a Curving Vehicle

The relationship between load transfer and carbody lateral acceleration for the Talgo coach was developed based on static lean measurements and computations provided by the manufacturer[3]. Calculations showed that, for a Talgo coach car loaded to 50% of its capacity, the steady-state safety limit criterion of 60% wheel unloading, in the presence of a 56 mph sidewind, would be reached at a cant deficiency of 8.1 inches. At this cant deficiency, by definition, the steady-state lateral acceleration measured in the plane of the rails (on the axle) would be 0.137 g. These calculations were based on manufacturer's data that indicated that the carbody tilt angle relative to the axle (plane of the rails) at a cant deficiency of 8.1 inches would be about 2.4 degrees. If the carbody had tilted 2.4 degrees, the steady-state lateral acceleration measured on the carbody floor would have been less by an amount equal to the sine of the tilt angle (= 0.041 g), or, 0.137 - 0.041 = 0.10 g.

As noted in **Figure 3.8**, the tilt angle of the Talgo coach under test, as determined from the steady-state lateral acceleration measurements, never exceeded 1.2 degrees at cant deficiencies up to 8 inches. That is, the magnitude of tilt angle in the tested condition reached only one-half of the expected value. The specific explanation for the reduced tilt is unclear, but the suspension characteristics of the coach car under test were clearly different from those used to determine the safety limits. The reduced magnitude of tilt for a given cant deficiency has a two-fold effect on the acceleration measurement used to indicate the vehicle safety from overturn. The first is that, if the body does not swing as far towards the outside of the curve, the center of gravity of the body remains closer to the center of the rails, and thus the wheel unloading on the inside rail wheels is reduced. In effect, a higher cant deficiency can be accommodated before the wheel unloading reaches the steady-state criterion. The second effect is that, if the acceleration measurement is made on the carbody floor (in the plane of the floor), a higher lateral acceleration will be measured for the same cant deficiency if the tilt angle is less. This is the same effect as that experienced by passengers; the higher the tilt angle for a given cant deficiency, the lower the lateral acceleration felt by the passenger.

Using the above information, the acceleration safety limits for the Talgo coach car used in the corridor tests were re-calculated. For a Talgo car loaded to 50% of its capacity, the steady-state safety limit criterion of 60% wheel unloading, in the presence of a 56 mph sidewind, would be reached at a cant deficiency of 9.8 inches. At this cant deficiency, by definition, the steady-state lateral acceleration measured in the plane of the rails (on the axle) would be 0.166 g. If the carbody tilts 1.4 degrees at this cant deficiency, the steady-state lateral

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[3] *Cant Deficiency Test Safety Monitoring Using Accelerometer Measurements*, Rep. No. DOT-FRA/ORD-89/05, prepared for FRA ORD by ENSCO, P. Boyd, August 1989.

acceleration measured on the carbody floor would have been less by an amount equal to the sine of the tilt angle (= 0.024 g), or, 0.166 - 0.024 = 0.14 g. Thus, the safety limit for steady-state lateral acceleration measured on the floor of the Talgo coach car which would indicate 60% wheel unloading was adjusted to be 0.14 g. In a similar fashion, the safety limit for transient lateral accelerations measured on the floor of the Talgo coach car was determined to be 0.21 g.

3.3 ONBOARD ACCELERATION TEST RESULTS, F40PH LOCOMOTIVE

The lateral accelerations measured on the cab floor of the F40PH locomotive in curves #74 and #76 as cant deficiency was increased are plotted in **Figures 3.10a,b**. The steady-state lateral acceleration (average over at least 2 seconds duration) and the peak lateral acceleration measured in each test run for each curve are shown. Trend lines have been drawn through the steady-state and peak values respectively.

In both special test curves, the scatter of data about the trend line for the measured steady-state accelerations is small. The increase in steady-state lateral acceleration with cant deficiency is very nearly the same for curves #74 and #76. In both curves, the maximum steady-state lateral acceleration on the cab floor of the F40PH locomotive approaches a magnitude of 0.175 g at 8 inches cant deficiency.

The peak or transient measurements are the extremes which can result from the effects of vehicle dynamics and track perturbations superimposed on the steady state measurements. The scatter of these peak measurements about the trend lines is much greater. For the F40-PH locomotive, the scatter is more evident in curve #76, again giving an indication that this curve may have a higher content of track geometry perturbations than curve #74. Peak accelerations measured in curve #76 reached magnitudes of 0.3g for the F40PH locomotive.

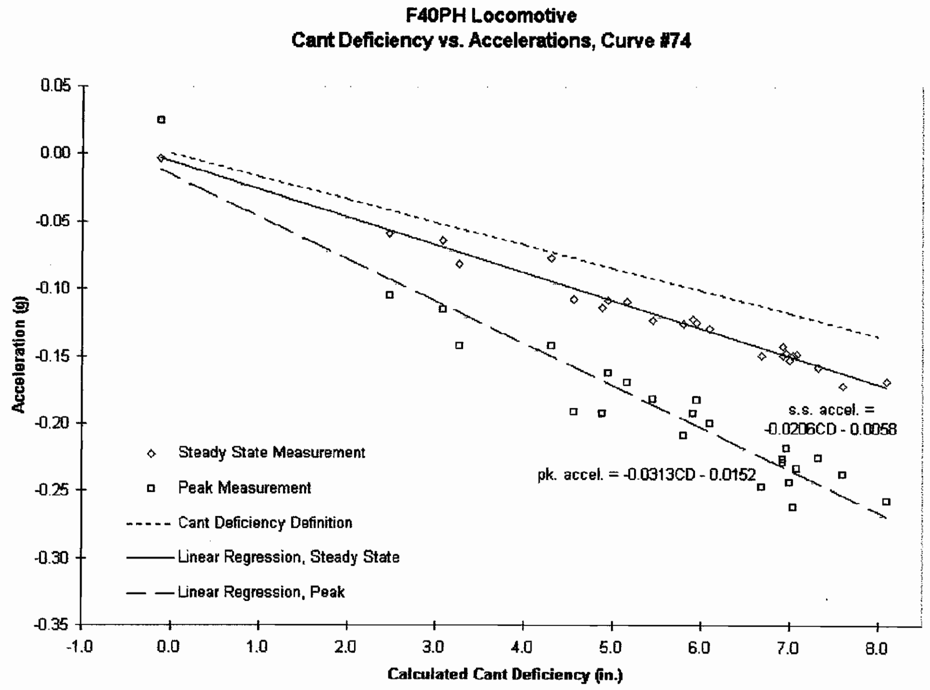


Figure 3.10a: Lateral Acceleration in Curve #74, F40PH Locomotive

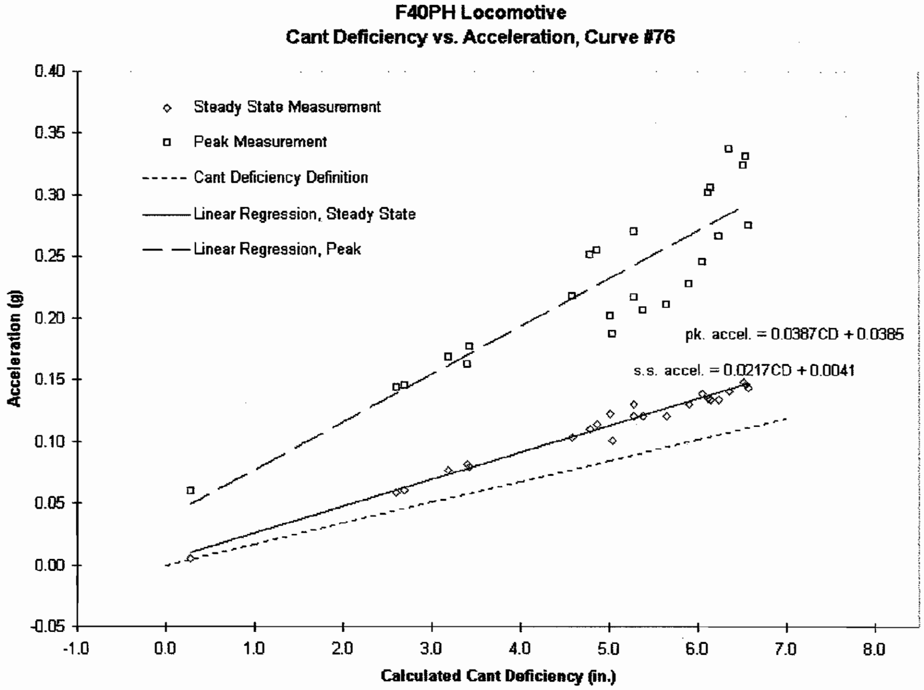


Figure 3.10b: Lateral Acceleration in Curve #76, F40PH Locomotive

Also shown on each plot by a dotted line is the definition of cant deficiency, which is the amount of superelevation or crosslevel that would have had to be added in order to balance the lateral forces or accelerations in the plane of the rails (on the axle). By definition, there is a one-to-one relationship between the unbalanced lateral acceleration that would have been measured on the axle "in the plane of the rails" and cant deficiency. The difference between the steady-state lateral acceleration measured on the cab floor of the F40PH locomotive at a given cant deficiency and that which would be measured on the axle is due to the roll of the carbody on its suspension with respect to the axle.

For the locomotive, at any cant deficiency, the level of steady-state lateral acceleration measured on the cab floor is always higher than the level that would have been measured on the axle in the plane of the rails (the dotted line). This indicates that the carbody has rolled towards the outside of the curve such that a lower component of gravitational acceleration has been subtracted from the curving acceleration. For each point, the difference between the measured steady-state acceleration and the dotted line is a measure of the body roll. The body roll for each test run in each curve as determined from this difference is plotted as a function of cant deficiency in **Figure 3.11**. The maximum roll angle determined for the F40PH carbody was 2.5 degrees. This roll angle is slightly higher than that used to compute the safety limits for steady-state and transient lateral accelerations measured on the cab floor. As a result of these special curve tests, the safety limits were re-evaluated as discussed in the following sections.

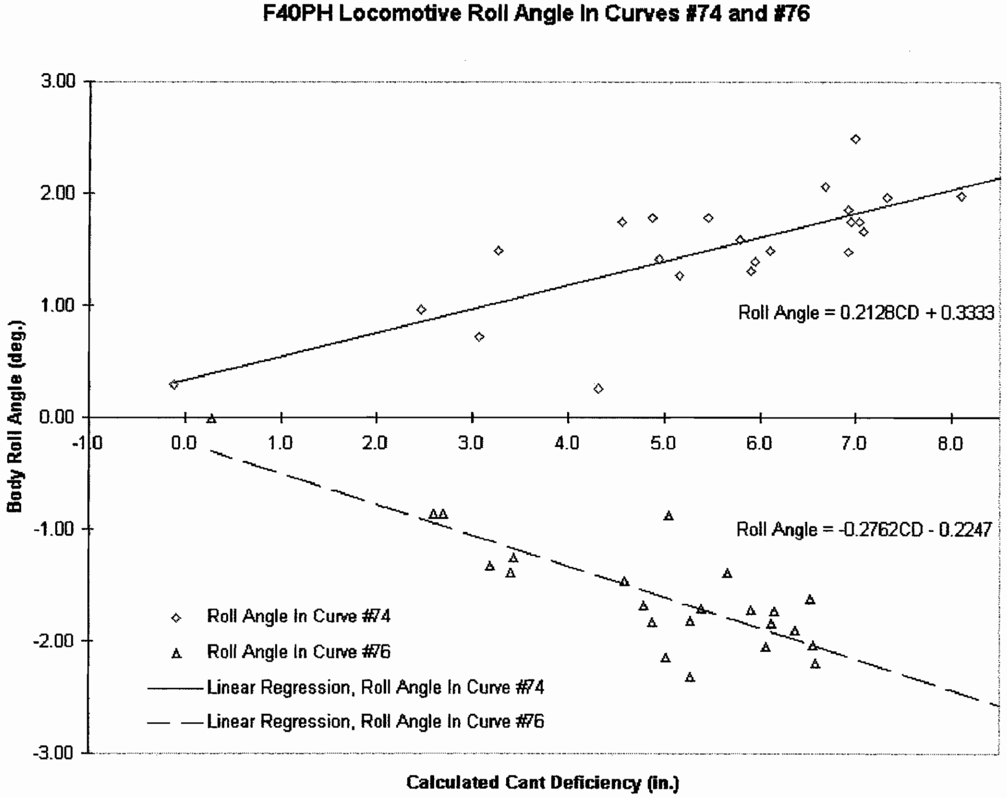


Figure 3.11: Carbody Roll Angle versus Cant Deficiency, F40PH Locomotive

3.3.1 Re-Evaluation of Acceleration Safety Limits for the F40PH Locomotive

The relationship between load transfer and carbody lateral acceleration for the F40PH locomotive was determined from tests using instrumented wheelsets. Results showed that the steady-state safety limit criterion of 60% wheel unloading, in the presence of a 56 mph sidewind, would be reached at a cant deficiency of 9.5 inches. At this cant deficiency, by definition, the steady-state lateral acceleration measured in the plane of the rails (on the axle) would be 0.16 g. The roll angle of the locomotive carbody on its suspension at this cant deficiency was determined to be nominally 2 degrees. Hence, the steady-state lateral acceleration measured on the cab floor would have been greater by an amount equal to the sine of the roll angle (= 0.03 g), or, 0.160 + 0.03 = 0.19 g.

Since the measured roll angle determined from the special curve tests was nominally 2.5 degrees at a cant deficiency of 8 inches, a correction was applied to the limits to account for the slight increase in roll angle. The safety limit for steady-state lateral acceleration measured on the cab floor of the F40PH locomotive was determined to be 0.20 g. In a similar computation, the safety limit for transient lateral accelerations measured on the floor of the F40PH locomotive was determined to be 0.32 g.

3.4 ONBOARD ACCELERATION TEST RESULTS, F59PH LOCOMOTIVE

The lateral accelerations measured on the cab floor of the F59PH locomotive in curves #74 and #76 as cant deficiency was increased are plotted in **Figures 3.12a,b.** The steady-state lateral acceleration (average over at least 2 seconds duration) and the peak lateral acceleration measured in each test run for each curve are shown. Trend lines have been drawn through the steady-state and peak values respectively.

In both special test curves, the scatter of data about the trend line for the measured steady-state accelerations is small. The increase in steady-state lateral acceleration with cant deficiency is very nearly the same for curves #74 and #76. In both curves, the maximum steady-state lateral acceleration on the cab floor of the F59PH locomotive approaches a magnitude of 0.185 g at 8 inches cant deficiency.

As was the seen in the results from the tests done on the F40PH locomotive, the peak or transient measurements display more scatter in the measurements made in curve #76 than that seen in the results from curve #74. Again this gives an indication that curve #76 may have a higher content of track geometry perturbations than curve #74. Peak accelerations measured in curve #76 reached magnitudes of 0.31g for the F59PH locomotive.

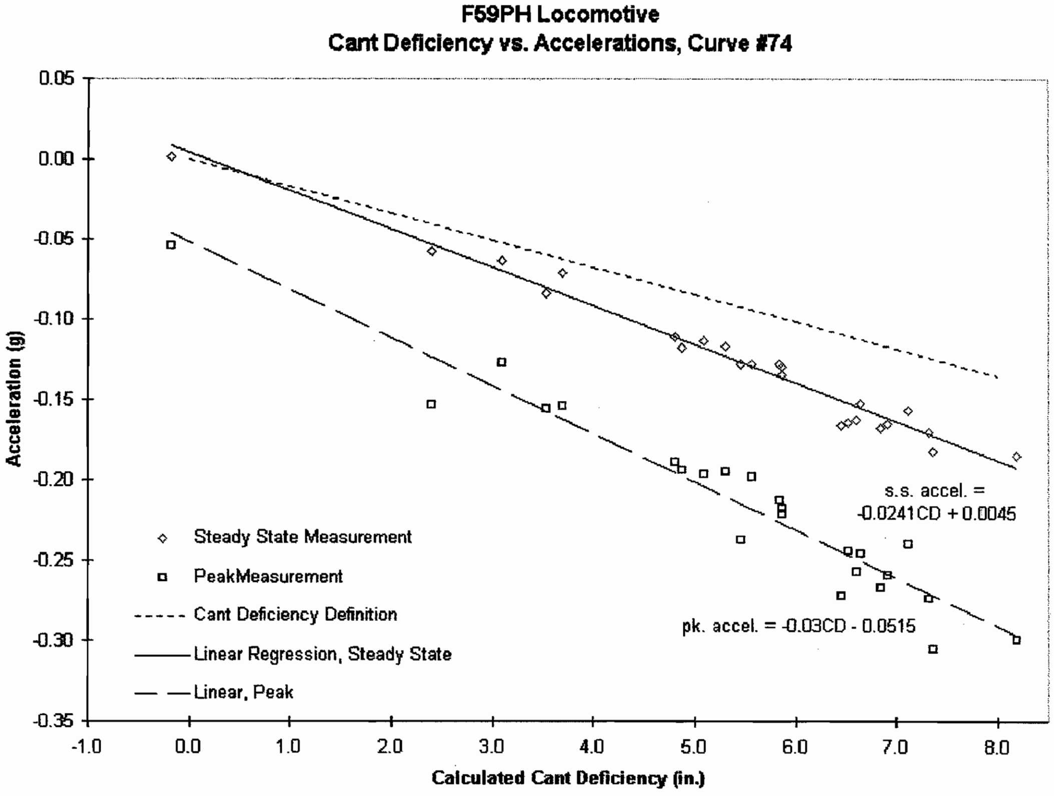


Figure 3.12a: Lateral Acceleration in Curve #74, F59PH Locomotive

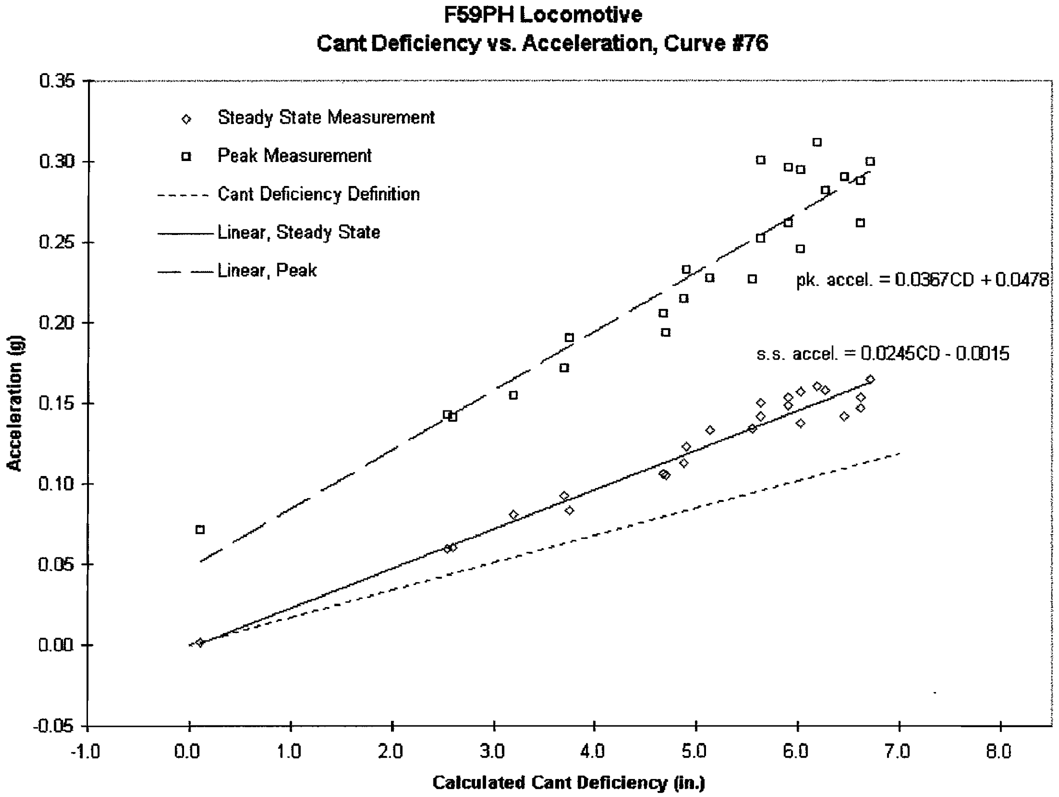


Figure 3.12b: Lateral Acceleration in Curve #76, F59PH Locomotive

As was done with the results of the F40PH locomotive, shown on each plot by a dotted line is the definition of cant deficiency. The difference between the steady-state lateral acceleration measured on the cab floor of the F59PH locomotive at a given cant deficiency and that which would be measured on the axle is due to the roll of the carbody on its suspension with respect to the axle. For the locomotive, at any cant deficiency, the level of steady-state lateral acceleration measured on the cab floor is always higher than the level that would have been measured on the axle in the plane of the rails (the dotted line). This indicates that the carbody has rolled towards the outside of the curve as was seen with the F40PH locomotive. The body roll for each test run in each curve as determined from this difference is plotted as a function of cant deficiency in **Figure 3.13.** The maximum roll angle determined for the F59PH carbody was 3.3 degrees. This roll angle is slightly higher than that used to compute the safety limits for steady-state and transient lateral accelerations measured on the cab floor. As a result of these special curve tests, the safety limits for the F59PH locomotive were re-evaluated as well.

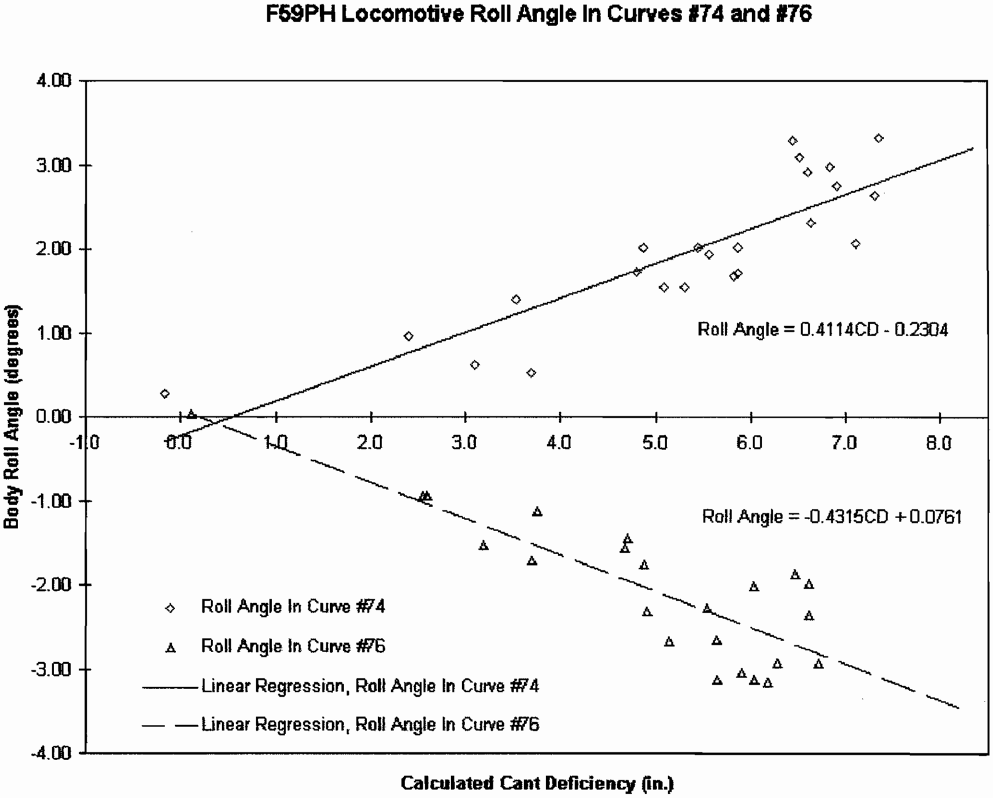


Figure 3.13: Carbody Roll Angle versus Cant Deficiency, F59PH Locomotive

3.4.1 Re-Evaluation of Acceleration Safety Limits for the F59PH Locomotive

Even though the roll angles determined for the locomotives were different, the result of their determination are the same.

The measured roll angle determined from the special curve tests was slightly higher than that found during previous tests. As was done in the case of the F40PH locomotive, a correction was applied to the limits to account for the slight increase in roll angle. The safety limit for steady-state lateral acceleration measured on the cab floor of the F59PH locomotive was determined to be 0.20 g. In a similar computation, the safety limit for transient lateral accelerations measured on the floor of the F59PH locomotive was determined to be 0.32 g.

3.5 SUMMARY OF ACCELERATION SAFETY LIMITS

After a re-evaluation of the vehicles used in this test program, the safety limits for lateral acceleration measurement on the carbody floor corresponding to the steady-state and transient overturning criteria were modified. These limits are given in **Table 3.5.**

TABLE 3.5: RE-EVALUATED SAFETY LIMITS FOR HIGH CANT DEFICIENCY TESTS

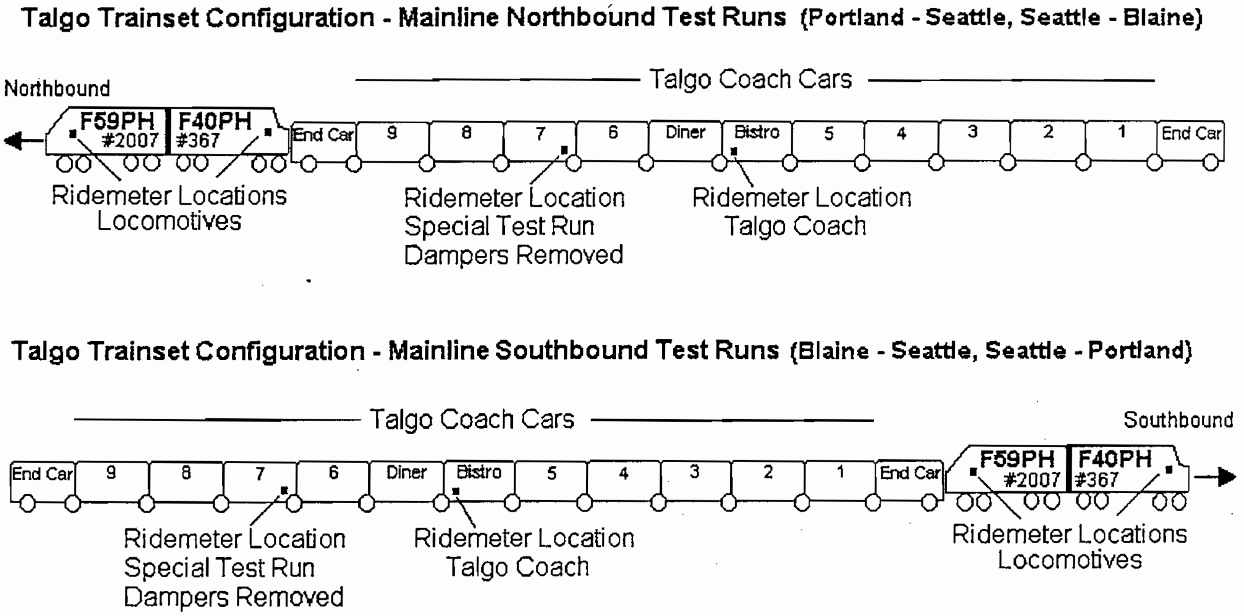
Parameter	Measurement	Talgo Coach	F40PH, F59PH Locomotive
Lateral Acceleration	Steady State	0.14 g	0.20 g
Lateral Acceleration	Zero to Peak	0.21 g	0.32 g

4.0 MAINLINE CANT DEFICIENCY (VEHICLE ACCELERATION) TESTS

A description of the procedures used for the mainline cant deficiency (vehicle acceleration) tests is presented in the following section. Summaries of the test results for the different sections of the test zone are presented in the subsequent sections. The mainline testing comprised a series of runs over the Pacific Northwest Corridor track between Seattle and Blaine and between Seattle and Portland to determine transient performance for a wide variety of track conditions. A transient measurement is the extreme which can result from the effects of vehicle dynamics and track perturbations superimposed on the steady state measurement. The steady state test results derived at one curve (as in Section 3) can be applied to all curves if expressed as functions of cant deficiency. However, transient measurements depend on track geometry and are unique to each curve. A large sample of test curves is required to accurately gauge the range of transient accelerations and forces to be expected.

4.1 TEST PROCEDURES

Figure 4.1 illustrates the two configurations of the test consist used for the mainline cant deficiency tests conducted between 7 August and 14 August.


Talgo Trainset Configuration - Mainline Northbound Test Runs (Portland - Seattle, Seattle - Blaine)

Talgo Trainset Configuration - Mainline Southbound Test Runs (Blaine - Seattle, Seattle - Portland)

Figure 4.1: Configurations of the Talgo Test Consist, Mainline Cant Deficiency Tests

Ridemeters were placed in three vehicles for each mainline test run. The locations of the ridemeters for each test are given in **Table 4.1**.

TABLE 4.1: TEST SCHEDULE WITH INSTRUMENTATION LOCATION

Date	Test	Ridemeter Location
8/7/97	4" Intended Cant Deficiency Seattle WA to Blaine WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car
8/7/97	6" Intended Cant Deficiency Blaine WA to Seattle WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car
8/11/97	7" Intended Cant Deficiency Seattle WA to Blaine WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car
8/11/97	7" Intended Cant Deficiency Blaine WA to Seattle WA	F40PH Locomotive Talgo Bistro Coach Car Talgo Coach Car 7*
8/12/97	4" Intended Cant Deficiency Seattle WA to Portland WA	F40PH Locomotive Talgo Bistro Coach Car Talgo Coach Car 7
8/12/97	6" Intended Cant Deficiency Portland OR to Seattle WA	F40PH Locomotive Talgo Bistro Coach Car Talgo Coach Car 7
8/13/97	7" Intended Cant Deficiency Seattle WA to Portland WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car
8/13/97	8" Intended Cant Deficiency Portland OR to Seattle WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car
8/14/97	8" Intended Cant Deficiency Seattle WA to Blaine WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car
8/14/97	71/2" Intended Cant Deficiency Seattle WA to Blaine WA	F40PH Locomotive F59PH Locomotive Talgo Bistro Coach Car

* Ridemeter moved from F59PH Locomotive to Talgo Coach Car 7 at MP 94 north of Seattle

The ridemeter was used to digitally record and display the carbody accelerations continuously in real time over the duration of each test run; the ridemeter also recorded and displayed the vehicle location and vehicle speed at which the accelerations were measured. Each ridemeter was set to digitally sample at a rate of 200 samples per second.

During each test trip, visible landmarks such as stations, road crossings, and bridges were recorded on data sheets with the corresponding GPS location, time, and any other pertinent information in order to assist in identifying track location for the measured acceleration signals. At the conclusion of each test run, the recorded lateral acceleration signals were analyzed, using a 10 Hz, single pole digital filter, and examined for the safety criteria exceptions. The limits for steady-state, peak, and peak-to-peak lateral accelerations calculated before the commencement of the test (indicated in **Table 1.1**) were applied. In the event that an exception was found, the track location and vehicle speed at which the exception was observed were recorded and considered in the establishment of the speed profile for the next test run and for the revenue service operation.

The lateral acceleration response of the Talgo trainset cars as a function of cant deficiency was analyzed over the test zone as follows:

- A curve was identified from the lateral acceleration signal recorded on the vehicle by the ridemeter; from the signal, the steady-state lateral acceleration of the vehicle in the curve was extracted by taking the average value through the curve (over a time period of at least 2 seconds); the peak lateral acceleration was taken as the extreme value in the curve.

- Curve location and vehicle speed were determined using track charts and the recorded GPS data from the ridemeter; measured curvature and crosslevel for the curve, and vehicle speed were used to compute cant deficiency.

An example of the analysis process is illustrated below for the location near MP 10 south of Tacoma WA, where a 0.37 g peak lateral acceleration and a 0.16 g steady-state lateral acceleration were measured on the F40PH locomotive as it traveled through curve #10A.

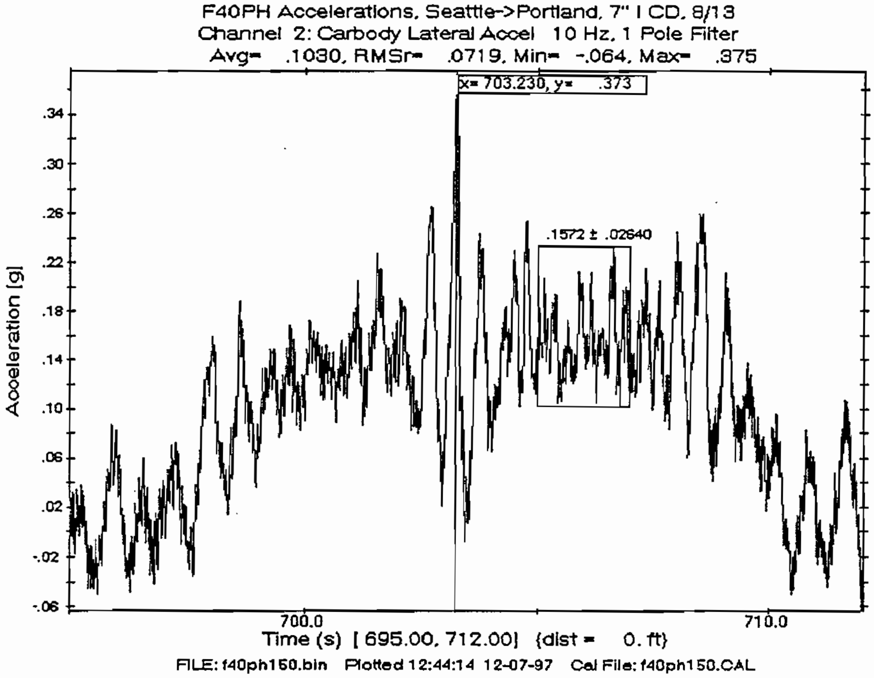


Figure 4.2: Lateral Acceleration, F40PH Locomotive in Curve #10A, South of Tacoma WA

In a number of instances, multiple peak acceleration exceptions were found in a particular curve for a given test run. If more than one peak acceleration exception was found to occur within a one second time frame, a single peak exception was reported with an acceleration value equal to the magnitude of the maximum observed acceleration. Any transient peak that was determined to influence the vehicle for a distance-based duration of less than 5 feet was attributed to noise or vibration and was neglected in accounting for transient accelerations.

A similar process was done with steady-state exceptions. Steady-state accelerations were looked at over a period of two seconds. In the event that there was more than one steady-state acceleration exception found in a given curve (can occur if the vehicle remains in the full body of the curve for more than two seconds), a single steady-state exception value was assigned with an acceleration equal to the magnitude of the maximum observed exception.

The results of this procedure are a list of locations in which transient and/or steady-state acceleration thresholds were exceeded. Listed in **Table 4.2** are the number of **curves** in the Seattle - Blaine and the Seattle - Portland test zones in which lateral accelerations measured on any of the vehicles exceeded safety limits. The table is arranged in order of ascending cant deficiency, indicating the number of curve locations at which thresholds were exceeded within the given range of cant deficiency in each row.

TABLE 4.2: NUMBER OF CURVES WITH SAFETY LIMIT EXCEPTIONS

Calculated Cant Deficiency (in)	**Seattle to Blaine** Number of Curves With Safety Limit Exceptions (Total curves tested =165)	**Seattle to Portland** Number of Curves With Safety Limit Exceptions (Total curves tested = 217)
0 < CD < 4	3	1
4 ≤ CD < 5	1	5
5 ≤ CD < 6	3	8
6 ≤ CD < 7	6	5
7 ≤ CD < 8	1	6
8 ≤ CD	1	3
Totals	15	28

A total of 15 curves were identified in the Seattle-Blaine segment for which one or more vehicles experienced lateral accelerations above the safety limits during the testing at up to 8 inches of cant deficiency. A total of 28 curves were similarly identified for the Seattle-Portland segment. Test results for each track segment have been considered separately and are presented in the following sections.

4.2 TEST RESULTS, SEATTLE - BLAINE CORRIDOR

Data from all test runs between Seattle and Blaine were examined in detail to identify both the accelerations that exceeded safety limits and the locations at which these limits were exceeded. The number of occasions when the peak and steady-state lateral accelerations reached or exceeded the limits specified in **Table 3.5** are summarized in **Table 4.3**.

TABLE 4.3: NUMBER OF THRESHOLD EXCEPTIONS BETWEEN SEATTLE AND BLAINE

Number of Test Runs : 6 Number of Curves In Test Section : 165

Calculated Cant Deficiency (in.)	Talgo Coach Car (Bistro)		Talgo Coach Car 7 (Dampers Removed)		F40PH Locomotive		F59PH Locomotive	
	Steady-State	Peak	Steady-State	Peak	Steady-State	Peak	Steady-State	Peak
Tangent	0	0	-	-	0	0	0	2
0 < CD < 4	0	0	-	-	0	7	0	2
4 ≤ CD < 5	0	0	-	-	0	2	0	1
5 ≤ CD < 6	0	0	-	-	0	8	0	3
6 ≤ CD < 7	2	0	-	-	0	3	0	2
7 ≤ CD < 8	1	0	-	-	0	1	0	0
8 ≤ CD	1	0	-	-	0	0	1	1
Totals	4	0	-	-	0	21	1	11

Note: Safety Limits: Talgo Cars: steady-state=0.14 g, peak=0.21 g; Locomotives: steady-state=0.20 g, peak=0 .32 g

Table 4.3 is organized in order of ascending **calculated** cant deficiency experienced by the particular vehicle. Each test run was conducted with a speed profile intended to achieve a specific cant deficiency in as many curves as possible. Due to the difficulty in getting the trainset to the exact desired speed or discrepancies in curvature or crosslevel, some curves were traversed at a cant deficiency slightly different than the desired cant deficiency. Cant deficiency in each case was computed using the average curvature and crosslevel, measured by the T-10 track inspection vehicle, and the measured vehicle speed from the ridemeter data at the time and location where the particular acceleration was measured.

It should be noted that there is more than one way to calculate cant deficiency. Cant deficiency can be based on the average properties of the curve, as is being done at this stage of the analysis. It is also common to base the cant deficiency on the **limiting** crosslevel and curvature. The limiting properties of a given curve are the properties whose combination result in the largest cant deficiency within that curve. The limiting crosslevel and curvature are not necessarily the largest values of these quantities. The limiting properties of a curve are often used in the establishment of maximum speeds through the curve. The use of these properties will be illustrated in Section 4.4.

The individual safety limit exceptions, in conjunction with the location of each exception, are listed in **Tables 4.4**, **4.5**, and **4.6**. The tables correspond to the F40PH locomotive, the F59PH locomotive and the Talgo Coach Car (Bistro) respectively. In the cases where it was difficult to determine the track on which the exception occurred, the track that the event was most likely to occur on was reported with a question mark added to indicate a level of uncertainty.

TABLE 4.4: THRESHOLD EXCEPTIONS FOR THE F40PH LOCOMOTIVE BETWEEN SEATTLE AND BLAINE

Location	Track No.	Type of Exception	Exception Value (g)	Duration of Transient Exception (ft)	Speed (mph)	Curvature (°)	Super-elevation (in.)	Calculated Cant Deficiency (in)
Curve #8A (S of Edmonds Sta)	2?	transient	0.36	6	55	5.25	5.28	5.7
	2	transient	0.38	6	59	5.25	5.28	7.3
Curve #10A (S of Edmonds Sta)	2	transient	0.34	6	62	4.10	4.55	6.3
Curve #11A	2	transient	-0.35	6	62	-4.13	-4.49	6.5
Curve #13A	1?	transient	-0.44	7	65	4.02	4.82	6.9
Curve #21A	2	transient	0.34	5	58	4.22	4.78	5.0
Curve #22A	1?	transient	-0.35	6	57	2.12	1.18	3.6
	1	transient	-0.39	6	63	2.12	1.18	4.6
Curve #29A	1	transient	0.36	6	67	-1.48	-0.75	3.8
Curve #49	1	transient	-0.38	10	72	-2.47	-3.17	5.7
	1	transient	-0.34	8	73	2.47	3.35	5.7
	1	transient	-0.38	7	73	-2.47	-3.17	5.9
	1	transient	-0.38	12	74	2.47	3.35	5.9
Curve #50	1	transient	0.42	10	76	-2.00	-3.08	4.9
	1	transient	0.37	10	76	2.05	3.10	5.1
	1	transient	0.43	9	76	2.05	3.10	5.1
Curve #50A	1	transient	-0.42	8	69	-1.97	-3.98	2.5
	1	transient	-0.75	13	72	1.98	3.99	3.1
	1	transient	-0.40	7	73	1.98	3.99	3.3
	1	transient	-0.53	26	74	-1.96	-3.98	3.4
	1	transient	-0.58	15	75	1.98	3.99	3.7

Totals: 10 Curves; 21 Transient Exceptions

TABLE 4.5: THRESHOLD EXCEPTIONS FOR THE F59PH LOCOMOTIVE BETWEEN SEATTLE AND BLAINE

Location	Track No.	Type of Exception	Exception Value (g)	Duration of Transient Exception (ft)	Speed (mph)	Curvature (°)	Super-elevation (in.)	Calculated Cant Deficiency (in)
Curve #1783	1?	steady-state	-0.20	-	41	-10.00	-3.21	8.4
	1?	transient	0.36	11	43	-10.00	-3.21	9.5
2502' N of MP 42, tangent N of Curve #41	1	transient	-0.40	9	80	0.00	0.00	0.00
2705' N of MP 42, tangent N of Curve #41	1	transient	-0.41	8	78	0.00	0.00	0.00
Curve #49	1	transient	-0.34	11	72	2.47	3.35	5.5
Curve #50	1	transient	0.40	7	75	-2.00	-3.08	4.7
	1	transient	0.40	6	76	2.05	3.10	5.1
	1	transient	0.40	7	76	2.05	3.10	5.1
Curve #50A	1	transient	-0.59	14	72	1.98	3.99	3.1
	1	transient	-0.68	15	75	1.98	3.99	3.7
Curve #87B	1	transient	-0.40	6	47	-6.55	-3.82	6.2
	1	transient	-0.41	6	48	-6.55	-3.82	6.6

Totals: 5 Curves, 2 Tangent Locations; 11 Transient Exceptions, 1 Steady-State Exception

TABLE 4.6: THRESHOLD EXCEPTIONS FOR THE TALGO COACH CAR BETWEEN SEATTLE AND BLAINE

Location	Track No.	Type of Exception	Exception Value (g)	Duration of Transient Exception (ft)	Speed (mph)	Curvature (°)	Super-elevation (in.)	Calculated Cant Deficiency (in)
Curve #1783	1?	steady-state	0.15	-	41	-10.00	-3.21	8.4
Curve #90A	1	steady-state	0.14	-	53	-5.53	-4.05	6.7
Curve #90B	1	steady-state	-0.14	-	53	5.85	4.59	6.7
Curve #92	1	steady-state	0.14	-	54	-6.02	-4.15	7.9

Totals: 4 Curves; 4 Steady-State Exceptions

Table 4.7 is a summary of the results of the test runs between Seattle and Blaine. It includes all locations at which an acceleration exception was found and the information pertinent to each location. **Table 4.7**, as with the previous tables, is organized according to the calculated cant deficiency at which the exception was found to occur. There were instances where more than one exception was found to occur at a given location on a particular test. When the exceptions were grouped together, the minimum cant deficiency was associated with the location.

TABLE 4.7: SUMMARY OF SAFETY LIMIT EXCEPTIONS BETWEEN SEATTLE AND BLAINE

Cant Deficiency (in)	Location	Affected Vehicles	Comments
0 (Tangent)	2502' N of MP 42, tangent N of Curve #41	F59PH	Transient exception observed; Possible Cause: location identified by T10 survey as a 1.6" Warp condition, located at MP 42 + 2368'.
	2705' N of MP 42, tangent N of Curve #41	F59PH	Transient exception observed; Possible Cause: location identified by T10 survey as a 1.6" Warp condition, located at MP 42 + 2368'.
0 < CD < 4	Curve #22A	F40PH	Speed of 63 mph (5" cant deficiency) limited by Curve 22 for which 61 mph results in 8" cant deficiency.
	Curve #29A	F40PH	Speed limited curve; Max speed of 79 mph results in 5.25" cant deficiency; Transient exception observed at 67 mph (3.8" cant deficiency); Possible Cause: Crossing/switch in curve.
	Curve #50A	F40PH F59PH	Transient exception observed; Possible Cause: location identified by T10 survey as a 1.4" Warp condition, located at MP 50 + 3263'; Crossing/switch in curve.
4 ≤ CD < 5	Curve #50	F40PH F59PH	Transient exception observed at 76 mph (5" cant deficiency); Possible Cause: Crossing/switch in curve.
5 ≤ CD < 6	Curve #8A (S of Edmonds Sta)	F40PH	Transient exception observed at 55 mph (5.7" cant deficiency). Possible Cause: Sharp gage deviation in curve.
	Curve #21A	F40PH	Transient exception observed at 58 mph (5" cant deficiency); Possible Cause: Crossing/switch in curve.
	Curve #49	F40PH F59PH	Transient exception observed; Possible Cause: location identified by T10 survey as Wide Gage, 57.613", located at MP 48 + 4723'; Crossing/switch in curve.
6 ≤ CD < 7	Curve #10A (S of Edmonds Sta)	F40PH	Speed limited curve; Max speed of 63 mph; Transient exception observed at 62 mph (6.3" cant deficiency).
	Curve #11A	F40PH	Speed limited curve; Max speed of 63 mph; Transient exception observed at 62 mph (6.5" cant deficiency).
	Curve #13A	F40PH	Transient exception observed at 65 mph (6.9" cant deficiency).
	Curve #87B	F59PH	Transient exception observed at 47 mph (6.2" cant deficiency); Possible Cause: Crossing/switch in curve; sharp gage deviations in curve.
	Curve #90A	Talgo Coach	Steady-state exception observed; Possible Cause: location identified by T10 survey as a 1.5" Warp condition, located at MP 90 + 2804'; Narrow Gage condition, 55.888", MP 90 + 2919'; Warp condition
	Curve #90B	Talgo Coach	Steady-state exception observed; Possible Cause: location identified by T10 survey as a 1.5" Warp condition, located at MP 90 + 3360'.
7 ≤ CD < 8	Curve #92	Talgo Coach	Steady-state exception observed; Possible Cause: location identified by T10 survey as a Wide Gage Exception, 57.627", located at MP 92 + 777'.
8 ≤ CD	Curve #1783	F59PH Talgo Coach	Transient exception observed at 41mph (8.4" cant deficiency); Steady-state exception observed at 43 mph (9.5" cant deficiency).

4.3 TEST RESULTS, SEATTLE - PORTLAND CORRIDOR

The number of occasions when peak and steady-state lateral accelerations reached or exceeded safety limits between Seattle and Portland are presented in **Table 4.8**. The format of **Table 4.8** is the same as that of **Table 4.3**.

TABLE 4.8: NUMBER OF THRESHOLD EXCEPTIONS BETWEEN SEATTLE AND PORTLAND

Number of Test Runs : 4 Number of Curves In Test Section : 217

Calculated Cant Deficiency (in.)	Talgo Coach Car (Bistro)		Talgo Coach Car 7 (Dampers Removed)		F40PH Locomotive		F59PH Locomotive	
	Steady-State	Peak	Steady-State	Peak	Steady-State	Peak	Steady-State	Peak
Tangent	0	0	0	0	0	0	0	3
0 < CD < 4	0	0	0	0	0	2	0	1
4 ≤ CD < 5	0	0	0	0	0	4	0	2
5 ≤ CD < 6	0	0	0	0	0	15	0	5
6 ≤ CD < 7	1	0	0	0	0	8	0	5
7 ≤ CD < 8	0	0	0	0	0	10	1	7
8 ≤ CD	1	0	0	0	2	0	2	0
Totals	2	0	0	0	2	39	3	23

Note: Safety Limits: Talgo Cars: steady-state=0.14 g, peak=0.21 g; Locomotives: steady-state=0.20 g, peak=0 .32 g

The ridemeter was placed on F59PH locomotive for the tests conducted between Seattle and Blaine was put on car 7 of the Talgo trainset for the first two test runs between Portland and Seattle. No safety limit thresholds were exceeded by the lateral accelerations recorded on Talgo coach car 7.

The individual safety limit exceptions cited in **Table 4.8** are detailed in **Tables 4.9**, **4.10**, and **4.11**. The tables correspond to the F40PH locomotive, the F59PH locomotive and the Talgo Coach Car (Bistro) respectively.

TABLE 4.9: THRESHOLD EXCEPTIONS FOR THE F40PH LOCOMOTIVE BETWEEN SEATTLE AND PORTLAND

Location	Track No.	Type of Exception	Exception Value (g)	Duration of Transient Exception (ft)	Speed (mph)	Curvature (°)	Super-elevation (in.)	Calculated Cant Deficiency (in)
Curve #3A X	2	transient	-0.35	7	68	-2.42	-0.19	7.5
Curve #1	2	steady-state	0.20	-	60	-3.75	-0.84	8.5
Curve #1A	2	transient	-0.37	5	53	-3.07	-0.41	5.5
	2	transient	-0.62	12	59	3.07	0.41	6.9
Curve #9A	1	steady-state	-0.20	-	67	-3.20	-0.94	8.9
Curve #10A	2	transient	0.37	8	75	-2.92	-4.91	6.4
Curve #15	1	transient	-0.44	14	70	-3.05	-3.15	7.2
	1	transient	-0.38	6	70	-3.05	-3.15	7.2
Curve #15B	1	transient	-0.67	10	64	-2.22	-2.69	3.6
	1	transient	-0.63	11	66	2.22	2.69	3.9
	2	transient	-0.84	8	67	-2.22	-2.69	4.2
Curve #24	1	transient	-0.44	12	69	3.38	4.58	6.5
	1	transient	-0.38	10	71	-3.38	-4.58	7.2
	1	transient	-0.37	6	71	-3.38	-4.58	7.2
Curve #25A	1	transient	-0.63	9	72	-3.03	-4.83	5.9
	1	transient	-0.41	9	72	-3.03	-4.83	5.9
Curve #51A	1	transient	-0.36	7	79	-1.95	-3.84	4.6
Curve #62	2	transient	0.41	8	72	3.00	4.94	5.8
	2	transient	0.39	12	77	3.00	4.94	7.3
Curve #69	1	transient	0.38	8	69	-2.92	-5.28	4.3
	2	transient	0.49	10	77	2.92	5.28	6.7
Curve #71	2	transient	0.44	10	65	1.93	1.32	4.3
	2	transient	0.40	11	73	1.93	1.32	5.8
	2	transient	0.57	15	73	1.93	1.32	5.8
Curve #71A	2	transient	-0.46	10	71	-1.98	-1.41	5.5
Curve #81A	1	transient	-0.42	10	72	3.05	4.51	6.4
Curve #87	2	transient	0.43	11	72	2.97	3.52	7.1
	2	transient	0.37	11	71	2.97	3.52	6.8
Curve #89	1	transient	-0.55	10	74	2.97	5.00	6.2
Curve #94A	2	transient	-0.36	7	72	-2.65	-3.91	5.6
Curve #122	2	transient	0.46	10	69	1.92	0.84	5.5
	2	transient	0.36	8	69	1.92	0.84	5.5
	2	transient	0.35	6	69	1.92	0.84	5.5
	2	transient	0.49	12	69	1.92	0.84	5.5
	2	transient	0.35	9	70	-1.92	-0.84	5.6
	2	transient	0.49	9	70	-1.92	-0.84	5.6
	1	transient	0.39	7	70	1.92	0.84	5.6
	1	transient	0.49	15	72	1.92	0.84	6.0
Curve #133	2	transient	-0.37	5	77	-2.07	-1.39	7.1
	2	transient	-0.39	6	77	-2.07	-1.39	7.1
Curve #5 (Near Portland)	1	transient	0.35	5	63	-2.98	-1.11	7.0

Totals: 21 Curves; 39 Transient Exceptions, 2 Steady-State Exceptions

TABLE 4.10: THRESHOLD EXCEPTIONS FOR THE F59PH LOCOMOTIVE BETWEEN SEATTLE AND PORTLAND

Location	Track No.	Type of Exception	Exception Value (g)	Duration of Transient Exception (ft)	Speed (mph)	Curvature (°)	Super-elevation (in.)	Calculated Cant Deficiency (in)
Curve #2 X	2	steady-state	0.20	-	59	3.95	1.49	7.9
391' SW of MP 8 X, tangent N of Curve #8 X	1	transient	0.41	5	70	0.00	0.00	0.00
Curve #10 X	1	transient	-0.39	11	68	3.03	4.33	5.3
1166' S of MP 18 X, tangent	1	transient	0.35	7	76	0.00	0.00	0.00
2299' N of MP 25 X, tangent	1	transient	0.36	8	80	0.00	0.00	0.00
Curve #30 X	2	transient	-0.33	7	78	-2.00	-3.56	4.8
Curve #1	1	steady-state	0.20	-	60	-3.75	-0.84	8.5
Curve #1A	1	transient	-0.39	6	59	3.07	0.41	6.9
Curve #9A	1	steady-state	-0.20	-	66	-3.20	-0.94	8.7
Curve #15	1	transient	-0.36	5	70	-3.05	-3.15	7.2
Curve #15B	1	transient	-0.70	16	66	2.22	2.69	3.9
Curve #24	1	transient	-0.37	10	66	3.38	4.58	5.6
	1	transient	-0.35	6	71	-3.38	-4.58	7.2
Curve #25A	1	transient	-0.46	14	71	-3.03	-4.83	5.7
	1	transient	-0.42	10	72	3.03	4.83	5.9
Curve #53A	1	transient	-0.36	7	71	-1.47	-1.00	4.1
Curve #62	2	transient	0.35	9	77	3.00	4.94	7.3
Curve #65	2	transient	-0.33	5	72	-2.97	-3.02	7.6
Curve #69	2	transient	0.36	7	77	2.92	5.28	6.6
Curve #71	2	transient	0.35	10	73	1.93	1.32	5.8
Curve #87	2	transient	0.32	5	70	2.97	3.52	6.5
Curve #89	1	transient	-0.59	15	74	2.97	5.00	6.2
Curve #122	1	transient	0.36	6	72	1.92	0.84	6.0
Curve #133	2	transient	-0.35	7	77	-2.07	-1.39	7.1
	2	transient	-0.36	7	77	-2.07	-1.39	7.1
	2	transient	-0.34	5	78	-2.07	-1.39	7.3

Totals: 19 Curves, 3 Tangent Locations; 23 Transient Exceptions, 3 Steady-State Exceptions

TABLE 4.11: THRESHOLD EXCEPTIONS FOR THE TALGO COACH CAR BETWEEN SEATTLE AND PORTLAND

Location	Track No.	Type of Exception	Exception Value (g)	Duration of Transient Exception (ft)	Speed (mph)	Curvature (°)	Super-elevation (in.)	Calculated Cant Deficiency (in)
Curve #39 X	1	steady-state	0.14	-	35	-10.20	-0.32	8.3
Curve #17C	1	steady-state	-0.14	-	72	3.25	4.88	6.7

Totals: 2 Curves; 2 Steady-State Exceptions

Table 4.12 summarizes the results of the test runs between Seattle and Portland. The format of **Table 4.12** is the same as that of **Table 4.7**.

TABLE 4.12: SUMMARY OF SAFETY LIMIT EXCEPTIONS BETWEEN SEATTLE AND PORTLAND

Cant Deficiency (in)	Location	Affected Vehicles	Comments
0 (Tangent)	391' SW of MP 8 X, tangent N of Curve #8 X	F59PH	Possible Cause: Profile, alignment deviations; Crossings/switches in track.
	1166' S of MP 18 X, tangent	F59PH	Possible Cause: Profile, alignment deviations; Crossings/switches in track.
	2299' N of MP 25 X, tangent	F59PH	?
0 < CD < 4	Curve #15B	F40PH F59PH	Transient exceptions observed; Possible Cause: location identified by T10 survey as a 1.35" Warp condition, located at MP 15+5198'; Large alignment deviations in curve; Crossing/switch in curve.
4 ≤ CD < 5	Curve #30 X	F59PH	Transient exception observed; Possible Cause: location identified by T10 survey as having sudden curvature deviation and decrease in crosslevel within curve.
	Curve #51A	F40PH	?
	Curve #53A	F59PH	Transient exception observed; Possible Cause: location identified by T10 survey as Narrow Gage, 55.678", located at MP 53+4292' ; Profile deviations at N and and S end of curve.
	Curve #69	F40PH F59PH	Transient exceptions observed; Possible Cause: Crossings/switches in curves.
	Curve #71	F40PH F59PH	Transient exceptions observed; Possible Cause: location identified by T10 survey as a 1.38" Warp31 condition, located at MP 71+1525'; Profile, alignment deviations in curve.
5 ≤ CD < 6	Curve #10 X	F59PH	Transient exceptions observed; Possible Cause: Profile, alignment deviations in curve; Crossings/switches in curve.
	Curve #1A	F40PH F59PH	Transient exceptions observed; Possible Cause: Large profile, alignment deviations in curve; Crossings/switches in curve, at S end of curve.
	Curve #24	F40PH F59PH	Transient exceptions observed; Possible Cause: Large profile deviations at N end of curve; Crossings/switches in curve.
	Curve #25A	F40PH F59PH	Transient exceptions observed; Possible Cause: location identified by T10 survey as a 1.12" Warp condition, located at MP 26 - 4663'; Profile, alignment deviations at N end of curve; Crossing/switch in curve.
	Curve #62	F40PH F59PH	Transient exceptions observed; Possible Cause: location identified by T10 survey as Wide Gage, 57.631", located at MP 63+2751'.
	Curve #71A	F40PH	Transient exception observed; Possible Cause: Profile deviations in curve; Crossing/switch in curve.
	Curve #94A	F40PH	Transient exception observed; Possible Cause: Profile deviations in curve.
	Curve #122	F40PH F59PH	Transient exceptions observed; Possible Cause: Crossings/switches in curves.

(Continued on following page)

TABLE 4.12(CONT.): SUMMARY OF SAFETY LIMIT EXCEPTIONS BETWEEN SEATTLE AND PORTLAND

Cant Deficiency (in)	Location	Affected Vehicles	Comments
6 ≤ CD < 7	Curve #10A	F40PH	Transient exceptions observed; Possible Cause: Crossing/switch at N end of curve.
	Curve #17C	Talgo Coach	Steady-state exception observed; Possible Cause: 3.25° curve, 4.9" superelevation over length of 845'; Sudden gage and alignment changes at S end of curve.
	Curve #81A	F40PH	Transient exception; Possible Cause: Sudden change in profile, alignment at N end of curve; Crossing/switch in curve.
	Curve #87	F40PH F59PH	Transient exceptions observed; Possible Cause: Crossing/switch at N end of curve.
	Curve #89	F40PH F59PH	Transient exceptions observed; Possible Cause: Sudden change in gage at N end of curve; Crossing/switch at N end of curve.
7 ≤ CD < 8	Curve #2 X	F59PH	Steady-state exception observed.
	Curve #3A X	F40PH	Transient exception observed; Possible Cause: Sudden changes in profile at N end of curve.
	Curve #15	F40PH F59PH	Transient exceptions observed; Possible Cause: Large profile deviations in curve; Crossing/switch in curve.
	Curve #65	F59PH	Transient exception observed; Possible Cause: Sudden profile and alignment changes at N end and S end; Crossing/switch at S end of curve.
	Curve #133	F40PH F59PH	Transient exceptions observed; Possible Cause: location identified by T10 survey as Wide Gage, 57.645", Located at MP 132+5333'; Crossing/switch in curve.
	Curve #5 (Near Portland)	F40PH	Transient exception observed; Possible Cause: Narrow gage in curve near S end (T-10 Survey);
8 ≤ CD	Curve #39 X	Talgo Coach	Steady-state exception observed; Crossing/switch S end of curve.
	Curve #1	F40PH F59PH	Steady-state exceptions observed.
	Curve #9A	F40PH F59PH	Steady-state exceptions observed.

4.4 INDIVIDUAL CURVE ANALYSIS, SEATTLE - BLAINE AND SEATTLE - PORTLAND CORRIDORS

The initial consideration of the accelerations' data resulted in the locations of safety limit threshold exceptions reported in the previous two sections. Upon identification of these locations, the maximum safe cant deficiency was estimated for all of the curves between Blaine and Portland. The peak value of transient acceleration observed in each curve was plotted against the cant deficiency, based on the limiting properties of the particular curve, for both locomotives. The Talgo coach car was not considered in this analysis due to the number of safety limit exceptions found on the coach car compared to exceptions found on the locomotives. Once the data was plotted, a trend line was fit to the data and a relationship between peak acceleration and cant deficiency was determined for each vehicle. The maximum safe cant deficiency could be determined for those curves in which high cant deficiencies were not achieved by extrapolating each peak acceleration to the safety limit using the established trend.

The acceleration used in the analysis of each curve was the acceleration recorded on the "lead" locomotive used during the high cant deficiency run on the particular test zone. This convention resulted in accelerations measured on the F40PH locomotive being used in the analysis of the Seattle - Blaine corridor while accelerations measured on the F59PH locomotive were used in the consideration of the curves between Seattle and Portland. Using results from the one locomotive on a particular corridor while employing measurements from a different locomotive for analysis of the other corridor does not present a significant source of error due to the fact that both locomotives behaved in a similar manner over each test zone.

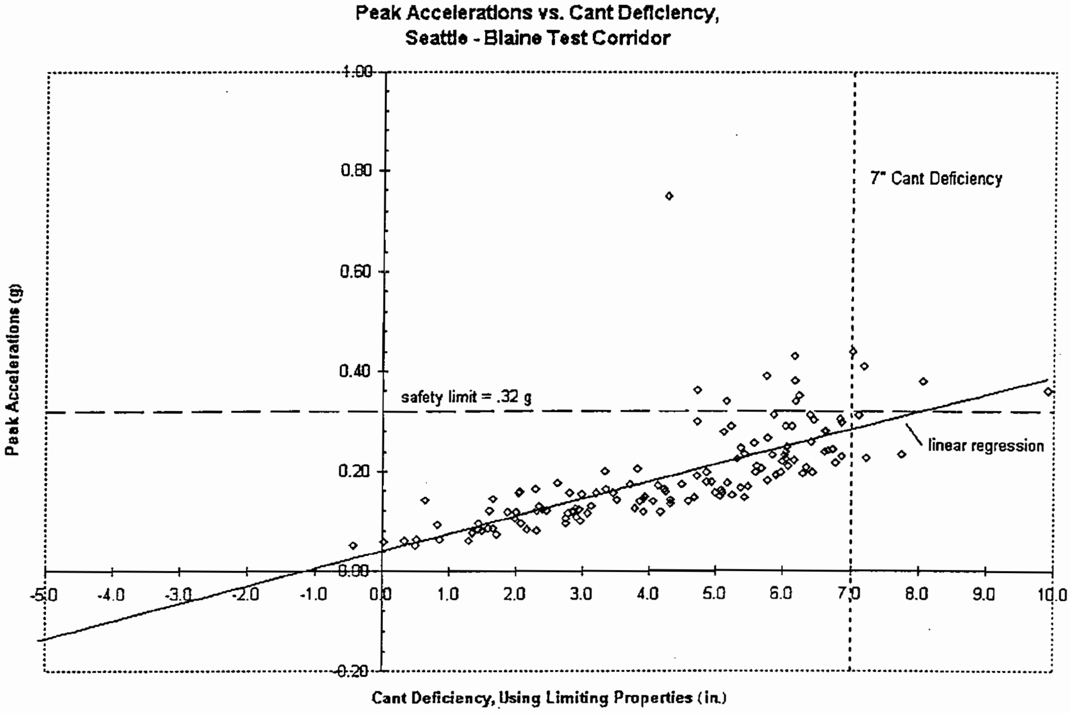


Figure 4.3: Peak Accelerations in Curves of Seattle - Blaine Test Corridor

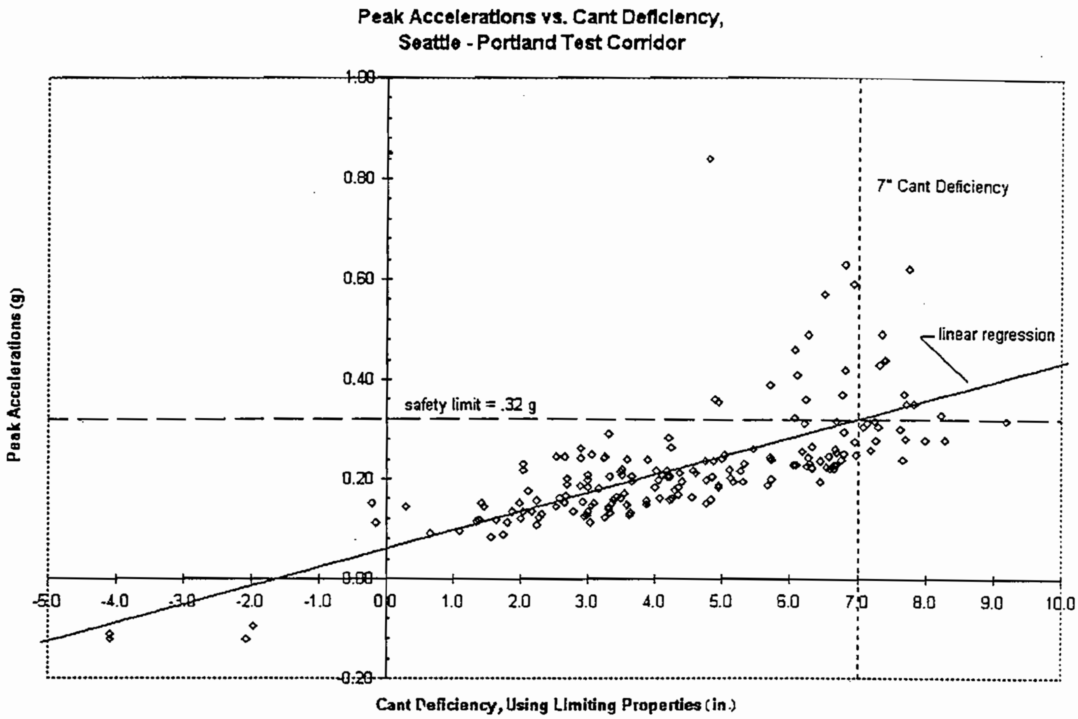


Figure 4.4: Peak Accelerations in Curves of Seattle - Portland Corridor

Figure 4.3 shows the peak accelerations plotted against the cant deficiency for the F40PH locomotive on the Seattle - Blaine test section. **Figure 4.4** shows the corresponding information for the F59PH locomotive on the Seattle - Portland test section. The slopes of the trend lines shown on each graph were used to calculate the maximum safe cant deficiency for a particular curve. An example of a typical calculation is offered below.

Consider **Figure 4.5**, a time history trace of the lateral accelerations measured on the F59PH locomotive as it traversed through curve #30 X, south of Seattle. It can be seen that the vehicle experienced a peak transient acceleration of .325 g within the curve (this exception can be seen in **Table 4.8**). **Figure 4.6** illustrates the curvature and crosslevel measured by the T-10 track inspection vehicle within curve #30 X. It can be observed that there is an increase in curvature over a short distance in conjunction with a decrease in the crosslevel at the same location. This track condition is often referred to as a "down and out" condition.
The properties of the curve as measured by the T-10 vehicle are:

average curvature = -2.00 ° average crosslevel = -3.56 "
limiting curvature = -2.10 ° limiting crosslevel = -2.79 "

The information pertinent to the occurrence of the safety limit exception is:

v = 78 mph peak acceleration = .325 g

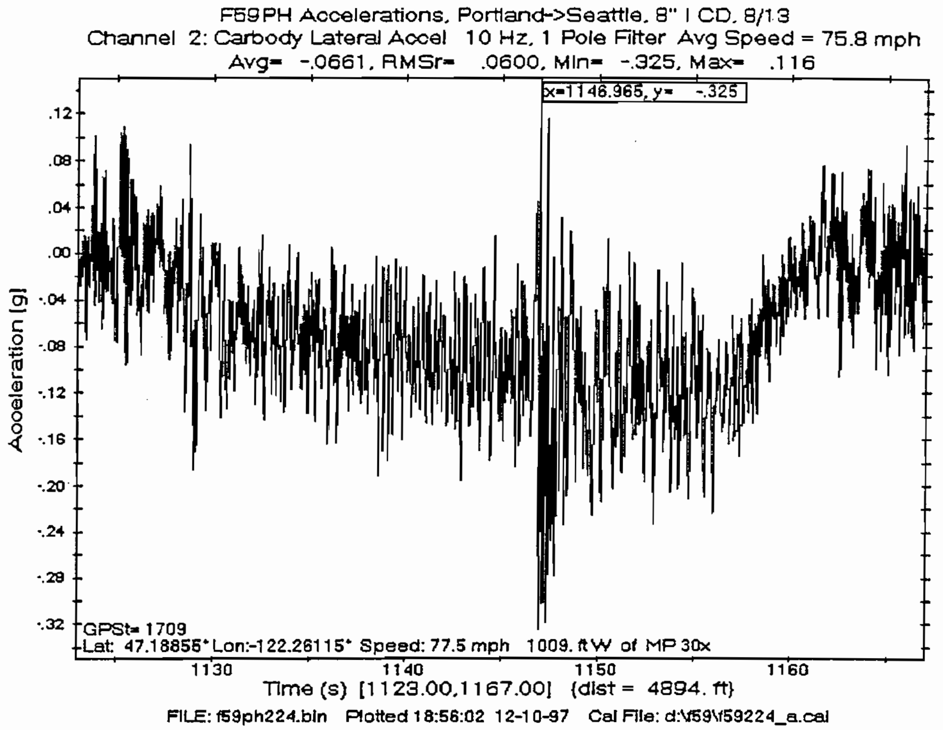


Figure 4.5: Lateral Acceleration, F59PH Locomotive in Curve #30 X, South of Seattle

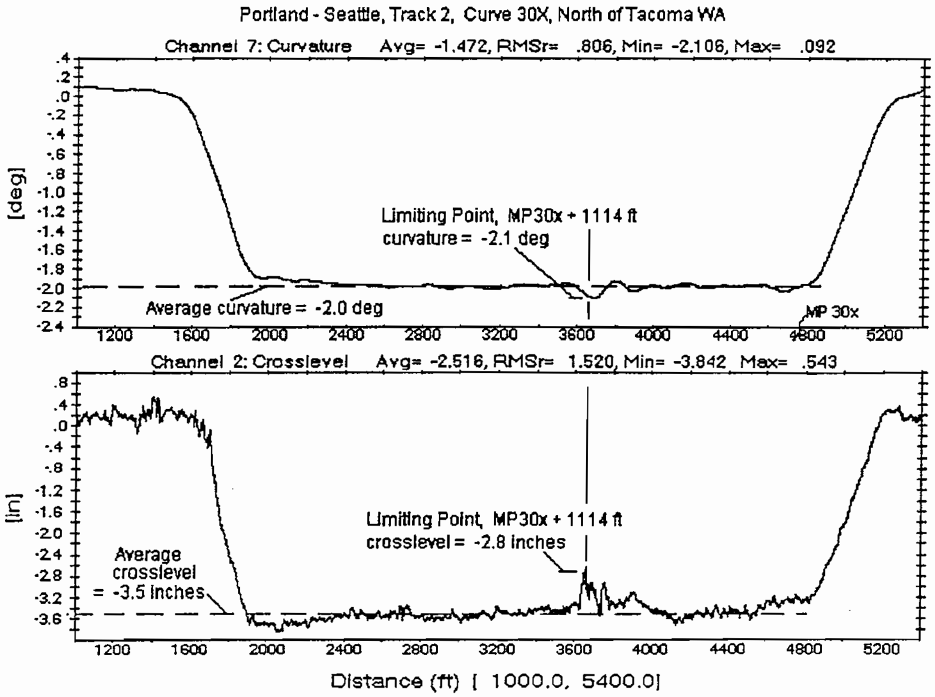


Figure 4.6: Measured Curvature and Crosslevel Through Curve #30 X, South of Seattle

The calculation for cant deficiency is given in Section 3, and repeated below, as:

$$U = \frac{v^2}{1451.21}D - E$$

U = *cant deficiency [inches]*
v = *forward speed [mph]*
D = *track curvature [°]*
E = *track superelevation [inches]*

Using the data recorded as the locomotive passed through curve #30 X, the cant deficiencies based on both the average and limiting properties of the curve are:

$$Average\ U = \frac{78^2}{1451.21}(-2.00)-(-3.56) = 4.9\ (for\ v > v_{balance})$$

$$Limiting\ U = \frac{78^2}{1451.21}(-2.10)-(-2.79) = 6.1\ (for\ v > v_{balance})$$

The slope and the intercept of the trend line shown in **Figure 4.4** are necessary to calculate the safe cant deficiency. The equation of the trend line was determined to be:

$$Peak\ Acceleration = .0373\ U + .0598$$

If the maximum safe cant deficiency is estimated by saying it is that cant deficiency at which the acceleration safety limit is achieved, the following equation is arrived at:

$$.32 = .0373\ U_{safe} + .0598$$

Subtracting the general equation from the relationship above yields the following relationship for the safe cant deficiency:

$$U_{safe} = \frac{.32 - Peak\ Acceleration}{.0373} + U$$

Using the information pertaining to curve #30 X yields the following:

$$U_{safe}\ \textit{Based On Limiting Properties} = \frac{.32 - .325}{.0373} + 6.1 = 5.9$$

The trend line used in this calculation is based on the limiting cant deficiency (see **Figure 4.4**). If the same trend is applied to the cant deficiency based on the average curve parameters in order to estimate the safe cant deficiency based on average curve properties, the following result is obtained:

$$U_{safe}\ \textit{Based On Average Properties} = \frac{.32 - .325}{.0373} + 4.9 = 4.7$$

Once these values are obtained, the maximum speed through the curve can be calculated from the following relationship:

$$V_{\max} = \sqrt{\frac{U_{safe} + E}{.0007\ D}}$$

Putting in the values based on average properties and those based on limiting properties yield the following results for curve #30 X:

Maximum Safe Cant Deficiency Based on Limiting Properties = 5.9; V = 78 mph
Maximum Safe Cant Deficiency Based on Average Properties = 4.7; V = 78 mph

This procedure was carried out for all curves between Blaine and Portland where acceleration data was high enough to discern. In the cases where the maximum safe cant deficiency was determined to be less than 3 inches, the value reported was 3 inches, the current authorized cant deficiency.

Table 4.13 presents those curves between Blaine and Seattle that have a maximum safe limiting cant deficiency less than 7 inches. Those curves not shown in **Table 4.13** either have a maximum safe cant deficiency greater than 7 inches or have properties such that the track class speed prevents the achievement of cant deficiencies greater than 7 inches. As can be seen in **Table 4.13**, there are **17 route curves** that require speed regulation. All other curves are either safe for 7 inches cant deficiency or have cant deficiencies that are limited by track class speed. Information pertaining to all the curves between Seattle and Blaine is presented in **Appendix B** starting on page B-2.

Table 4.14 shows the information discussed above for the Seattle - Portland corridor. Reference to **Table 4.14** shows that there are **27 route curves** that require speed regulation. Information pertaining to all curves between Portland and Seattle are presented in **Appendix B** starting on page B-7.

In the event that a specific curve could not be identified from the acceleration data, a speed of zero was recorded for the maximum test speed. This happened when the test consist was traveling at near balance speeds.

TABLE 4.13: CURVES WITH EXCEPTIONS AND/OR MAXIMUM SAFE CANT DEFICIENCIES LESS THAN 7 INCHES BETWEEN SEATTLE AND BLAINE

Curve Start		Curve End		Curve No.	Track No.	Average Curve Properties		Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD @ 79 mph Based On Avg. Cond.
MP	FT	MP	FT			Curvature (deg)	Xlevel (in)		Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
101	4313	101	2465	**101A**	1	-3.02	-3.98	64	4.6	5.2	**5.4**	**6.0**	67	67		9.0
93	353	92	4593	**93**	1	-5.05	-2.96	51	6.1	6.4	**6.5**	**6.9**	52	52		18.8
87	3189	87	1784	**87B**	1	6.60	3.86	48	6.6	7.2	**4.2**	**4.8**	42	42	**EXCEPTION**: F59, Max g=-.41	24.5
50	4920	50	3120	**50A**	1	1.98	3.99	72	3.1	4.2	**3.0**	**3.0**	72	66	**EXCEPTION**: F40, Max g=-.75; F59, Max g=-.68	4.5
50	2692	50	1541	**50**	1	-2.00	-3.08	76	4.9	6.2	**3.0**	**3.0**	66	59	**EXCEPTION**: F40, Max g=.43; F59, Max g=.40	5.5
49	306	48	4572	**49**	1	2.47	3.35	72	5.5	6.1	**3.7**	**4.4**	64	65	**EXCEPTION**: F40, Max g=-.38; F59, g=-.34	7.3
29	5031	29	2893	**29A**	1	-1.48	-0.75	68	3.9	4.7	**3.0**	**3.6**	61	59	**EXCEPTION**: F40, g=.36	5.6
22	3743	22	1235	**22A**	1	2.12	1.18	63	4.7	5.7	**3.0**	**3.7**	54	52	**EXCEPTION**: F40, g=-.39	7.9
21	5174	21	4234	**21A**	2	-4.20	-4.90	58	4.8	5.1	**4.3**	**4.6**	56	56	**EXCEPTION**: F40, g=.34	13.2
20	1657	20	971	**20**	1	-3.43	-3.67	64	6.0	5.9	**6.2**	**6.1**	65	65		11.1
20	971	19	5052	**20**	1	-2.67	-1.86	64	5.7	6.4	**5.9**	**6.6**	65	65		9.6
13	3152	13	1314	**13A**	1?	4.02	4.82	65	6.7	7.0	**3.4**	**3.7**	54	55	**EXCEPTION**: F40, g=-.44	12.5
11	1430	11	454	**11A**	2	4.17	5.22	62	5.8	6.2	**5.0**	**5.4**	60	60	**EXCEPTION**: F40, g=-.35	12.7
10	3748	10	2750	**10B**	1	3.95	4.48	61	5.5	6.0	**6.3**	**6.9**	63	63		12.5
10	1261	10	137	**10A**	2	-4.10	-4.93	62	5.9	6.2	**5.4**	**5.6**	60	60	**EXCEPTION**: F40, g=.34	12.7
10	137	9	4403	**10**	1	4.13	5.16	59	4.8	5.1	**6.1**	**6.3**	63	63		12.6
8	2576	8	1684	**8A**	2	-5.15	-5.34	59	7.0	8.1	**5.3**	**6.3**	55	55	**EXCEPTION**: F40, Max g=.38	16.8
1	2106	1	1737	**1C**	1	1.87	1.12	37	0.6	0.6	**5.7**	**5.8**	73	71		6.9

Totals: 17 route curves

TABLE 4.14: CURVES WITH EXCEPTIONS AND/OR MAXIMUM SAFE CANT DEFICIENCIES LESS THAN 7 INCHES BETWEEN SEATTLE AND PORTLAND

Curve Start		Curve End		Curve No.	Track No.	Average Curve Properties		Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD @ 79 mph Based On Avg. Cond.
MP	FT	MP	FT			Curvature (deg)	Xlevel (in)		Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
3	31	3	1166	**3**	1	-1.98	-1.00	46	1.9	3.0	**4.9**	**6.0**	66	66		7.5
4	2581	5	559	**5**	1	2.98	1.11	63	7.0	7.8	**6.2**	**7.0**	60	60	**EXCEPTION**: F40, g=.35	11.7
133	242	132	3263	**133**	2	-2.07	-1.39	77	7.1	7.7	**5.6**	**6.2**	70	70	**EXCEPTION**: F40, Max g=-.37	7.5
122	4762	122	2148	**122**	1,2	1.92	0.84	69	5.5	6.3	**3.0**	**3.0**	54	48	**EXCEPTION**: F40, Max g=.49	7.4
94	3595	94	2291	**94A**	2	-2.65	-3.91	72	5.6	6.2	**4.4**	**5.1**	68	68	**EXCEPTION**: F40, g=-.36	7.5
89	2349	88	5074	**89**	1	-2.97	-5.00	74	6.2	6.9	**3.0**	**3.0**	63	60	**EXCEPTION**: F59, g=-.59; F40, g=-.55	7.8
87	1583	86	4445	**87**	2	2.97	3.52	72	6.9	7.3	**3.8**	**4.2**	60	60	**EXCEPTION**: F40, Max g=.43	9.2
80	3996	80	2877	**81A**	1	-3.05	-4.51	72	6.4	6.8	**3.5**	**4.0**	62	62	**EXCEPTION**: F40, g=-.42	8.6
71	3537	71	1900	**71A**	2	-1.98	-1.41	71	5.5	6.1	**3.0**	**3.0**	57	53	**EXCEPTION**: F40, g=-.46	7.1
71	1631	70	4683	**71**	2	1.93	1.32	73	5.8	6.5	**3.0**	**3.0**	57	52	**EXCEPTION**: F40, Max g=.57	7.0
70	2988	70	2597	**70A**	2	-3.45	-4.11	61	4.6	5.0	**6.6**	**6.9**	67	67		10.7
69	2935	69	818	**69**	1,2	2.92	5.28	77	6.6	7.3	**3.0**	**3.0**	64	62	**EXCEPTION**: F40, Max g=.49	7.3
62	2919	62	1673	**62**	2	3.00	4.94	72	5.8	6.1	**3.2**	**3.5**	63	63	**EXCEPTION**: F40, Max g=.41	8.0
54	955	54	311	**54**	1	-1.53	-0.77	66	3.8	4.2	**4.8**	**5.2**	73	72		5.8
53	4414	53	3960	**53A**	1	-1.47	-1.00	72	4.2	4.9	**3.2**	**4.0**	65	65	**EXCEPTION**: F59, g=-.36	5.3
51	3764	51	2893	**51A**	1	-1.95	-3.84	79	4.5	4.9	**3.4**	**3.7**	73	74	**EXCEPTION**: F40, g=-.36	4.5
25	3141	25	533	**25A**	1	-3.03	-4.83	72	6.0	6.8	**3.0**	**3.0**	61	59	**EXCEPTION**: F40, Max g=-.63; F59, Max g=-.46	8.2
24	512	23	4546	**24**	1	-3.38	-4.58	69	6.5	7.4	**3.1**	**4.0**	57	58	**EXCEPTION**: F40, Max g=-.44; F59, Max g=-.37	10.0
15	4340	15	3305	**15B**	1,2	-2.22	-2.69	67	4.2	4.8	**3.0**	**3.0**	61	57	**EXCEPTION**: F40, Max g=-.84; F59, g=-.70	6.8
15	1346	14	4213	**15**	1	-3.05	-3.15	70	7.1	7.4	**3.7**	**4.0**	57	56	**EXCEPTION**: F40, Max g=-.44	10.0

(Continued on following page)

TABLE 4.14(CONT.): CURVES WITH EXCEPTIONS AND/OR MAXIMUM SAFE CANT DEFICIENCIES LESS THAN 7 INCHES BETWEEN SEATTLE AND PORTLAND

Curve Start		Curve End		Curve No.	Track No.	Average Curve Properties		Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD @ 79 mph Based On Avg. Cond.
MP	FT	MP	FT			Curvature (deg)	Xlevel (in)		Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
10	4366	10	2629	**10A**	2	2.92	4.91	75	6.4	6.8	**5.0**	**5.3**	70	70	**EXCEPTION**: F40, g=.37	7.6
1	4102	1	3194	**1A**	1,2	-3.07	-0.41	59	6.9	7.8	**3.0**	**3.0**	40	37	**EXCEPTION**: F40, Max g=-.62; F59, g=-.39	12.8
37	3669	37	1568	**37A X**	2	-4.00	-3.55	58	5.7	6.7	**5.8**	**6.7**	58	58		13.7
37	1008	36	4762	**37 X**	2	5.03	5.18	57	6.0	6.2	**6.3**	**6.5**	57	57		16.5
30	3183	29	4778	**30 X**	2	-2.00	-3.56	78	4.9	6.1	**4.7**	**5.9**	78	78	**EXCEPTION**: F59, g=-.32	5.0
10	3653	10	2001	**10 X**	1	-3.03	-4.33	68	5.3	5.7	**3.5**	**3.8**	61	61	**EXCEPTION**: F59, g=-.39	8.7
3	1013	3	322	**3A X**	2	-2.42	-0.19	68	7.5	7.7	**6.6**	**6.9**	64	64	**EXCEPTION**: F40, g=-.35	10.2

Totals: 27 route curves

Table 4.15 presents those curves between Blaine and Seattle that have a maximum safe limiting cant deficiency less than 6 inches. There are **11 route curves** that presently require speed regulation over this segment of track. **Table 4.16** shows the curves between Seattle and Portland that have a maximum safe limiting cant deficiency less than 6 inches. There are **20 route curves** that require speed regulation over this track segment.

Information pertaining to all curves between Blaine and Portland are presented in **Appendix B.**

4.5 RIDE QUALITY, TALGO COACH CAR

For operation of any vehicle at high speed (Track Class 6 and above), the Track Safety Standards, Subpart G, §213.333, require that the peak-to-peak lateral acceleration measured on the carbody in any one second time period should not exceed 0.5 g. A more stringent limit of 0.25 g peak-to-peak lateral acceleration within a one second window has been suggested in the past for passenger safety[4], and this same limit is often used by Amtrak for track maintenance purposes.

For the Talgo coach car, during all test runs between Portland and Blaine, the maximum peak-to-peak lateral acceleration within a one second window was measured to be 0.23 g; no measured peak-to-peak lateral accelerations exceeded the recommended passenger safety limit of 0.25 g, well within the vehicle/track interaction safety standards. The maximum vertical acceleration was measured to be 0.46 g peak to peak.

4.6 RIDE QUALITY, F40PH AND F59PH LOCOMOTIVES

As stated earlier, the Track Safety Standards require that the peak-to-peak lateral acceleration measured on the carbody in any one second time period should not exceed 0.5 g during operation of any vehicle at high speed (Track Class 6 and above). This limit was recommended to reduce the risk of very poor or unsafe ride quality. For the locomotives, it should be noted that, when a transient lateral acceleration exceeds the safety margin from vehicle overturn of 0.31 g, zero-to-peak, it is likely that the same acceleration event, peak-to-peak within a one second window, will also exceed the limit of 0.5 g.

During all test runs between Portland and Blaine, there were numerous instances where the peak-to-peak lateral acceleration measured on the carbody of the locomotives exceeded the 0.5 g level: 30 instances at 11 locations for the F40PH, 69 instances at 53 locations for the F59PH.

In the future, should the locomotives be operated at higher speeds (Track Class 6 and above), the governing or limiting criteria for safety will likely be the vehicle/track interaction limit of 0.5 g, peak-to-peak, rather than the vehicle overturn limit of 0.31 g, zero-to-peak.

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[4] *Railroad Passenger Ride Safety*, Rep. No. DOT-FRA/ORD-89/06, prepared for FRA ORD by ENSCO, R.P. Owings & P.L. Boyd, April 1989.

TABLE 4.15: CURVES WITH EXCEPTIONS AND/OR MAXIMUM SAFE CANT DEFICIENCIES LESS THAN 6 INCHES BETWEEN SEATTLE AND BLAINE

Curve Start		Curve End		Curve No.	Track No.	Average Curve Properties		Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD @ 79 mph Based On Avg. Cond.
MP	FT	MP	FT			Curvature (deg)	Xlevel (in)		Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
87	3189	87	1784	**87B**	1	6.60	3.86	48	6.6	7.2	**4.2**	**4.8**	42	42	**EXCEPTION**: F59, Max g=-.41	24.5
50	4920	50	3120	**50A**	1	1.98	3.99	72	3.1	4.2	**3.0**	**3.0**	72	66	**EXCEPTION**: F40, Max g=-.75; F59, Max g=-.68	4.5
50	2692	50	1541	**50**	1	-2.00	-3.08	76	4.9	6.2	**3.0**	**3.0**	66	59	**EXCEPTION**: F40, Max g=.43; F59, Max g=.40	5.5
49	306	48	4572	**49**	1	2.47	3.35	72	5.5	6.1	**3.7**	**4.4**	64	65	**EXCEPTION**: F40, Max g=-.38; F59, g=-.34	7.3
29	5031	29	2893	**29A**	1	-1.48	-0.75	68	3.9	4.7	**3.0**	**3.6**	61	59	**EXCEPTION**: F40, g=.36	5.6
22	3743	22	1235	**22A**	1	2.12	1.18	63	4.7	5.7	**3.0**	**3.7**	54	52	**EXCEPTION**: F40, g=-.39	7.9
21	5174	21	4234	**21A**	2	-4.20	-4.90	58	4.8	5.1	**4.3**	**4.6**	56	56	**EXCEPTION**: F40, g=.34	13.2
13	3152	13	1314	**13A**	1?	4.02	4.82	65	6.7	7.0	**3.4**	**3.7**	54	55	**EXCEPTION**: F40, g=-.44	12.5
11	1430	11	454	**11A**	2	4.17	5.22	62	5.8	6.2	**5.0**	**5.4**	60	60	**EXCEPTION**: F40, g=-.35	12.7
10	1261	10	137	**10A**	2	-4.10	-4.93	62	5.9	6.2	**5.4**	**5.6**	60	60	**EXCEPTION**: F40, g=.34	12.7
1	2106	1	1737	**1C**	2	1.87	1.12	37	0.6	0.6	**5.7**	**5.8**	73	71		6.9

Totals: 11 route curves

TABLE 4.16: CURVES WITH EXCEPTIONS AND/OR MAXIMUM SAFE CANT DEFICIENCIES LESS THAN 6 INCHES BETWEEN SEATTLE AND PORTLAND

Curve Start		Curve End		Curve No.	Track No.	Average Curve Properties		Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD @ 79 mph Based On Avg. Cond.
MP	FT	MP	FT			Curvature (deg)	Xlevel (in)		Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
122	4762	122	2148	**122**	1,2	1.92	0.84	69	5.5	6.3	**3.0**	**3.0**	54	48	**EXCEPTION:** F40, Max g=.49	7.4
94	3595	94	2291	**94A**	2	-2.65	-3.91	72	5.6	6.2	**4.4**	**5.1**	68	68	**EXCEPTION:** F40, g=-.36	7.5
89	2349	88	5074	**89**	1	-2.97	-5.00	74	6.2	6.9	**3.0**	**3.0**	63	60	**EXCEPTION:** F59, g=-.59; F40, g=-.55	7.8
87	1583	86	4445	**87**	2	2.97	3.52	72	6.9	7.3	**3.8**	**4.2**	60	60	**EXCEPTION:** F40, Max g=.43	9.2
80	3996	80	2877	**81A**	1	-3.05	-4.51	72	6.4	6.8	**3.5**	**4.0**	62	62	**EXCEPTION:** F40, g=-.42	8.6
71	3537	71	1900	**71A**	2	-1.98	-1.41	71	5.5	6.1	**3.0**	**3.0**	57	53	**EXCEPTION:** F40, g=-.46	7.1
71	1631	70	4683	**71**	2	1.93	1.32	73	5.8	6.5	**3.0**	**3.0**	57	52	**EXCEPTION:** F40, Max g=.57	7.0
69	2935	69	818	**69**	1,2	2.92	5.28	77	6.6	7.3	**3.0**	**3.0**	64	62	**EXCEPTION:** F40, Max g=.49	7.3
62	2919	62	1673	**62**	2	3.00	4.94	72	5.8	6.1	**3.2**	**3.5**	63	63	**EXCEPTION:** F40, Max g=.41	8.0
54	955	54	311	**54**	1	-1.53	-0.77	66	3.8	4.2	**4.8**	**5.2**	73	72		5.8
53	4414	53	3960	**53A**	1	-1.47	-1.00	72	4.2	4.9	**3.2**	**4.0**	65	65	**EXCEPTION:** F59, g=-.36	5.3
51	3764	51	2893	**51A**	1	-1.95	-3.84	79	4.5	4.9	**3.4**	**3.7**	73	74	**EXCEPTION:** F40, g=-.36	4.5
25	3141	25	533	**25A**	1	-3.03	-4.83	72	6.0	6.8	**3.0**	**3.0**	61	59	**EXCEPTION:** F40, Max g=-.63; F59, Max g=-.46	8.2
24	512	23	4546	**24**	1	-3.38	-4.58	69	6.5	7.4	**3.1**	**4.0**	57	58	**EXCEPTION:** F40, Max g=-.44; F59, Max g=-.37	10.0
15	4340	15	3305	**15B**	1	-2.22	-2.69	67	4.2	4.8	**3.0**	**3.0**	61	57	**EXCEPTION:** F40, Max g=-.84; F59, g=-.70	6.8
15	1346	14	4213	**15**	1	-3.05	-3.15	70	7.1	7.4	**3.7**	**4.0**	57	56	**EXCEPTION:** F40, Max g=-.44	10.0
10	4366	10	2629	**10A**	2	2.92	4.91	75	6.4	6.8	**5.0**	**5.3**	70	70	**EXCEPTION:** F40, g=.37	7.6
1	4102	1	3194	**1A**	1,2	-3.07	-0.41	59	6.9	7.8	**3.0**	**3.0**	40	37	**EXCEPTION:** F40, Max g=-.62; F59, g=-.39	12.8
30	3183	29	4778	**30 X**	2	-2.00	-3.56	78	4.9	6.1	**4.7**	**5.9**	78	78	**EXCEPTION:** F59, g=-.32	5.0
10	3653	10	2001	**10 X**	1	-3.03	-4.33	68	5.3	5.7	**3.5**	**3.8**	61	61	**EXCEPTION:** F59, g=-.39	8.7

Totals: 20 route curves

5.0 DISCUSSION OF RESULTS

Test runs were conducted over Pacific Northwest Corridor track between Portland, OR and Blaine, WA to assess the vehicle/track interaction response of a Talgo train consisting of 13 cars, one F40PH locomotive, and one F59PH locomotive.

Repeated runs over two (2) special curves, instrumented on the wayside to measure point loadings, indicated the following:

- The lateral to vertical force ratio (L/V) on any wheel of any vehicle within the trainset at these instrumented locations **never exceeded 0.6** for cant deficiencies up to **8 inches.**
- **Low rail wheels** of the **Talgo coach cars unloaded** approximately **47% under dynamic conditions at 8 inches cant deficiency** while the low rail wheels of **both locomotives unloaded** approximately **56% at 8 inches cant deficiency.**

Mainline testing was performed at cant deficiencies up to 8 inches over the more than 382 curves within the corridor. Carbody accelerations on each locomotive and on a coach car were measured continuously to indicate wheel unloading. Accelerations were compared to safety thresholds for steady-state and transient events. The following observations were made:

- In all cases, the locomotives reached acceleration safety limits before the Talgo coach car.
- Safety criteria were met at speeds which produced **7 inches** of cant deficiency in **all but 44 curves.** The limited curves are distributed throughout the test zone and are listed in **Tables 4.13** and **4.14.**
- Safety criteria were met at speeds producing **6 inches** of cant deficiency in **all but 31 curves.** The limited curves are distributed throughout the test zone and are listed in **Tables 4.15** and **4.16.**

APPENDIX A

CURVE DATA AND PROPOSED CURVING SPEEDS FOR TALGO TRAIN TESTING

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ■ Test Not Required ▩ Maximum Unbalance < 4"

	SPEED LIMIT		PROP. REV.	EXISTING			Super	UNBALANCED SPEEDS per Existing Geometry						Max.	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	unb (in.)	COMMENTS
0.00															**Seattle Station**
	30	53	50	0	4	18	1.50	39	43	46	50	53	56	7	Begin Tunnel MP 0.15
	30	54	50	0A	4	12	1.50	39	43	47	51	54	57	7	End Tunnel MP 1.11
1.10															
	30	37	35	1	4	12	1.20	38	42	46	49	53	56	3	Muni. Speed Restriction
	30	37	35	1A	8	24	1.10	26	29	32	35	37	39	7	
	30	38	35	1B	5	12	1.60	36	39	43	46	49	51	4	
	30	38	35		6	12	1.20	31	35	38	41	43	46	5	
	30	38	35	1C	2	24	1.80	53	59	64	68	72	76	1	
1.46	30	38	35	BATTERY ST.				31	35	38				5	GRADE XING PROTECTION
1.51	30	38	35	WALL ST.				31	35	38				5	GRADE XING PROTECTION
	30	37	35	1D	4	0	0.75	37	41	45	49	53	56	3	
1.57	30	65	60	VINE ST.				48	54	60	65			6	GRADE XING PROTECTION
1.60															
1.77	40	65	60	BROAD ST.				48	54	60	65			6	GRADE XING PROTECTION
	40	65	60	1E	2	18	0.75	48	54	60	65	69	74	6	
3.00															
	20	20	20												2 trks to 1, MP 3.42, Hand throw t.o, 20mph,
3.30															Galer St. Interlocking
	40	52	50	3	5	18	3.00	40	43	46	49	52	54	7	
4.40															
	30	52	50	4	4	48	2.20	39	43	46	49	52	55	7	
	30	52	50		1	45	1.00	57	64	70	76	81	86	2	
	30	51	50		2	15	1.10	51	57	62	67	72	76	3	
5.40															1 trk to 2, MP 5.42, No.20 lh t.o's, 30mph,
	30	55	40	5	1	36	1.00	60	67	73	79	85	90	2	diverging mvmt only (to/from trk 1)
5.90															
	30	43	40	6	6	0	0.70	30	33	37	40	43	46	7	
	30	41	40		5	25	1.50	34	38	41	44	47	50	5	
6.40															
	20	20	20	6A	4	18	1.70	40	44	47	51	54	57	0	Drawbridge: 20 mph MP 6.4-MP 6.6; ex. se 1.7"-3"
6.60															
	35	35	35	6B	3	12	3.20	53	57	61	64	67	71	0	
	35	35	35	7	2	0	0.75	52	58	64	69	74	79	1	2 trks to 1, MP 7.39, No.20 lh t.o, 35mph,
	35	35	35	7A	1	30	0.75	60	67	74	80	86	91	1	diverging mvmt only (to/from trk 2)
7.70															

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ▨ Test Not Required ▨ Maximum Unbalance < 4"

MP	SPEED LIMIT EXIST.	SPEED LIMIT TEST	PROP. REV. SPEED	EXISTING CURVES NO.	EXISTING CURVES DEG	EXISTING CURVES MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
	35	35	35												1 trk to 2, MP 7.73, No.20 equil. t.o, 35mph
7.90															
	45	59	55	8	3	6	1.50	46	50	55	59	63	66	6	
	45	58	55	8A	5	36	5.00	45	48	51	53	55	58	8	
	45	58	55		4	18	3.00	45	48	52	55	58	60	7	
	45	58	55		2	0	0.90	53	59	66	70	75	80	4	
8.80															
	50	60	60	9	1	6	0.75	70	79	86	94	100	107	2	
9.70															
	50	63	60	10	4	18	3.90	48	51	54	57	60	63	8	
	50	63	60	10A	4	18	4.30	49	53	56	58	61	64	8	M/W MP 10.8-30.5 Trk 2 UC6 8/1-8/12
	50	63	60	10B	1	14	0.75	66	74	82	88	95	101	3	M/W MP 10.8-30.5 Trk 1 UC6 8/13-8/22
	50	63	60		1	30	0.75	60	67	74	80	86	91	3	
	50	63	60		4	18	4.00	48	52	55	58	60	63	8	
	50	63	60	11	4	18	3.80	48	51	54	57	60	63	8	
	50	63	60		2	3	1.00	53	59	65	70	75	79	5	
	50	63	60	11A	4	30	4.50	49	52	55	58	60	63	8	
11.30															
	50	73	70	11B	3	3	3.30	54	58	62	66	69	73	8	
	55	73	70	11C	1	45	0.60	54	61	68	73	79	84	6	
	55	73	70	12	2	12	1.40	53	59	64	69	74	78	7	
12.60															
	50	63	60	12A	3	54	4.90	54	57	60	63	66	69	6	
	50	64	60	13	2	54	3.25	55	60	64	68	71	74	5	
13.20															
	50	62	60	13A	4	12	4.20	49	53	56	59	62	64	7	
	50	65	60	13B	1	12	0.75	67	76	83	90	96	102	3	
	50	63	60	14	1	36	0.75	58	65	72	78	83	88	4	
	50	63	60	14A	4	12	4.50	51	54	57	60	63	65	7	
	50	64	60	15	4	18	4.50	50	53	56	59	62	64	8	
	50	64	60	15A	3	12	2.10	48	52	56	60	64	67	7	
15.80															
	35	35	35												2 trks to 1, MP 15.87,No.20 equil. t.o, 35mph
16.00															
	50	52	50	16	1	15	0.75	65	74	81	88	94	100	2	
16.70															

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

░ Grade Crossing Protection Required ▓ Test Not Required ▒ Maximum Unbalance < 4"

	SPEED LIMIT		PROP. REV.	EXISTING CURVES			Super	UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
	45	52	50	17	5	12	3.80	43	46	49	52	54	57	6	
17.00															Edmonds Station MP 17.55
17.43	60	52	79	DAYTON ST.				62	68	72	77			6	GRADE XING PROTECTION
	60	79	79	17A	2	6	2.70	62	68	72	77	81	86	6	Muni. Speed restriction 60 mph, MP 17.05-MP 20.0,
17.67	60	79	79	MAIN ST.				62	68	72	77			6	GRADE XING PROTECTION
	60	79	79	18	1	6	0.70	69	78	86	93	100	106	4	2 grade Xings
	60	79	79	18A	1	5	0.70	70	79	87	94	101	107	4	1 trk to 2, MP 17.8, No. 20 rh t.o, 30mph,
	60	79	79	18B	0	30	0.75	104	116	128	139	149	158	1	diverging mvmt only (to/from trk 2)
	60	79	79	19	0	54	0.75	77	87	96	104	111	118	3	
20.00															
	50	62	60	20	2	51	1.75	49	54	58	62	66	70	6	Muni. Speed Restriction
	50	62	60		4	0	3.60	49	52	55	59	62	64	7	
	50	61	60	20A	4	24	3.40	46	49	52	55	58	61	8	
20.50															
	50	60	60	20B	1	12	0.75	67	75	83	90	96	102	2	
	50	50	60	21	1	12	0.75	67	75	83	90	96	102	1	
21.80															
	50	63	60	21A	4	30	4.50	49	52	55	58	60	63	8	
	50	61	60	22	4	48	4.50	47	50	53	56	59	61	8	
22.18	50	61	60	PED. XING				47	50	53	56	59	61	8	GRADE XING PROTECTION
22.20															
	50	63	60	22A	2	12	1.10	52	58	63	68	73	77	5	
	50	62	60	23	2	42	2.00	51	56	61	65	69	73	5	
	50	62	60		2	36	2.00	52	57	62	66	70	74	5	
23.10															
	50	62	60	23A	4	12	4.10	49	52	56	59	61	64	7	
	50	62	60	24	0	30	0.75	104	116	128	139	149	158	1	
24.21	50	62	60	PED. XING				48	51	54	57	60	62	8	GRADE XING PROTECTION
	50	62	60	24A	4	30	4.30	48	51	54	57	60	62	8	
	50	62	60	24B	3	24	2.20	47	51	55	59	62	65	7	
	50	62	60	25	4	11	4.00	49	52	55	58	61	64	7	
	50	60	55	25A	4	30	3.50	45	49	52	55	58	60	8	
25.40															Muni. Speed Restriction
	55	62	60	25B	3	8	4.50	58	62	66	69	72	75	4	
	55	63	60	25C	3	0	3.35	55	59	63	67	70	74	5	
25.90															

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ▨ Test Not Required ▨ Maximum Unbalance < 4"

	SPEED LIMIT		PROP. REV.	EXISTING CURVES				UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	Super -elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
	60	63	60	26	3	6	4.50	59	63	66	70	73	76	4	
	60	62	60	26A	2	48	3.50	58	62	66	70	73	77	4	
	60	62	60	26B	1	17	0.60	63	72	79	86	92	98	3	
	60	63	60	26C	2	12	2.10	58	63	68	73	77	81	4	
26.90															
	45	45	45	27	2	0	1.00	53	60	65	71	76	80	2	2 trks to 1, MP 27.05, No. 20 equil. t.o, 45mph
	45	45	45	27A	1	45	1.00	67	64	70	76	81	86	1	1 trk to 2, MP 27.84, No. 20 equil. t.o, 45mph
27.90															
	45	58	55	28	3	20	0.75	40	45	50	54	58	61	7	
28.40															
28.86	55	69	70	PARK ST.				40	45	50	54	58		7	GRADE XING PROTECTION
	55	71	70	29	0	36	0.75	94	106	117	127	136	144	1	
	55	71	70	29A	1	30	1.25	64	71	77	83	89	94	4	
30.20															
	55	73	70	30	3	12	4.10	56	60	64	67	70	73	8	
	55	67	65	30A	3	45	4.75	54	58	61	64	67	70	7	
30.50															
	55	69	65	31	1	31	1.00	61	69	75	81	87	92	4	
	55	69	65	32	0	30	0.75	104	116	128	139	149	158	1	
32.10															Milepost break
1784.70															
	25	67	65	1784B	2	30	0.75	46	52	57	62	67	71	7	2 trks to 1 MP 32.16, No.20 lh t.o, 25mph trk 1 only
	25	67	65	1784A	1	12	0.75	67	75	83	90	96	102	3	
	25	72	65	1784	1	30	0.50	58	65	72	79	85	90	5	**Everett Station MP 1783.87**
1783.80															
	25	43	40	1783A	6	0	0.75	30	34	37	40	43	46	7	
1783.20															
	25	25	35	1783	10	14	3.00	29	31	33	35	37	39	1	P.A. JCT.
1782.70															Curve 25 near station and x-overs
	15	15	15												3 No.11 t.o.'s MP 1782.51, 15mph
1782.60															
0.00															Milepost break
	30	36	35	0	9	48	2.75	29	31	34	36	38	40	6	
	30	36	35		9	30	2.75	29	32	34	36	38	40	6	
	30	36	35	0A	3	12	0.75	41	46	51	55	59	63	2	
	30	36	35		6	12	0.75	29	33	36	39	42	45	5	

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ▨ Test Not Required ▨ Maximum Unbalance < 4"

			PROP.	EXISTING				UNBALANCED SPEEDS						Max.	
	SPEED LIMIT		REV.	CURVES			Super	per Existing Geometry						unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
0.80															Curve 0B replaced w/ No. 20 t.o.
8.00															Milepost break
	25	25	35	**8**	3	48	1.25	40	44	48	52	56	59	0	
	35	37	35	**8A**	8	24	1.00	26	29	32	35	37	39	7	
	35	48	45	**8B**	6	0	2.50	36	39	42	45	48	50	7	
	35	46	45	**8C**	4	36	1.75	38	42	46	49	52	65	5	
8.50	35	46	45	PVT. XING				38	42	46				5	GRADE XING PROTECTION
	35	46	45	**"8D"**	1	36	0.75	58	65	72	78	83	88	2	Original Curve 8E Removed
	35	48	45	**"8E"**	4	20	0.00	31	36	41	44	48	51	7	Curves "8D, "8E", "8F" are new.
	35	46	45	**"8F"**	0	48	0.75	82	92	101	110	118	125	0	
	35	46	45	**9**	3	12	0.75	41	46	51	55	59	63	4	
	35	46	45	**9A**	2	0	0.75	52	58	64	69	74	79	2	
9.60															Approach signal in yard limits: restricted speed 1 mi.,
	35	35	45	**9B**	1	12	0.00	60	69	77	85	91	98	1	Northbound only
10.60															
	10	10	20	**"10"**	9	12	0.75	24	27	30	32	35	37	0	Curves not numbered on trk chart
	10	10	20	**"10A"**	12	0	0.75	21	24	26	28	30	32	0	
37.00															**DELTA JCT.**
	10	10	10												Drawbridge MP 37.06, 10mph
37.20															
	35	35	35												Muni. Speed Restriction, Marysville
37.70															
	20	20	20	**38**	1	18	0.75	64	72	79	86	92	98	0	37.8 2 drawbridges
38.70															
	50	50	50												Muni. Speed Restriction, Marysville
41.00															
	79	79	79	**41**	1	35	4.00	79	85	90	95	100	104	3	
	79	79	79	**43**	1	10	2.20	80	87	94	100	106	112	3	
	79	79	79	**46**	0	32	0.75	100	113	124	134	144	153	2	
	79	79	79	**47**	1	5	1.75	79	87	94	101	107	113	3	
47.90															
	70	79	79	**48**	2	9	4.50	71	75	79	84	87	91	5	
48.37	70	79	79	SILL RD.				71	75	79				5	GRADE XING PROTECTION
48.81	60	74	79	212TH. ST. NW				56	60	64	67	71	74	7	GRADE XING PROTECTION
48.90															
	60	71	70	**49**	3	0	3.50	56	60	64	67	71	74	7	

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ■ Test Not Required ▩ Maximum Unbalance < 4"

MP	SPEED LIMIT EXIST.	SPEED LIMIT TEST	PROP. REV. SPEED	EXISTING CURVES NO.	EXISTING CURVES DEG	EXISTING CURVES MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
	60	72	70	49A	2	48	4.10	60	64	68	72	75	79	6	
49.50															
49.93	65	79	79	SATHER RD.				62	67	72	76			7	GRADE XING PROTECTION
50.17	65	79	79	227TH. ST. NW				62	67	72	76			7	GRADE XING PROTECTION
	65	79	79	50	2	12	3.00	62	67	72	76	81	85	7	
	65	79	79	50A	2	36	4.00	62	66	70	74	78	81	7	
51.00															
	79	79	79	55	1	0	1.80	83	91	99	106	112	118	3	
	79	79	79	57	1	0	1.90	84	92	99	106	113	119	2	
	79	79	79	61	0	30	0.75	104	116	128	139	149	158	1	Mount Vernon Station MP 66.8
	79	79	79	67	1	12	3.50	88	94	101	106	112	117	2	
67.90															
67.95	50	61	60	GATES ST.				49	53	57	61			7	GRADE XING PROTECTION
	50	63	60	68	3	30	3.00	49	53	57	61	64	67	7	Muni. Speed Restriction 50mph Mt. Vernon
	50	63	60	68A	4	6	4.50	51	54	58	60	63	66	7	
68.67	50	63	70	FIR ST.				51	54	58	60	63		7	GRADE XING PROTECTION
68.83	50	63	70	RIVERSIDE ST.				51	54	58	60	63		7	GRADE XING PROTECTION
69.28	50	73	70	COLLEGE ST.				50	57	63	68	73		7	GRADE XING PROTECTION
69.00															
	50	73	70	69	2	5	0.70	50	57	63	68	73	77	7	
69.83	50	73	70	HOAG RD.				50	57	63	68	73		7	GRADE XING PROTECTION
	50	72	70	70	2	12	1.00	51	57	62	67	72	76	7	
70.40															
	79	79	79												
74.50															
	45	51	50	74	5	30	4.10	43	46	49	51	54	56	6	
74.80															
	79	79	79												
76.50															
	60	73	70	76	3	12	5.00	60	63	67	70	73	76	7	
76.70															
	79	79	79	82	1	31	3.50	78	84	89	95	99	104	3	
82.50															
	40	46	45	82A	7	0	4.30	39	41	44	46	48	50	6	
	40	47	45	83	3	15	1.00	42	47	61	55	59	63	4	

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ▨ Test Not Required ▨ Maximum Unbalance < 4"

MP	SPEED LIMIT		PROP. REV.	EXISTING CURVES			Super	UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
83.12	40	45	45	PVT. XING				45 MPH MAX. THROUGH XING NO PROTECTION REQUIRED							
	40	47	45	84	6	30	3.90	39	42	44	47	49	51	6	
	40	47	45	84A	5	30	3.50	41	44	47	50	52	55	5	
	40	46	45	84B	4	0	1.00	38	42	46	50	53	57	5	
	40	46	45	85	8	0	5.00	38	40	42	44	46	48	7	
85.05															
	45	57	55	85A	2	0	0.50	50	57	63	68	73	78	4	
	45	56	55	85B	2	12	0.75	49	56	61	66	71	75	4	
	45	56	55	85C	1	12	0.75	67	75	83	90	96	102	2	
85.50															
	45	56	55	86	4	18	2.60	43	47	50	53	56	59	7	
	45	52	50	86A	5	2	2.64	40	43	47	50	52	55	7	
	45	60	55	86B	2	22	0.90	49	54	60	65	69	73	5	
	45	59	55	87	2	0	0.80	52	59·	64	70	75	79	4	
87.20															
	40	46	45	87A	7	44	4.54	37	40	42	44	46	48	7	
	40	47	45	87B	7	0	3.70	37	40	42	44	47	49	7	
87.67	40	47	45	COVE RD.				37	40	42	44	47		7	GRADE XING PROTECTION
	40	48	45	87C	4	12	1.70	40	44	48	51	54	57	5	
	40	47	45	88	6	30	4.00	39	42	44	47	49	51	6	
88.30															
88.47	45	56	55	PVT. XING				45	48	51	54	56		7	GRADE XING PROTECTION
	45	56	55	89	5	12	4.50	45	48	51	54	56	59	7	
89.39	45	56	55	YACHT CLUB RD.				45	48	51	54	56		7	GRADE XING PROTECTION
	45	59	55	89A	2	12	0.75	49	56	61	66	71	75	5	
	45	52	55	90	1	30	0.90	61	68	75	81	87	92	2	
90.45															
	40	52	50	90A	6	12	3.80	40	42	45	48	50	52	8	
	40	52	50	90B	6	30	4.20	40	42	45	47	50	52	8	
	40	53	50	91	4	12	1.20	38	42	46	49	53	56	7	
	40	51	50	91A	4	45	2.50	41	44	47	51	53	56	6	
	40	52	50	92	6	24	4.00	40	42	45	47	50	52	8	
	40	53	50	92A	4	36	2.10	40	44	47	50	53	56	7	
	40	51	50	93	5	30	3.00	39	43	46	48	51	53	7	**Bellingham Station MP 93.36**
93.60															
	35	35	35	93A	8	48	4.00	34	36	38	40	42	44	4	

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ■ Test Not Required ▨ Maximum Unbalance < 4"

	SPEED LIMIT		PROP. REV.	EXISTING CURVES			Super	UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
	35	35	35	**93B**	5	30	1.90	36	39	42	45	48	51	3	
	35	35	35	**94**	6	36	2.20	34	37	39	42	45	47	3	
	35	35	35	**94A**	1	0	0.75	73	82	91	98	105	112	0	
	35	35	35	**94B**	2	48	0.75	44	49	54	59	63	67	2	
	35	35	35	**96**	6	18	2.30	35	38	41	43	46	48	3	
	35	35	35	**96A**	7	30	2.25	32	35	37	40	42	44	4	
	35	35	35	**96B**	2	54	0.75	43	48	53	58	62	66	2	
	35	35	35	**96C**	3	36	0.75	39	43	48	52	55	59	2	
96.70															
	20	20	20	**97**	6	30	0.50	28	31	35	38	41	43	1	Mainline through GP paper plant; 20mph restriction
97.05															
	45	45	45	**97A**	2	48	1.00	45	51	55	60	64	68	3	97.1-100.2 Revenue 55mph, test next higher
	45	45	45		2	0	0.50	50	57	63	68	73	78	2	
	45	60	55	**98**	1	10	0.75	68	76	84	91	97	104	2	
	45	56	55	**98A**	3	0	1.60	47	52	56	60	64	68	5	
	45	59	55	**99**	3	30	1.50	43	47	52	55	59	62	7	
	45	57	55	**99A**	4	48	3.10	43	46	49	52	55	57	8	
	45	57	55	**99B**	0	36	0.75	94	106	117	127	136	144	1	
	45	57	55	**100**	3	48	2.60	46	50	53	57	60	63	6	
100.15															
	40	51	50	**100A**	7	0	4.70	40	42	44	47	49	51	8	
100.27	40	51	50	**CLIFFSIDE DR.**				40	42	44	47	49	51	8	GRADE XING PROTECTION
	40	51	50	**100B**	6	42	4.10	39	42	44	46	49	51	8	
	40	52	50	**100C**	6	36	4.50	40	43	45	48	50	52	8	
	40	52	50	**101**	5	0	2.30	39	42	46	49	52	54	7	
101.05	40	52	50	**WYNN RD.**				39	42	46	49	52		7	GRADE XING PROTECTION
101.10															
	55	68	65	**101A**	3	18	3.75	54	58	62	65	68	71	7	
101.63	55	69	65	**COUNTRY LANE**				54	58	62	65	68	71	7	GRADE XING PROTECTION
	55	68	65	**102**	2	4	1.75	57	63	68	73	78	82	5	
	55	66	65	**103**	3	54	5.00	54	57	61	63	66	69	7	
103.14	55	66	65	**RURAL AVE.**				54	57	61	63	66		7	GRADE XING PROTECTION
103.40															
105.06	70	79	79	**HOVANDER RD.**				72	77					4	
	70	79	79	**105**	2	3	4.50	72	77	81	86	90	93	4	
105.80															

TALGO CURVE ANALYSIS

SEATTLE TO BLAINE

▨ Grade Crossing Protection Required ▨ Test Not Required ▨ Maximum Unbalance < 4"

	SPEED LIMIT		PROP. REV.	EXISTING CURVES				UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	Super -elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
	45	56	50	**106**	5	30	4.20	43	46	49	51	54	56	8	
106.01	45	56	50	**2ND. ST.**				43	46	49	51	54	56	8	GRADE XING PROTECTION
106.20															
	79	79	79												
108.30															Ferndale
	70	79	79	**108**	2	0	4.10	71	76	81	85	89	93	5	
108.60	70	79	79	**BROWN RD.**				71	76					5	GRADE XING PROTECTION
															END TEST
108.70															
	79	79													
118.20															
	50	76		118	2	42	3.00	56	61	65	69	73	76		
	50	68		118A	3	54	4.50	52	56	59	62	65	68		
	50	63		119	4	30	4.50	49	52	55	58	60	63		
	50	63			2	30	0.75	46	52	57	62	67	71		
	50	63			3	48	3.60	50	53	57	60	63	66		
	50	74		119A	2	36	2.00	52	57	62	66	70	74		Blaine MP 119.3 Customs Stop
	50	79		119B	1	48	1.00	56	63	69	75	80	85		USA-CANADA BORDER MP119.59

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ■ Test Not Required ▨

MP	SPEED LIMITS EXIST.	SPEED LIMITS TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
0.0X															**Seattle Station**
	20/20	20	20	**0**	6	30	1.00	30	33	36	39	42	44	1	Curve 0 is adjacent to Station. Incr. speed after Royal Brougham
	20/20	**44**	40	**0A**	6	18	0.50	28	32	35	38	41	44	8	Muni. Speed Restriction 20 mph, MP 0.0-MP 2.0, 5 Grade Xings
0.84X	20/20	**44**	40	**HOLGATE ST.**				28	32	35	38	41	44	8	GRADE XING PROTECTION
1.28X	20/20	**64**	60	**LANDER ST.**				44	49	54	58	62		8	GRADE XING PROTECTION
1.5X	20/20	**64**	60	**1**	2	56	0.90	44	49	54	58	62	66	8	*M/W MP 0.0X-12.1X Trk 1 TP31 7/10-7/18*
	20/20	**64**	60	**1A**	3	6	0.90	42	48	52	56	60	64	8	
1.66X	20/20	**64**	60	**HORTON ST.**				42	48	52	56	60	64	8	GRADE XING PROTECTION
1.85X	20/20	**64**	60	**SPOKANE ST. WB**				42	48	52	56	60	64	8	GRADE XING PROTECTION
1.86X	20/20	**64**	60	**SPOKANE ST. EB**				42	48	52	56	60	64	8	GRADE XING PROTECTION
2.0X															Muni. Speed Restriction 40 mph, MP 2.0-MP 3.4
	40/30	**58**	55	**2**	4	0	1.50	40	44	48	52	55	58	8	
	40/30	**66**	65	**3**	0	48	0.75	82	92	101	110	118	125	2	
	40/30	**69**	65	**3A**	2	30	0.40	44	50	56	60	65	69	8	
3.2X															
	40/30	**79**	79	**3B**	1	12	0.50	65	73	81	88	94	101	5	
3.4X															
	70/50	**79**	79	**3C**	0	30	0.80	104	117	129	139	149	159	1	
	70/50	**79**	79	**5**	1	48	4.00	75	80	85	89	93	98	4	Curve 5 is just north of Military Rd. Grade Xing.
5.3X	40/40	**79**	79												
5.27X	40/40	**79**	79	**MILITARY RD.**				75						4	GRADE XING PROTECTION
5.4X															
	70/50	**70**	79	**6**	0	48	0.50	79	90	99	108	116	123	2	
	70/50	**70**	79	**7**	1	6	1.75	79	86	94	100	107	113	2	
	70/50	**70**	79	**7A**	0	20	0.75	127	143	157	170	182	194	0	
	70/50	**70**	79	**8**	1	36	3.50	76	82	87	92	97	101	2	
	70/50	**73**	79	**8A**	1	36	3.90	78	84	89	94	99	103	2	
8.8X															
	55/45	**73**	70	**9**	3	10	3.71	55	59	63	66	70	73	8	
	55/45	**73**	70	**9A**	1	6	1.00	72	81	88	95	102	108	3	
	55/45	**73**	70	**10**	3	4	3.49	55	59	63	66	70	73	8	
10.7X															

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ▨ Test Not Required ▨

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
	75/50	75	79	12	0	24	0.60	113	128	141	154	165	175	1	Trk 1 only
	75/50	75	79	12A	0	18	0.60	131	148	163	177	190	202	1	Trk 1 only
	75/50	75	79	12B	1	18	4.00	88	94	99	105	110	115	1	
	75/50	75	79	13	0	30	0.75	104	116	128	139	149	158	1	Trk 2 only
	75/50	75	79	13A	0	30	0.75	104	116	128	139	149	158	1	Trk 2 only
	75/50	75	79	15	0	37	0.50	90	102	113	123	132	140	2	
15.5X															Muni. speed Restriction 40mph, MP15.9-MP17.2, 7 grade Xings.
	40/40	40	79	16	1	0	0.75	73	82	91	98	105	112	0	Trk. 1 only Skip 4" test, avoid Kent grade crossing protection.
	40/40	40	79	16A	1	0	0.75	73	82	91	98	106	112	0	Trk. 1 only Skip 4" test, avoid Kent grade crossing protection.
17.2X															
	75/50	75	79												
20.9X															
	40/40	40	79	21	0	15	0.75	146	165	181	196	210	224	0	Muni. Speed Restriction, Auburn
21.6X															
	79/50	79	79												
27.4X															
	65/50	79	79	27	2	0	3.81	70	75	79	84	88	92	5	Muni. Speed Restriction 65 mph, MP 28.0 - MP 28.5, 2 Grade Xings
28.0X															
	65/40	65	79												4 Grade Xings, no curves.
28.5X															
	65/50	79	75	30	2	24	2.94	59	64	69	73	77	81	8	Muni. Speed Restriction 30 mph, MP 30.65 - MP 32.8, 7 Grade Xings
30.5X															
	30/30	75	79												
32.8X															
	75/30	75	79												
33.4X															
	75/50	75	79												
34.4X															
	45/45	63	60	34	4	30	4.50	49	52	55	58	60	63	8	
34.6X															
	65/60	65	65	35	2	30	4.44	65	69	73	77	81	84	3	
36.4X															

TALGO CURVE ANALYSIS

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▨ Grade Crossing Protection Required ■ Test Not Required ■

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (In.)	COMMENTS
	45/40	60	60	36	4	12	4.19	49	53	56	59	62	64	6	
	45/40	59	55	37	5	4	4.44	46	49	52	54	57	59	8	
	45/40	60	55	37A	4	2	4.19	50	54	57	60	63	66	6	
37.8X															
	30/30	43	40	38	6	9	1.00	30	34	37	40	43	46	7	
	30/30	43	40	38A	2	0	0.94	53	59	65	70	75	80	2	
	30/30	42	40	38B	6	10	1.75	33	36	40	42	45	48	6	
39.7X															Tacoma Station MP 39.3
	10/10	33	30	39	10	6	0.75	23	26	29	31	33	35	7	
	10/10	34	30	39A	9	51	0.75	23	26	29	31	34	36	7	
0.00															Milepost break
	30/30	53	50	0	4	30	1.25	37	41	45	48	51	54	8	*M/W MP 0.0-132.99 Trk S T208 TP31 7/21-7/29*
	30/30	53	50	0A	4	0	0.75	37	41	45	49	53	56	7	
	30/30	54	50	0B	2	30	1.25	49	55	60	64	69	73	4	
	30/30	54	50	0C	2	0	0.50	50	57	63	68	73	78	4	
	30/30	54	50	1	3	50	0.75	37	42	46	50	54	57	7	
1.60															
	30/30	65	60	1A	3	0	0.75	42	48	52	57	61	65	8	
	30/30	65	60	1B	2	18	1.00	50	56	61	66	70	75	6	Temco Grain
	30/30	65	60	2	2	24	1.25	50	56	61	66	70	74	6	
	30/30	64	60	2A	3	1	0.75	42	47	52	57	61	64	8	
	30/30	64	60	2B	1	0	1.40	79	88	96	103	110	116	1	
	30/30	62	60	2C	2	42	1.25	47	53	58	62	66	70	6	
2.60															
	30/30	62	70												
2.80															
	50/50	74	70	3	3	0	3.50	56	60	64	67	71	74	8	
	50/50	74	70	3A	1	0	0.75	73	82	91	98	105	112	3	
	50/50	74	70	4	2	48	3.10	56	60	64	68	72	75	8	
	50/50	74	70	4A	1	15	0.75	65	74	81	88	94	100	4	
5.10															
	40/40	40	40												No. 20 Equilateral turnout: 2 trks to 1

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ▩ Test Not Required ▩

	SPEED LIMITS		PROP. REV.	EXISTING CURVES			Super	UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
	40/40	63	60	5B	2	35	2.20	54	59	63	67	71	75	5	
	40/40	64	60		2	31	2.20	54	59	64	68	72	76	5	2 Tunnels Nelson Bennett
	40/40	64	60		2	10	2.20	59	64	69	74	78	82	4	
	40/40	64	60		1	0	1.50	80	89	96	104	110	116	1	
	40/40	64	60	6	3	0	2.50	51	56	60	64	67	71	6	
	40/40	40	40												No. 20 Equilateral turnout: 1 trk to 2
6.50															*M/W MP 6.7-48.1 Trk 1 UC6 7/25-7/30*
	60/50	79	79	7	2	12	2.60	60	65	70	75	79	83	7	*M/W MP 6.7-46.0 Trk 1 SB1 7/28-8/8*
	60/50	79	79	7A	2	0	3.90	70	75	80	84	88	92	5	*M/W MP 6.7-46.0 Trk 2 SB1 8/11-8/22*
	60/50	79	79	8	2	0	3.25	67	72	77	81	86	90	5	*M/W MP 8.1-8.4 Trk 2 UC6 7/31*
	60/50	79	79	9	2	0	2.80	64	70	75	79	84	88	6	
9.50															
	35/35	65	60	9A	3	0	1.00	44	49	53	58	62	65	8	Muni speed restriction MP 9.5-10.3, 2 Grade Xings.
9.75	35/35	66	60	6TH AVE.				44	49	53	58	62	65	8	GRADE XING PROTECTION No Const. Warning Titlow
10.06	35/35	79	75	S. 19TH ST.				44	49	53	58	62	65	8	GRADE XING PROTECTION No Const. Warning Titlow
10.30															
	60/50	77	75	10	3	0	4.56	60	64	67	71	74	77	8	
	60/50	77	75	10A	3	0	4.56	60	64	67	71	74	77	8	
10.80															
	70/50	70	79	11	1	4	1.50	78	86	93	100	107	113	2	
	70/50	70	79	12	1	0	1.00	76	85	93	100	107	113	2	Skip 4" test, avoid grade crossing protection 4 ped. xings
13.20															
	60/50	74	70	13	2	45	3.40	58	62	66	70	74	77	7	
	60/50	60	70	13A	2	15	2.50	59	64	69	73	78	82	3	No Test: Near Drawbridge
14.00															
	40/30	40	40	14	3	15	3.00	51	55	59	63	66	70	1	
14.20															
	30/30	30	30												Drawbridge MP 14.25 30 mph
14.30															
	50/50	50	65	14A	2	0	2.80	64	70	76	79	84	88	1	Muni. speed restriction 50mph MP 14.3-MP15.9, 2 Grade Xings.
	50/50	68	65	15	3	12	2.40	49	53	57	61	65	68	8	No test Cv. 14A: Near drawbridge
14.94	50/50	73		PVT. XING				49	53	57	61	65	68	8	GRADE XING PROTECTION Xing in Cv. 15

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required

■ Test Not Required

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MP	SPEED LIMITS EXIST.	SPEED LIMITS TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
	50/50	73	70	**15A**	3	0	3.25	55	59	63	66	70	73	8	
	50/50	75	70	**15B**	2	18	3.00	61	66	70	75	79	83	6	Steilacoom
15.72	50/50	75	70	**UNION AVE.**				61	66	70	75			6	GRADE XING PROTECTION PER WUTC
15.90															
	60/50	71	70	**16**	3	0	4.56	60	64	67	71	74	77	6	
	60/50	73	70	**17**	3	20	4.50	57	60	64	67	70	73	8	
	60/50	72	70	**17A**	2	0	2.25	61	67	72	77	81	86	5	
	60/50	73	70	**17B**	1	40	2.25	67	73	79	84	89	94	4	
	60/50	73	70	**17C**	3	0	4.25	59	63	66	70	73	76	7	
	60/50	71	70	**18**	3	0	4.56	60	64	67	71	74	77	6	
18.58	60/50	72	70	**KETRON-SOLO PT. RD.**				53	58	62	65	69	72	8	GRADE XING PROTECTION No Constant Warning
	60/50	72	70	**19**	3	0	3.00	53	58	62	65	69	72	8	
	60/50	79	75	**19A**	2	30	4.00	63	68	72	76	79	83	7	
	60/50	79	75	**19B**	2	30	3.75	62	67	71	75	78	82	7	
19.90															
	70/50	79	79	**20**	1	24	3.10	79	85	91	96	102	106	3	
	70/50	79	79	**20A**	2	0	4.00	71	76	80	85	89	93	5	
	70/50	79	79	**20B**	1	20	2.75	78	85	91	97	102	107	3	
	70/50	76	79	**21**	2	0	4.00	71	76	80	85	89	93	4	
	70/50	70	79	**21A**	1	0	1.80	83	91	99	106	112	118	2	
21.90															
	60/50	73	70	**22**	3	12	4.75	59	63	66	69	72	76	7	
	60/50	73	70	**22A**	2	0	2.50	63	68	73	78	82	87	5	
	60/50	73	70	**22B**	3	12	5.00	60	63	67	70	73	76	7	
	60/50	73	70	**23**	2	12	2.75	61	66	71	75	80	84	5	
23.80															
	55/50	73	70	**24**	3	15	4.00	55	59	63	66	70	73	8	
	55/50	75	70	**24A**	3	0	3.75	57	61	65	68	72	75	8	
	55/50	75	70	**25**	3	0	3.75	57	61	65	68	72	75	8	
	55/50	74	70	**25A**	3	3	4.75	60	64	68	71	74	77	7	
25.60															
	79/50	79	79	**26**	1	0	1.80	83	91	99	106	112	118	3	

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▨ Grade Crossing Protection Required ▨ Test Not Required ▨

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
27.70															
	70/50	79	79	**28**	1	40	4.20	79	84	89	94	98	102	3	
28.10															
	79/50	79	79												**Olympia-Lacey Station MP 32.22**
33.80															
	70/50	79	79	**34**	1	54	4.90	77	82	86	91	95	98	3	
34.20															
	79/50	79	79												
36.20															
	70/50	79	79	**36**	2	3	4.75	73	78	82	87	90	94	4	
36.50															
	79/50	79	79												
41.40															
	70/50	79	79	**41**	1	54	4.90	77	82	86	91	95	98	3	
41.70															
	79/50	79	79	**42**	1	0	2.20	86	94	101	108	115	121	2	
46.00															Bucoda
	70/50	79	79	**46**	2	0	4.70	74	79	83	87	91	95	4	Muni. Speed Restriction 70mph MP 46.0-MP 47.0, 2 grade Xings
46.76	70/50	79	79	**W. 6TH ST.**				69	74	79					GRADE XING PROTECTION PER WUTC
46.82	70/50	79	79	**W. 7TH ST. (PED)**				69	74	79				5	GRADE XING PROTECTION
	70/50	79	79	**47**	1	58	3.60	69	74	79	84	88	92	5	
	70/50	74	79	**47A**	2	0	3.30	67	72	77	82	86	90	4	
47.70															
	60/50	74	70	**47B**	3	0	4.56	60	64	67	71	74	77	7	
47.90															
	79/50	79	79	**50**	0	44	0.88	87	97	107	116	124	131	2	
51.20															*M/W MP 51.2-132.99 Trk 2 TP31 7/30-8/4*
	60/50	78	75	**51**	2	50	4.14	60	64	68	72	75	78	8	
51.40															
	65/50	79	79	**51A**	2	0	3.90	70	75	80	84	88	92	5	
	65/50	79	79	**52**	1	45	2.30	66	72	77	82	87	92	5	
	65/50	79	79	**52A**	0	45	0.69	84	94	104	113	121	129	3	

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▨ Grade Crossing Protection Required ▨ Test Not Required ▨

MP	SPEED LIMITS EXIST.	SPEED LIMITS TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
	65/50	79	79	**53**	1	15	1.00	68	76	83	89	96	101	4	
53.10															
	65/40	79	79												
53.70															
	40/40	79	79	**53A**	1	36	1.10	61	67	74	80	85	90	6	Muni. Speed Restriction 40mph MP 53.7-MP 55.2, 7 grade Xings
	40/40	79	79	**53B**	1	0	0.60	72	81	89	97	104	111	4	
	40/40	79	79	**54**	1	30	1.00	62	69	76	82	87	93	6	**Centralia Station MP 54.01**
	40/40	79	79	**54A**	1	30	1.00	62	69	76	82	87	93	6	
55.20															
	65/40	79	79	**57**	1	0	0.75	73	82	91	98	105	112	4	
57.60															
	50/40	79	79												Muni. Speed Restriction 50mph, MP 57.6-MP 58.0, 3 Grade Xings
58.00															
	65/40	79	79												Main St. Grade Xing
58.10															
	75/40	79	79												
58.30															
	79/50	79	79	**59**	0	30	1.20	110	122	133	143	153	162	1	
	79/50	79	79	**60**	0	42	0.75	87	98	108	117	126	134	2	*M/W MP 60.5-117.9 Trk 2 UC6 7/3-7/24*
	79/50	79	79	**60A**	0	30	1.00	107	120	131	141	151	160	1	
	79/50	79	79	**61**	1	0	1.38	79	88	95	103	109	116	3	
62.20															
	60/50	78	75	**62**	3	0	4.80	61	65	68	72	75	78	8	
	60/50	79	75	**63**	3	0	5.00	62	65	69	72	76	79	8	
63.00															
	65/50	79	75	**63A**	1	10	1.94	78	85	92	99	105	110	3	
64.50															
	50/50	72	65	**65**	3	0	3.00	53	58	62	65	69	72	8	Muni. Speed Restriction 50mph, MP 64.5-MP 65.1, 1 Grade Xing
65.10															Napavine: Restriction lifted 7/9/97
	79/50	79	79	**67**	0	59	2.00	85	93	101	108	114	121	2	
69.10															
	60/50	77	75	**69**	3	0	4.56	60	64	67	71	74	77	8	

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▨ Grade Crossing Protection Required ▨ Test Not Required ▨

	SPEED LIMITS		PROP. REV.	EXISTING CURVES			Super	UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
69.24	60/50	79	75	PVT. XING				60	64	67	71	74	77	8	GRADE XING PROTECTION
	60/50	79	75	70	1	20	1.00	65	73	80	87	93	98	5	Muni. Speed Restriction 50mph, MP 70.2-MP 71.7, 2 Grade Xings
70.40															
	50/50	70	65	70A	2	30	2.80	58	62	67	71	75	79	6	
	50/50	70	65		3	28	4.00	54	57	61	64	67	70	8	
	50/50	70	65		2	42	3.20	57	62	66	70	73	77	6	
70.80															
	50/50	79	75	71	1	54	1.25	57	63	69	74	79	83	7	
	50/50	79	75	71A	2	0	1.31	56	62	67	72	77	82	7	Winlock
71.44	50/50	79	75	WALNUT ST.				56	62	67	72	77		7	GRADE XING PROTECTION PER WUTC
71.70															
	75/50	79	79												
72.20															
	79/50	79	79	72	0	30	0.75	104	116	128	139	149	158	1	
	79/50	79	79	73	0	30	0.75	104	116	128	139	149	158	1	
	79/50	79	79	75	1	10	2.06	79	86	93	99	105	111	3	
	79/50	79	79	75A	1	31	4.00	81	87	92	97	102	106	3	
	79/50	79	79	76	1	0	1.44	80	88	96	103	110	116	3	
	79/50	79	79	76A	1	1	1.25	77	86	94	101	108	114	3	
77.80															
	55/50	75	70	78	3	2	4.40	59	63	67	70	73	76	8	
	55/50	75	70	78A	3	12	4.63	58	62	66	69	72	75	8	
	55/50	75	70	79	3	11	4.38	58	61	65	68	71	75	8	
	55/50	75	70	79A	3	2	4.00	57	61	65	69	72	75	8	
79.50															
	70/50	79	79	79B	1	30	3.90	81	87	92	97	102	106	3	
	70/50	79	79	80	1	15	1.44	71	79	86	92	98	104	4	
80.45	70/50	79	79	AGREN RD.				71	79					4	GRADE XING PROTECTION Letter?
	70/50	79	79	81	1	36	3.00	73	79	85	90	94	99	4	
	70/50	79	79		1	30	3.00	76	82	87	93	98	102	4	
81.29	70/50	75	79	PVT. XING				58	62	65	68	72	75	8	GRADE XING PROTECTION Letter?
81.60															*M/W MP 81.5 Trk D BR32 5/19-7/25*

▨ Grade Crossing Protection Required ■ Test Not Required ■

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (In.)	COMMENTS
	60/50	75	70	81A	3	12	4.50	58	62	65	68	72	75	8	
81.80															
	65/50	79	75	82	2	32	4.49	65	69	73	77	80	84	7	
	65/50	79	75	82A	1	6	1.00	72	81	88	95	102	108	4	
82.72	65/50	79	75	PVT. XING				62	66	70	74	77		8	GRADE XING PROTECTION
82.85	65/50	79	75	PVT. XING				62	66	70	74	77		8	GRADE XING PROTECTION
	65/50	79	75	83	2	45	4.50	62	66	70	74	77	81	8	
83.20															
	79	79	79												
85.40															
	70/50	79	79	85	1	30	2.75	74	80	86	91	96	101	4	
	70/50	79	79	86	2	0	4.50	73	78	82	87	91	94	4	
86.90															
	50/50	73	70	87	3	0	3.30	55	59	63	67	70	73	8	Muni. Speed Restriction 50mph, MP 86.9-MP 87.5, 1 Grade Xing
87.50															
	79/50	79	79												
89.00															
	60/50	76	70	89	3	0	5.00	62	65	69	72	76	79	7	
	60/50	74	70	89A	2	54	4.25	60	64	68	71	74	78	7	
89.80															
	70/50	70	70	90	1	0	1.00	76	85	93	100	107	113	2	Skip 4" test, avoid grade crossing protection MP 90.23
91.00															
	60/50	74	70	91	3	10	5.00	60	64	67	70	74	77	7	*M/W MP 91.58-92.11 Trk 2 RP20 8/28*
91.20															*M/W MP 91.58-92.11 Trk 1 RP20 8/29*
	70/50	79	79	92	1	50	4.00	74	79	84	88	93	97	4	
	70/50	79	79	92A	1	45	4.00	76	81	86	90	95	99	4	
92.50															
	65/50	79	79	92B	1	58	3.75	70	75	80	84	88	92	5	
93.70															*M/W MP 96.12-96.31 Trk 1 RP20 8/27*
	60/50	74	70	93	3	5	4.75	60	64	67	71	74	77	7	*M/W MP 97.73-98.53 Trk 1 RP20 8/25-8/27*
	60/50	73	70	94	3	10	5.90	63	67	70	73	76	79	6	*M/W MP 97.0-132.99 Trk 2 SB1 7/1-7/14*
	60/50	75	70	94A	2	48	3.90	59	63	67	71	75	78	7	*M/W MP 97.0-132.99 Trk 1 SB1 7/15-7/25*

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ▨ Test Not Required ▨

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
95.00															
	45/40	74	70	95	2	0	0.63	51	57	63	69	74	78	7	Muni. Speed Restriction 45 mph, MP 95.0-MP 96.51, 2 Grade Xings
	45/40	75	70	96	2	15	0.88	50	56	61	66	71	75	8	
96.60															
	40/40	62	55	96A	3	30	1.50	43	47	52	55	59	62	8	Muni. Speed Restriction 40 mph, MP 96.51-MP 98.0, 4 Grade Xings
96.80															
	40/40	77	70												
96.96	40/40	77	70	BNSF PVT. XING				52	58	63	68	73	77	8	GRADE XING PROTECTION BNSF
	40/40	77	70	97	2	12	1.10	52	58	63	68	73	77	8	**Kelso Station MP 97.3**
97.30															
	40/40	79	79												
98.00															
	60/40	79	79	98	1	20	1.50	69	77	83	90	95	101	4	Muni. Speed Restriction 60 mph, MP 98.0-MP 100.6, 1 Grade Xing
	60/40	79	79	100	2	12	3.75	66	71	75	80	84	87	6	
100.29	60/40	77	70	BNSF PVT. XING				60	64	67	71	74	77	6	GRADE XING PROTECTION BNSF
100.40															
	60/40	71	70	100A	3	0	4.56	60	64	67	71	74	77	6	
100.60															
	79/50	79	79	101	1	48	1.00	56	63	69	75	80	85	7	
	79/50	79	79	102	0	45	1.00	87	98	107	115	123	131	2	*M/W MP 102.13-122.03 Trk 2 TP31 8/13-8/21*
102.60															
	79/60	79	79	102A	1	50	5.00	79	84	88	93	97	101	3	
	79/60	79	79	103	1	15	2.00	76	83	89	96	101	107	3	
	79/60	79	79	103A	1	0	1.94	84	92	100	106	113	119	2	
	79/60	79	79	104	1	0	2.44	88	96	103	110	116	122	2	
	79/60	79	79	105	0	31	0.75	102	115	126	137	146	156	2	
	79/60	79	79	105A	0	45	1.00	87	98	107	115	123	131	2	
	79/60	79	79	105B	0	36	0.75	94	106	117	127	136	144	2	
106.60															
	70/50	79	79												
107.60															
	70/60	79	79	107	1	20	1.25	67	75	82	88	94	100	5	Muni. Speed Restriction 70 mph, MP 107.6-MP 108.6, no grade Xings

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ▨ Test Not Required ▨

	SPEED LIMITS		PROP. REV.	EXISTING CURVES			Super	UNBALANCED SPEEDS per Existing Geometry						Max. unb	
MP	EXIST.	TEST	SPEED	NO.	DEG	MIN	-elev.	3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	(in.)	COMMENTS
	70/60	79	79	108	2	0	4.75	74	79	83	88	92	96	4	Kalama - Restriction lifted 7/9/97
108.50															
	79/60	79	79	109	1	30	3.00	76	82	87	93	98	102	4	
	79/60	79	79	110	1	0	0.75	73	82	91	98	105	112	4	*M/W MP 110.39-110.59 Trk 2 RP20 8/22*
	79/60	79	79	111	1	0	1.50	80	89	96	104	110	116	3	*M/W MP 111.83-112.06 Trk 2 RP20 8/22*
	79/60	79	79	112	1	30	3.50	79	85	90	95	100	105	3	
	79/60	79	79	114	2	0	4.31	72	77	82	86	90	94	4	*M/W MP 114.1-114.4 Trk 2 Curve 114 RP20 8/21*
114.40															
	70/60	70	79												Exist. speed break in curve 114
114.70															
	79/60	79	79												
115.70															
	75/60	75	79												
116.80															
	75/50	75	79												
118.80															
	70/60	70	79	119	1	8	1.56	76	84	91	98	104	110	2	
	70/60	70	79	119A	0	26	0.75	111	125	138	149	160	170	1	
	70/60	70	79	119B	1	0	1.75	82	91	98	105	112	118	2	
	70/60	79	79	120	2	0	4.50	73	78	82	87	91	94	4	*M/W MP 120.54-120.74 Trk 2 RP20 8/20*
	70/60	79	79	120A	2	0	4.75	74	79	83	88	92	95	4	
121.00															
	70/60	70	79	121	0	30	0.75	104	116	128	139	149	158	1	
122.00															
	70/50	70	79												
122.30															
	50/35	79	75	122	2	0	0.94	53	59	65	70	75	80	8	Muni. Speed Restriction 50 mph, MP 122.38-MP 123.1, 2 Grade Xings
123.10															
	70/60	79	79	123	2	0	4.70	74	79	83	87	91	95	4	
	70/60	79	79	123A	2	0	5.00	76	80	85	89	93	96	4	
	70/60	79	79	124	2	12	4.50	70	74	79	83	86	90	5	
	70/60	79	79	125	1	30	1.63	66	73	79	85	91	96	5	

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ▨ Test Not Required ▨

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (in.)	COMMENTS
125.50															
	70/60	75	79	**125A**	1	0	1.50	80	89	96	104	110	116	2	75 through grade xing MP 125.5, avoid protection
126.00															
	70/60	79	79	**126**	2	10	4.30	69	74	78	82	86	90	5	
126.70															
	79/60	79	79	**127**	0	20	1.00	131	146	160	173	185	196	0	
	79/60	79	79	**128**	0	45	0.75	85	95	105	113	121	129	3	
	79/60	79	79	**129**	0	30	1.00	107	120	131	141	151	160	1	
	79/60	79	79	**130**	1	10	1.88	77	85	92	98	104	110	3	
	79/60	79	79	**131**	1	0	1.56	81	89	97	104	111	117	3	*M/W MP 131.04-131.3 Trk 1 RP20 8/19*
131.50															*M/W MP 131.5-131.84 Trk 2 RP20 8/18*
	70/60	79	79	**131A**	2	10	4.38	70	74	79	83	87	90	5	
	70/60	79	79	**132**	2	0	4.56	73	78	83	87	91	95	4	
132.60															
	50/35	79	75	**133**	2	10	1.81	56	62	67	72	76	80	8	*M/W MP 132.63-132.99 Trk 2 Curve 133 RP20 8/15*
133.58	50/35	79	75	PVT. XING				56	62	67	72	76		8	GRADE XING PROTECTION
133.83	50/35	79	75	PVT. XING				56	62	67	72	76		8	GRADE XING PROTECTION
134.40															
	35/35	35	75	**135**	0	36	0.50	91	104	114	124	134	142	0	
	35/35	49	45	**136**	4	18	0.25	33	38	42	46	49	52	7	**Vancouver, WA Station MP 136.6**
136.50															
9.80															Milepost break
	30	30	30												Columbia R. Drawbridge MP 9.61, 30mph
8.60															
	70	70	79	**8**	0	36	0.75	94	106	117	127	136	144	1	
5.50															
	30	30	30												Willamette R. Drawbridge MP 5.3, 30 mph
5.10															
	35	65	60	**5**	3	6	1.25	44	49	54	58	62	65	8	
4.46	35	65	60	PVT. XING				44	49	54	58	62	65	8	GRADE XING PROTECTION
4.30															
	35	35	40	**4**	0	36	0.75	94	106	117	127	136	144	0	Switch in Curve 4 40mph revenue speed.

TALGO CURVE ANALYSIS

SEATTLE TO PORTLAND

▨ Grade Crossing Protection Required ■ Test Not Required ■

MP	SPEED LIMITS EXIST.	TEST	PROP. REV. SPEED	EXISTING CURVES NO.	DEG	MIN	Super -elev.	UNBALANCED SPEEDS per Existing Geometry 3"unb	4"unb	5"unb	6"unb	7"unb	8"unb	Max. unb (In.)	COMMENTS
	35	35	40	**3A**	3	6	1.00	43	48	53	57	61	64	2	Switch in Curve 3A 40mph revenue speed.
	35	35	40	**3**	2	0	1.00	53	60	65	71	76	80	1	Switch in Curve 3 40mph revenue speed.
	35	35	40	**2**	2	0	0.25	48	55	61	67	72	77	1	
	35	35	40	**1B**	0	36	0.75	94	106	117	127	136	144	0	Switch in Curve 1B 40mph revenue speed.
	35	35	40	**1A**	0	30	0.75	104	116	128	139	149	158	0	
	35	35	40	**1**	0	30	0.75	104	116	128	139	149	158	0	
0.90															
	10	43	40	**0B**	5	0	0.50	32	36	40	43	46	49	6	
0.81	10	35	30	**17TH. ST.**				23	26	29	31	33		7	GRADE XING PROTECTION
	10	33	30	**0A**	10	0	0.75	23	26	29	31	33	35	7	
	10	35	30		8	0	0.75	26	29	32	35	37	40	6	
0.67	10	33	30	**14TH. ST.**				23	26	29	31	33		7	GRADE XING PROTECTION
	10	32	30	**0**	6	30	0.75	29	32	36	39	41	44	4	
0.29	10	32	30	**9TH. ST.**				29	32					4	GRADE XING PROTECTION
0.30															
	10	10	10												**Portland Union Station MP** 0.0

APPENDIX B

CURVE DATA AND CALCULATED SAFE CANT DEFICIENCIES FOR TALGO TRAIN

Curve Start MP	Curve Start FT	Curve End MP	Curve End FT	Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD Based On Average Conditions	Maximum Test CD Based On Limiting Conditions	Maximum Safe CD (Extrapolated From Acceleration Data) Based On Average Conditions	Maximum Safe CD (Extrapolated From Acceleration Data) Based On Limiting Conditions	Maximum Safe Speed (mph) Based On Average Conditions	Maximum Safe Speed (mph) Based On Limiting Conditions	Comments	CD at 79 mph Based On Avg. Cond.
108	3743	108	1087	**108**	1.97	4.25	80	4.4	4.7	**5.0**	**5.3**	83	83	OK: Max. Safe CD > Max. CD @ 79 mph	4.2
106	876	105	4730	**106**	-5.03	-4.40	56	6.4	6.8	**6.9**	**7.3**	57	57		17.2
105	2138	105	554	**105**	1.95	4.42	0	-4.4	-4.3						4.0
103	2011	103	543	**103**	3.60	5.07	63	4.9	5.3	**7.6**	**8.0**	72	71		10.4
102	3384	102	1789	**102**	-2.00	-1.74	57	2.8	3.0	**7.6**	**7.7**	82	82	OK: Max. Safe CD > Max. CD @ 79 mph	6.9
101	4313	101	2465	**101A**	-3.02	-3.98	64	4.6	5.2	**5.4**	**6.0**	67	67		9.0
101	0	100	4461	**101**	4.42	2.47	49	4.7	5.1	**9.2**	**9.6**	62	62		16.5
100	3870	100	2766	**100C**	-6.20	-4.48	51	6.4	6.7	**8.6**	**8.9**	55	55		22.2
100	2766	100	1652	**100B**	6.15	4.25	49	6.1	6.3	**9.6**	**9.8**	57	57		22.2
100	1652	100	744	**100A**	-6.37	-4.79	49	5.7	6.0	**8.6**	**8.9**	55	55		22.6
100	744	99	4498	**100**	3.48	2.67	50	3.2	3.5	**8.3**	**8.6**	68	68		12.3
99	4287	99	3886	**99B**	-0.33	-0.71	0	-0.7	-0.5					OK: Highest CD at Track Class Speed <=3	0.7
99	2455	99	1452	**99A**	-4.37	-3.17	44	2.8	3.0	**9.0**	**9.3**	64	64		15.6
99	934	98	4915	**99**	-3.03	-1.41	44	2.7	2.9	**8.4**	**8.6**	68	68		11.6
98	4804	98	4107	**98A**	2.62	1.48	45	2.2	2.3	**7.9**	**8.0**	72	71		9.8
98	3622	98	2935	**98**	-1.03	-0.83	44	0.6	0.8	**7.1**	**7.3**	105	104	OK: Max. Safe CD > Max. CD @ 79 mph	3.6
97	2576	97	2090	**97A**	2.62	1.01	38	1.6	1.7	**8.6**	**8.7**	73	72		10.2
97	5	96	3590	**97**	6.07	0.59	22	1.4	1.9	**7.2**	**7.7**	43	44		25.5
96	3141	96	2133	**96C**	-3.07	-0.72	26	0.7	0.9	**8.0**	**8.2**	64	64		12.5
96	1594	96	670	**96B**	2.87	0.92	26	0.4	1.3	**7.3**	**8.3**	65	66		11.4
96	670	96	163	**96A**	-6.60	-3.96	30	0.2	0.3	**7.6**	**7.7**	50	50		24.4
96	163	95	4942	**96**	5.78	2.32	31	1.5	1.6	**7.2**	**7.3**	49	49		22.6
95	4118	95	3574	**94B**	-2.50	-0.60	36	1.6	1.7	**8.3**	**8.4**	72	71		10.2
95	3226	95	2666	**94A**	1.02	0.81	0	-0.8	-0.7						3.6
95	337	93	4382	**94**	-6.20	-2.34	33	2.3	2.8	**8.2**	**8.6**	50	50		24.3
93	4023	93	3616	**93B**	4.75	1.98	27	0.4	0.5	**8.1**	**8.2**	55	55		18.4
93	3579	93	2581	**93A**	8.03	4.11	25	-0.7	-0.4	**7.0**	**7.3**	45	45		30.4
93	353	92	4593	**93**	-5.05	-2.96	51	6.1	6.4	**6.5**	**6.9**	52	52		18.8
92	4081	92	3062	**92A**	-4.37	-2.17	50	5.2	5.4	**10.2**	**10.4**	64	64		16.6
92	897	91	4894	**92**	6.08	4.21	52	7.0	7.2	**9.7**	**9.9**	58	57		22.0
92	4894	92	2317	**91A**	-4.43	-2.50	52	5.7	6.0	**8.2**	**8.6**	59	59		16.6
92	274	90	3960	**91**	4.02	1.32	52	6.2	6.4	**9.6**	**9.9**	63	63		16.0
90	3960	90	3336	**90B**	-5.82	-4.39	51	5.8	6.1	**9.0**	**9.2**	58	58		20.6
90	3336	90	2745	**90A**	5.57	3.98	51	6.1	6.3	**9.3**	**9.5**	59	59		20.0
90	1552	90	1019	**90**	1.45	0.76	57	2.4	2.7	**8.6**	**8.9**	97	95	OK: Max. Safe CD > Max. CD @ 79 mph	5.5
89	3711	89	3062	**89A**	2.20	0.65	56	4.1	4.3	**9.4**	**9.6**	82	81		8.8
89	696	88	4371	**89**	5.07	4.60	57	6.6	6.9	**7.2**	**7.5**	58	58		17.2
88	2001	88	549	**88**	-6.03	-3.90	48	5.6	5.9	**9.2**	**9.6**	56	56		22.0
87	4620	87	3189	**87C**	-3.92	-1.67	48	4.5	4.9	**8.6**	**8.9**	62	61		15.2
87	3189	87	1784	**87B**	6.60	3.86	48	6.6	7.2	**4.2**	**4.8**	42	42	EXCEPTION: F59, Max g=-.41	24.5

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
87	1784	87	892	**87A**	-6.32	-4.17	45	4.7	4.8	**8.2**	**8.3**	53	53		23.0
87	892	87	316	**87**	1.87	0.71	50	2.5	2.7	**9.0**	**9.2**	87	86	OK: Max. Safe CD > Max. CD @ 79 mph	7.3
86	4604	86	3748	**86B**	-2.10	-0.79	60	4.4	4.6	**9.6**	**9.7**	85	85	OK: Max. Safe CD > Max. CD @ 79 mph	8.2
86	3194	86	2407	**86A**	-5.10	-4.77	51	4.4	4.7	**9.4**	**9.6**	64	63		17.2
86	2185	86	1177	**86**	4.05	2.71	55	5.7	5.9	**9.4**	**9.6**	66	66		14.7
85	2893	85	2259	**85C**	-1.12	-0.64	56	1.7	2.0	**7.8**	**8.1**	105	102		4.2
85	2032	85	1483	**85B**	-1.88	-0.53	56	3.5	3.9	**8.6**	**8.9**	84	82	OK: Max. Safe CD > Max. CD @ 79 mph	7.6
85	1415	85	638	**85A**	1.95	0.49	54	3.5	3.8	**9.1**	**9.3**	84	83		7.9
85	464	84	4709	**85**	-7.10	-5.02	43	3.9	4.2	**8.6**	**8.9**	53	53		25.5
84	4477	84	3331	**84B**	3.68	1.15	48	4.6	5.0	**9.5**	**9.9**	65	64		14.7
84	3331	84	2587	**84A**	-4.88	-3.39	47	4.1	4.3	**9.2**	**9.4**	61	62		17.6
84	2180	84	982	**84**	6.25	4.06	48	5.7	6.0	**7.8**	**8.1**	52	52		22.8
83	1103	83	385	**83**	3.22	1.07	48	4.0	4.2	**9.8**	**9.9**	70	70		12.8
82	4614	82	3722	**82A**	-6.35	-4.45	47	5.2	5.5	**9.6**	**9.8**	57	56		22.9
82	2259	82	242	**82**	1.52	3.46	65	1.0	1.3	**8.0**	**8.3**	105	103	OK: Max. Safe CD > Max. CD @ 79 mph	3.1
76	3764	76	2423	**76**	-3.03	-5.00	73	6.2	6.6	**7.4**	**7.7**	77	77		8.0
74	3748	74	2418	**74**	5.10	4.33	58	7.5	7.7	**9.9**	**10.2**	64	64		17.6
71	1483	71	369	**70**	2.12	1.07	72	6.4	6.6	**8.7**	**8.9**	82	82		8.0
70	3748	70	2291	**69**	2.05	0.81	70	6.2	6.6	**7.3**	**7.8**	76	76		8.0
68	3901	68	1916	**68A**	-3.82	-3.88	62	6.2	6.4	**8.0**	**8.2**	67	67		12.5
68	1568	67	4709	**68**	3.37	3.35	65	6.5	6.9	**9.1**	**9.4**	73	73		11.1
67	2919	67	2476	**67**	1.05	3.01	69	0.5	0.5	**7.8**	**7.9**	122	119	OK: Highest CD at Track Class Speed <=3	1.5
61	612	60	3437	**61**	0.48	0.71	80	1.4	2.0	**6.1**	**6.7**	143	135	OK: Achieved Track Class Speed, 79 mph	1.4
57	3014	56	3421	**57**	-0.97	-1.87	81	2.5	3.3	**5.9**	**6.7**	108	107	OK: Achieved Track Class Speed, 79 mph	2.3
54	5179	54	1473	**55**	-0.97	-1.80	72	1.6	2.1	**6.2**	**6.7**	110	109	OK: Highest CD at Track Class Speed <=3	2.4
50	4920	50	3120	**50A**	1.98	3.99	72	3.1	4.2	**3.0**	**3.0**	72	66	EXCEPTION: F40, Max g=-.75; F59, Max g=-.68	4.5
50	2692	50	1541	**50**	-2.00	-3.08	76	4.9	6.2	**3.0**	**3.0**	66	59	EXCEPTION: F40, Max g=.43; F59, Max g=.40	5.5
49	2349	49	1124	**49A**	2.55	4.41	73	5.1	5.4	**7.2**	**7.5**	81	81	OK: Max. Safe CD > Max. CD @ 79 mph	6.6
49	306	48	4572	**49**	2.47	3.35	72	5.5	6.1	**3.7**	**4.4**	64	65	EXCEPTION: F40, Max g=-.38; F59, g=-.34	7.3
48	982	47	4963	**48**	-1.97	-4.52	81	4.3	4.7	**8.1**	**8.4**	96	96	OK: Achieved Track Class Speed, 79 mph	3.9
47	2661	47	1573	**47**	0.98	1.70	70	1.6	2.4	**7.0**	**7.8**	113	113	OK: Highest CD at Track Class Speed <=3	2.5
46	1932	46	1198	**46**	0.43	0.64	78	1.2	1.7	**6.2**	**6.7**	151	142	OK: Achieved Track Class Speed, 79 mph	1.2
43	4044	43	2471	**43**	1.02	1.63	79	2.8	3.5	**7.5**	**8.2**	114	113	OK: Achieved Track Class Speed, 79 mph	2.7
41	4012	41	2381	**41**	1.52	3.91	79	2.6	2.9	**8.7**	**9.0**	110	109	OK: Achieved Track Class Speed, 79 mph	2.6
38	3157	38	2529	**38**	1.02	0.83	0	-0.8	-0.6						3.5
36	897	36	4715	**10A**	-12.25	-0.83	0	-0.8	-0.3						51.9
36	4715	36	4176	**10**	9.15	0.90	0	-0.9	-0.4						38.5
36	1298	9	5037	**9B**	1.03	1.54	0	-1.5	-0.7					OK: Highest CD at Track Class Speed <=3	2.9
9	3548	9	2349	**9A**	-1.90	-0.83	0	-0.8	-0.6						7.3
9	2233	9	1853	**9**	3.23	0.71	0	-0.7	-0.7						13.2

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
9	1494	9	1151		-0.62	-1.18	0	-1.2	-0.9					OK: Highest CD at Track Class Speed <=3	1.5
9	960	8	4831		1.37	0.54	0	-0.5	0.0						5.3
8	3732	8	3183	**8C**	4.48	1.88	45	4.3	4.5	**8.5**	**8.7**	58	58		17.4
8	2999	8	2122	**8B**	6.33	2.61	33	2.1	2.3	**8.9**	**9.1**	51	51		24.6
8	1858	8	1166	**8A**	8.18	1.04	28	3.5	3.8	**8.7**	**9.0**	42	43		34.2
8	1166	7	4778	**8**	-3.80	-1.17	30	1.2	1.4	**8.0**	**8.2**	59	59		15.2
7	4255	7	4012		1.68	0.20	0	-0.2	0.0						7.0
7	4012	7	3970		0.83	0.26	0	-0.3	-0.2						3.3
7	3970	7	3622		1.82	-0.18	0	-0.2	-0.7						8.0
7	3622	7	2967	**0A**	-5.90	-0.97	35	3.9	4.3	**9.2**	**9.6**	50	50		24.4
7	1816	6	5264	**0**	9.43	3.05	34	4.6	5.0	**9.3**	**9.7**	44	46		37.5
6	3099	1783	316	**1783**	-10.07	-3.21	43	9.6	9.9	**8.5**	**8.8**	41	41	EXCEPTION: F59, g=.36	40.1
1783	3537	1783	4593	**1783A**	-5.95	-0.79	43	6.8	7.1	**7.0**	**7.3**	44	44		24.8
1784	475	1784	950	**1784**	-1.43	-0.54	0	-0.5	-0.4						5.6
1784	1320	1784	3115	**1784A**	1.20	0.91	0	-0.9	-0.6						4.3
1784	3643	1784	4065	**1784B**	-4.05	-0.78	0	-0.8	-0.7						16.6
31	5243	31	3204	**32**	0.47	1.01	32	-0.7	0.0	**6.8**	**7.5**	156	144	OK: Highest CD at Track Class Speed <=3	1.0
31	966	30	3748	**31**	1.48	1.12	67	3.4	3.9	**8.3**	**8.8**	96	95	OK: Max. Safe CD > Max. CD @ 79 mph	5.3
30	2867	30	1879	**30A**	-3.08	-4.34	66	5.0	5.8	**7.5**	**8.3**	75	74		8.9
30	1747	30	918	**30**	2.85	3.63	67	5.2	5.6	**7.0**	**7.4**	74	74		8.6
29	5031	29	2893	**29A**	-1.48	-0.75	68	3.9	4.7	**3.0**	**3.6**	61	59	EXCEPTION: F40, g=.36	5.6
29	2423	28	4820	**29**	0.48	1.02	0	-1.0	-0.7					OK: Highest CD at Track Class Speed <=3	1.1
28	2244	28	316	**28**	-3.27	-4.55	58	2.9	3.3	**7.4**	**7.8**	73	73		9.5
27	4187	27	2444	**27A**	-1.68	-0.91	41	1.1	1.4	**7.5**	**7.9**	85	84	OK: Max. Safe CD > Max. CD @ 79 mph	6.3
27	1066	27	359	**27**	1.92	1.25	44	1.3	1.5	**8.1**	**8.3**	84	83	OK: Max. Safe CD > Max. CD @ 79 mph	7.0
26	5243	26	3252	**26C**	2.00	1.66	48	1.5	2.1	**8.0**	**8.5**	84	83	OK: Max. Safe CD > Max. CD @ 79 mph	6.9
26	2946	26	2106	**26B**	-1.17	-0.77	59	2.0	2.4	**7.7**	**8.1**	103	99	OK: Max. Safe CD > Max. CD @ 79 mph	4.2
26	1700	26	950	**26A**	2.52	4.23	63	2.7	2.9	**8.3**	**8.5**	85	84	OK: Max. Safe CD > Max. CD @ 79 mph	6.6
26	739	25	5089	**26**	-2.80	-4.79	63	2.9	3.1	**8.3**	**8.6**	83	82	OK: Max. Safe CD > Max. CD @ 79 mph	7.3
25	4841	25	3669	**25C**	-3.05	-4.55	64	4.0	4.2	**8.4**	**8.7**	79	79		8.6
25	3595	25	2845	**25B**	2.60	2.67	65	4.9	5.2	**9.7**	**10.0**	83	83		8.5
25	2280	25	1393	**25A**	3.77	4.39	59	4.7	5.2	**8.8**	**9.3**	71	71		11.8
25	1393	25	559	**25**	-3.72	-4.18	59	4.9	5.6	**8.4**	**9.1**	70	70		11.8
24	3843	24	2962	**24B**	-3.03	-2.83	62	5.3	5.7	**8.6**	**9.0**	74	73		10.2
24	2481	24	1599	**24A**	4.12	4.80	62	5.9	6.1	**6.8**	**7.0**	64	64		12.9
24	422	23	5232	**24**	-0.65	-0.57	0	-0.6	-0.5					OK: Highest CD at Track Class Speed <=3	2.2
23	2999	23	1346	**23A**	-4.07	-4.88	61	5.7	6.0	**8.0**	**8.4**	68	68		12.6
23	1346	22	4604	**23**	2.57	1.80	62	5.0	5.4	**7.4**	**7.9**	72	72		9.2
22	3743	22	1235	**22A**	2.12	1.18	63	4.7	5.7	**3.0**	**3.7**	54	52	EXCEPTION: F40, g=-.39	7.9
22	1235	22	395	**22**	-4.07	-4.55	61	5.8	6.0	**9.3**	**9.5**	70	70		12.9

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
21	5174	21	4234	**21A**	-4.20	-4.90	58	4.8	5.1	**4.3**	**4.6**	56	56	**EXCEPTION:** F40, g=.34	13.2
21	4234	21	517	**21**	1.08	0.39	64	2.6	3.2	**7.3**	**7.9**	102	101	**OK:** Max. Safe CD > Max. CD @ 79 mph	4.3
20	4862	20	3220	**20B**	1.10	0.91	64	2.2	2.8	**6.9**	**7.5**	101	100	**OK:** Max. Safe CD > Max. CD @ 79 mph	3.8
20	2904	20	1657	**20A**	4.10	4.47	62	6.3	6.7	**8.5**	**8.9**	68	68		13.2
20	1657	20	971	**20**	-3.43	-3.67	64	6.0	5.9	**6.2**	**6.1**	65	65		11.1
20	971	19	5052	**20**	-2.67	-1.86	64	5.7	6.4	**5.9**	**6.6**	65	65		9.6
19	1552	19	897	**19**	0.73	0.76	79	2.4	2.8	**8.1**	**8.6**	133	128	**OK:** Achieved Track Class Speed, 79 mph	2.4
18	4968	18	4493	**18B**	-0.45	-0.57	81	1.4	2.0	**7.3**	**7.8**	159	145	**OK:** Achieved Track Class Speed, 79 mph	1.4
18	2344	18	1346	**18A**	-1.02	-0.65	76	3.4	3.7	**7.6**	**7.9**	109	107	**OK:** Achieved Track Class Speed, 79 mph	3.7
18	464	17	4561	**18**	0.97	0.70	69	2.5	2.9	**8.3**	**8.7**	116	115	**OK:** Max. Safe CD > Max. CD @ 79 mph	3.5
17	3949	17	3395	**17A**	1.80	2.69	54	0.9	1.3	**8.3**	**8.7**	94	93	**OK:** Max. Safe CD > Max. CD @ 79 mph	5.1
16	4810	16	3722	**17**	-4.95	-4.14	53	5.6	5.9	**9.2**	**9.5**	63	62		17.1
16	3099	16	1599	**16**	1.20	0.74	54	1.7	2.5	**7.4**	**8.2**	99	98	**OK:** Max. Safe CD > Max. CD @ 79 mph	4.4
15	4213	15	2830	**15A**	2.92	2.94	46	1.4	1.6	**8.1**	**8.3**	74	74		9.6
15	1779	15	686	**15**	-4.00	-4.93	63	5.8	6.2	**8.6**	**8.9**	70	70		12.3
14	3199	14	1943	**14A**	-3.95	-4.72	64	6.5	6.8	**9.4**	**9.7**	72	72		12.3
14	448	13	4836	**14**	1.47	0.68	66	3.8	4.1	**8.1**	**8.4**	93	92		5.6
13	4424	13	3806	**13B**	-0.85	-0.63	66	1.9	2.3	**6.4**	**6.8**	109	106	**OK:** Highest CD at Track Class Speed <=3	3.0
13	3152	13	1314	**13A**	4.02	4.82	65	6.7	7.0	**3.4**	**3.7**	54	55	**EXCEPTION:** F40, g=-.44	12.5
13	1119	13	290	**13**	-2.55	-2.56	64	4.7	5.1	**9.3**	**9.7**	82	82		8.4
12	4408	12	3030	**12A**	-3.57	-4.06	60	4.7	4.9	**8.7**	**9.0**	72	72		11.3
12	1098	12	353	**12**	1.97	2.12	73	5.1	5.6	**8.3**	**8.8**	87	87	**OK:** Max. Safe CD > Max. CD @ 79 mph	6.3
11	3479	11	2750	**11C**	1.47	0.76	67	3.7	4.0	**8.9**	**9.2**	98	96	**OK:** Max. Safe CD > Max. CD @ 79 mph	5.5
11	2529	11	1731	**11B**	2.62	2.66	67	5.3	5.8	**6.9**	**7.3**	73	72		8.6
11	1430	11	454	**11A**	4.17	5.22	62	5.8	6.2	**5.0**	**5.4**	60	60	**EXCEPTION:** F40, g=-.35	12.7
10	4667	10	3748	**11**	-4.07	-4.50	59	5.1	6.0	**7.9**	**8.8**	66	66		13.0
10	3748	10	2750	**10B**	3.95	4.48	61	5.5	6.0	**6.3**	**6.9**	63	63		12.5
10	1261	10	137	**10A**	-4.10	-4.93	62	5.9	6.2	**5.4**	**5.6**	60	60	**EXCEPTION:** F40, g=.34	12.7
10	137	9	4403	**10**	4.13	5.16	59	4.8	5.1	**6.1**	**6.3**	63	63		12.6
9	3701	9	1552	**9**	1.00	0.78	62	1.9	2.6	**6.0**	**6.7**	99	99	**OK:** Max. Safe CD > Max. CD @ 79 mph	3.5
8	2576	8	1684	**8A**	-5.15	-5.34	59	7.0	8.1	**5.3**	**6.3**	55	55	**EXCEPTION:** F40, Max g=.38	16.8
8	712	7	5100	**8**	3.20	2.10	43	2.1	2.2	**8.8**	**8.9**	70	70		11.7
7	3743	7	2143	**7A**	1.40	0.73	0	-0.7	-0.3						5.3
7	1705	6	5258	**7**	-1.95	-0.81	0	-0.8	-0.6						7.6
6	4767	6	3622	**6B**	-2.98	-2.08	0	-2.1	-1.7						10.7
6	3088	6	2201	**6A**	4.02	1.84	0	-1.8	-1.3						15.4
6	1821	5	4979	**6**	-5.15	-0.94	34	3.2	3.9	**9.0**	**9.7**	53	52		21.2
5	2613	5	2196	**5**	1.38	-0.19	0	-0.2	-0.4						6.1
4	3210	4	2608	**4**	4.15	2.25	52	5.6	5.8	**9.6**	**9.8**	64	64		15.6
3	3099	3	2011	**3**	-4.97	-3.09	49	5.1	5.3	**9.5**	**9.7**	61	61		18.3

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
1	5042	1	4540	**1E**	-2.17	-0.77	49	2.9	3.1	**8.8**	**9.0**	80	80		8.5
1	2391	1	2106	**1D**	-2.55	-0.92	0	-0.9	-0.7						10.0
1	2106	1	1737	**1C**	1.87	1.12	37	0.6	0.6	**5.7**	**5.8**	73	71		6.9
1	1737	1	1151	**1B**	-5.00	-1.16	37	3.5	3.8	**6.7**	**7.1**	48	48		20.3
1	1151	1	660	**1A**	7.47	1.05	0	-1.1	-0.4						31.1
1	549	1	95	**1**	-3.95	-1.22	0	-1.2	-1.0						15.8
0	3785	0	2523	**0A**	3.97	1.09	0	-1.1	-0.5						16.0
0	1415	0	454	**0**	4.00	1.40	0	-1.4	-0.7						15.8

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
0	2312	0	2328		1.22	0.69	0	-0.7	-0.7						4.5
0	2328	0	2819	**0A**	-9.92	-0.99	0	-1.0	-0.1						41.7
1	4757	1	5206	**1B**	-0.35	-0.63	0	-0.6	-0.5					**OK:** Highest CD at Track Class Speed <=3	0.9
2	675	2	1415	**2**	-1.92	-0.44	50	2.9	3.3	**7.9**	**8.4**	80	79		7.8
3	31	3	1166	**3**	-1.98	-1.00	46	1.9	3.0	**4.9**	**6.0**	66	66		7.5
3	2222	3	3828	**3A**	3.02	1.09	43	2.8	3.1	**7.3**	**7.6**	64	63		11.9
4	982	4	1832	**4**	0.45	-0.58	0	-0.6	-0.3					**OK:** Highest CD at Track Class Speed <=3	2.5
4	2581	5	559	**5**	2.98	1.11	63	7.0	7.8	**6.2**	**7.0**	60	60	**EXCEPTION:** F40, g=.35	11.7
8	2777	8	3669	**8**	-0.40	-0.56	0	-0.6	-0.4					**OK:** Highest CD at Track Class Speed <=3	1.2
9	4762	10	776	**136**	-4.03	-0.12	0	-0.1	-0.4						17.2
134	4688	134	4234	**135**	-0.42	-0.41	0	-0.4	-0.1					**OK:** Highest CD at Track Class Speed <=3	1.4
133	242	132	3263	**133**	-2.07	-1.39	77	7.1	7.7	**5.6**	**6.2**	70	70	**EXCEPTION:** F40, Max g=-.37	7.5
132	1272	131	4503	**132**	1.95	4.48	79	3.9	4.2	**7.0**	**7.3**	92	92	**OK:** Achieved Track Class Speed, 79 mph	3.9
131	4355	131	2418	**131A**	-1.97	-4.05	81	4.7	5.3	**7.1**	**7.7**	91	90	**OK:** Achieved Track Class Speed, 79 mph	4.4
131	1552	131	168	**131**	0.97	1.42	80	2.8	3.4	**7.3**	**7.9**	115	112	**OK:** Achieved Track Class Speed, 79 mph	2.7
130	749	129	4741	**130**	0.90	1.45	78	2.3	3.1	**4.2**	**5.0**	95	93	**OK:** Achieved Track Class Speed, 79 mph	2.4
129	1219	129	42	**129**	0.47	1.01	0	-1.0	-0.8					**OK:** Highest CD at Track Class Speed <=3	1.0
128	1789	128	823	**128**	0.50	-0.50	0	-0.5	-0.1					**OK:** Highest CD at Track Class Speed <=3	2.7
127	1499	126	3938	**127**	-0.30	1.10	79	2.4	2.5	**4.4**	**4.5**	126	119	**OK:** Achieved Track Class Speed, 79 mph	2.4
126	3094	126	2080	**126**	1.90	4.40	61	0.4	0.7	**6.5**	**6.8**	91	91	**OK:** Max. Safe CD > Max. CD @ 79 mph	3.8
125	5084	125	4144	**125A**	0.97	1.39	79	2.7	3.3	**7.9**	**8.5**	118	117	**OK:** Highest CD at Track Class Speed <=3	2.8
125	237	124	4128	**125**	-1.20	-1.39	32	-0.5	-0.2	**5.0**	**5.4**	88	86	**OK:** Max. Safe CD > Max. CD @ 79 mph	3.8
124	3284	124	1953	**124**	2.05	4.84	14	-4.6	-4.1	**7.0**	**7.5**	92	90	**OK:** Max. Safe CD > Max. CD @ 79 mph	4.0
123	5179	123	4139	**123A**	-1.73	-3.83	38	-2.1	-2.0	**9.8**	**9.9**	107	103		3.6
123	2661	122	4915	**123**	-1.98	-5.04	44	-2.5	-2.1	**10.1**	**10.5**	105	102		3.5
122	4762	122	2148	**122**	1.92	0.84	69	5.5	6.3	**3.0**	**3.0**	54	48	**EXCEPTION:** F40, Max g=.49	7.4
121	3094	121	1900	**121**	0.45	0.62	79	1.3	1.9	**6.3**	**6.8**	149	141	**OK:** Achieved Track Class Speed, 79 mph	1.3
120	3838	120	2581	**120A**	1.93	3.78	78	4.4	4.7	**6.6**	**7.0**	88	88	**OK:** Achieved Track Class Speed, 79 mph	4.5
120	1779	120	4435	**120**	-1.98	-4.09	79	4.5	5.1	**7.2**	**7.8**	91	90	**OK:** Achieved Track Class Speed, 79 mph	4.4
120	3870	120	3036	**119B**	0.97	1.18	81	3.2	3.9	**7.7**	**8.5**	116	112	**OK:** Achieved Track Class Speed, 79 mph	3.0
120	1737	120	1573	**119A**	-0.22	-0.88	79	0.0	0.3	**5.1**	**5.3**	200	183	**OK:** Highest CD at Track Class Speed <=3	0.1
120	554	118	4102	**119**	1.08	1.54	79	3.1	4.0	**6.4**	**7.3**	103	101	**OK:** Achieved Track Class Speed, 79 mph	3.1
114	4250	114	1943	**114**	-1.97	-4.45	79	4.0	4.6	**6.9**	**7.5**	91	91	**OK:** Achieved Track Class Speed, 79 mph	4.0
112	348	111	4287	**112**	-1.32	-3.31	78	2.2	2.7	**6.7**	**7.1**	105	104	**OK:** Achieved Track Class Speed, 79 mph	2.4
111	2919	111	47	**111**	0.95	1.37	79	2.7	3.1	**7.3**	**7.7**	115	115	**OK:** Achieved Track Class Speed, 79 mph	2.7
110	3167	110	2032	**110**	0.92	1.02	79	3.0	3.7					**OK:** Achieved Track Class Speed, 79 mph	2.9
110	1742	110	586	**109**	-1.37	-3.03	80	2.9	3.3	**8.2**	**8.5**	109	108	**OK:** Achieved Track Class Speed, 79 mph	2.8
108	2756	108	881	**108**	1.95	4.73	80	3.9	4.6	**6.7**	**7.3**	92	91	**OK:** Achieved Track Class Speed, 79 mph	3.7
107	4477	107	3542	**107**	-1.03	-1.10	80	3.4	4.0	**6.2**	**6.8**	101	100	**OK:** Achieved Track Class Speed, 79 mph	3.3
105	4477	105	4197	**105B**	0.22	0.56	0	-0.6	-0.9					**OK:** Highest CD at Track Class Speed <=3	0.4

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
105	4023	105	3764	**105A**	-0.33	-0.49	0	-0.5	-0.6					OK: Highest CD at Track Class Speed <=3	0.9
105	1198	104	3785	**105**	0.47	0.79	80	1.3	2.0	**3.7**	**4.5**	118	112	OK: Achieved Track Class Speed, 79 mph	1.2
104	1964	103	5195	**104**	-0.97	-2.49	80	1.7	3.3	**3.8**	**5.3**	97	95	OK: Achieved Track Class Speed, 79 mph	1.7
103	4852	103	3194	**103A**	0.97	1.71	71	1.6	2.1	**5.5**	**6.0**	104	103	OK: Highest CD at Track Class Speed <=3	2.4
103	1789	102	5190	**103**	0.92	1.59	0	-1.6	-1.3					OK: Highest CD at Track Class Speed <=3	2.4
102	4635	102	3373	**102A**	-1.65	-5.03	28	-4.1	-4.1	**7.7**	**7.7**	106	104	OK: Highest CD at Track Class Speed <=3	2.1
102	2286	101	3199	**102**	-0.42	-0.60	0	-0.6	-0.2					OK: Highest CD at Track Class Speed <=3	1.2
101	2090	100	3780	**101**	-0.80	-0.88	70	1.8	2.3	**7.3**	**7.8**	121	118	OK: Highest CD at Track Class Speed <=3	2.6
100	2692	100	1314	**100A**	3.02	5.11	70	5.0	5.3	**8.4**	**8.7**	81	80		7.9
100	15	99	4192	**100**	-2.15	-3.74	77	4.9	5.5	**6.5**	**7.0**	83	83	OK: Achieved Track Class Speed, 79 mph	5.5
98	2951	97	3801	**98**	1.27	1.48	0	-1.5	-0.6						4.0
97	1240	97	660	**97**	-2.07	-1.09	0	-1.1	-0.8						7.8
96	4429	96	3484	**96A**	-3.25	-1.26	58	6.2	6.5	**9.6**	**9.8**	70	69		12.7
96	2001	96	982	**96**	2.00	0.88	72	6.3	6.7	**8.7**	**9.1**	83	83		7.7
95	3247	95	1346	**95**	1.95	0.78	70	5.8	6.3	**8.4**	**8.9**	83	82		7.6
94	3595	94	2291	**94A**	-2.65	-3.91	72	5.6	6.2	**4.4**	**5.1**	68	68	EXCEPTION: F40, g=-.36	7.5
94	1325	94	443	**94**	2.52	5.64	71	3.2	3.6	**8.3**	**8.8**	90	91		5.2
94	15	93	3674	**93**	-3.07	-4.79	70	5.4	5.7	**7.6**	**7.9**	77	77		8.4
92	3474	92	2428	**92B**	1.92	3.59	77	4.1	4.8	**7.4**	**8.0**	91	91	OK: Achieved Track Class Speed, 79 mph	4.7
92	2428	92	1420	**92A**	-1.52	-3.68	77	2.5	3.0	**5.8**	**6.3**	95	94	OK: Achieved Track Class Speed, 79 mph	2.8
92	517	91	2977	**92**	1.67	4.11	80	3.3	3.9	**5.4**	**6.1**	91	91	OK: Achieved Track Class Speed, 79 mph	3.1
91	860	90	5184	**91**	3.05	4.89	72	5.9	6.3	**8.5**	**8.9**	80	80		8.2
90	5184	90	496	**90**	-1.00	-0.91	75	3.0	3.5	**5.6**	**6.2**	97	97	OK: Max. Safe CD > Max. CD @ 79 mph	3.4
89	3954	89	2349	**89A**	2.72	4.44	73	5.5	6.1	**7.9**	**8.5**	81	81		7.2
89	2349	88	5074	**89**	-2.97	-5.00	74	6.2	6.9	**3.0**	**3.0**	63	60	EXCEPTION: F59, g=-.59; F40, g=-.55	7.8
87	1583	86	4445	**87**	2.97	3.52	72	6.9	7.3	**3.8**	**4.2**	60	60	EXCEPTION: F40, Max g=.43	9.2
86	3833	86	2180	**86**	-2.08	-4.72	78	3.9	4.4	**6.9**	**7.3**	90	89	OK: Achieved Track Class Speed, 79 mph	4.2
85	3194	85	2407	**85**	1.48	2.71	77	3.3	3.6	**7.9**	**8.1**	102	101	OK: Achieved Track Class Speed, 79 mph	3.7
83	1172	82	4741	**83**	-2.55	-4.62	79	6.3	6.6	**9.0**	**9.3**	88	88	OK: Achieved Track Class Speed, 79 mph	6.3
82	3284	82	2576	**82A**	0.97	1.08	79	3.0	3.6	**7.7**	**8.2**	115	112	OK: Achieved Track Class Speed, 79 mph	3.1
82	1531	81	4366	**82**	2.47	5.03	77	4.9	5.3	**7.7**	**8.0**	86	86	OK: Achieved Track Class Speed, 79 mph	5.6
80	3996	80	2877	**81A**	-3.05	-4.51	72	6.4	6.8	**3.5**	**4.0**	62	62	EXCEPTION: F40, g=-.42	8.6
80	1103	80	4076	**81**	-1.50	-3.10	75	2.7	3.5	**5.6**	**6.3**	92	91	OK: Max. Safe CD > Max. CD @ 79 mph	3.4
80	2629	80	1694	**80**	0.95	1.68	78	2.3	2.7	**5.9**	**6.2**	107	107	OK: Achieved Track Class Speed, 79 mph	2.4
79	5052	79	3521	**79B**	1.55	2.80	78	3.6	4.3	**7.4**	**8.1**	98	96	OK: Achieved Track Class Speed, 79 mph	3.9
79	2840	79	834	**79A**	-3.00	-4.10	74	7.2	7.7	**9.5**	**10.0**	81	81		8.8
79	227	78	3474	**79**	3.12	4.81	73	6.6	7.1	**7.0**	**7.5**	74	74		8.6
78	3474	78	2016	**78A**	-3.12	-4.76	75	7.3	7.6	**7.9**	**8.2**	77	77		8.6
78	1056	77	4250	**78**	2.95	4.60	75	6.9	7.2	**8.5**	**8.8**	80	80		8.1
76	3817	76	2486	**76A**	-1.03	-1.79	80	2.7	3.2	**6.5**	**6.9**	108	106	OK: Achieved Track Class Speed, 79 mph	2.7

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		Based On Avg. Cond.
76	1721	76	353	**76**	0.97	1.56	79	2.6	3.2	**4.7**	**5.4**	97	95	OK: Achieved Track Class Speed, 79 mph	2.6
75	4567	75	3067	**75A**	1.48	4.04	79	2.3	2.9	**6.0**	**6.5**	99	98	OK: Achieved Track Class Speed, 79 mph	2.3
75	343	74	4984	**75**	-1.12	-2.12	82	3.0	3.7	**6.3**	**7.0**	105	103	OK: Achieved Track Class Speed, 79 mph	2.7
73	3991	73	3616	**73**	0.40	1.08	81	0.7	1.6	**6.5**	**7.4**	166	149	OK: Highest CD at Track Class Speed <=3	0.6
72	4868	72	2566	**72**	0.45	1.04	80	0.9	1.4	**5.7**	**6.3**	148	143	OK: Highest CD at Track Class Speed <=3	0.9
71	3537	71	1900	**71A**	-1.98	-1.41	71	5.5	6.1	**3.0**	**3.0**	57	53	EXCEPTION: F40, g=-.46	7.1
71	1631	70	4683	**71**	1.93	1.32	73	5.8	6.5	**3.0**	**3.0**	57	52	EXCEPTION: F40, Max g=.57	7.0
70	2988	70	2597	**70A**	-3.45	-4.11	61	4.6	5.0	**6.6**	**6.9**	67	67		10.7
70	2138	70	79	**70**	-1.38	-1.12	69	3.4	4.2	**4.9**	**5.8**	80	79	OK: Max. Safe CD > Max. CD @ 79 mph	4.8
69	2935	69	818	**69**	2.92	5.28	77	6.6	7.3	**3.0**	**3.0**	64	62	EXCEPTION: F40, Max g=.49	7.3
67	3970	67	2317	**67**	0.92	2.16	82	2.1	2.6	**6.6**	**7.2**	118	118	OK: Achieved Track Class Speed, 79 mph	1.8
65	369	64	2661	**65**	-2.97	-3.02	72	7.6	8.2	**7.3**	**7.9**	71	71	EXCEPTION: F59, g=-.33	9.7
63	3548	63	200	**63A**	1.15	2.17	74	2.2	2.9	**3.8**	**4.5**	86	86	OK: Highest CD at Track Class Speed <=3	2.8
63	21	62	2919	**63**	-2.97	-5.02	74	6.3	6.8	**7.0**	**7.5**	77	77		7.7
62	2919	62	1673	**62**	3.00	4.94	72	5.8	6.1	**3.2**	**3.5**	63	63	EXCEPTION: F40, Max g=.41	8.0
61	3294	61	1895	**61**	0.97	1.93	80	2.3	3.0	**7.3**	**8.0**	117	115	OK: Achieved Track Class Speed, 79 mph	2.2
60	2967	60	2207	**60A**	0.43	1.21	79	0.6	1.4	**6.1**	**6.8**	156	142	OK: Achieved Track Class Speed, 79 mph	0.7
60	1441	59	2851	**60**	0.67	1.12	80	1.8	2.6	**6.1**	**6.9**	125	121	OK: Achieved Track Class Speed, 79 mph	1.7
59	1478	59	660	**59**	-0.47	-1.11	81	1.0	1.6	**7.8**	**8.4**	166	153	OK: Highest CD at Track Class Speed <=3	0.9
57	2940	57	681	**57**	0.97	0.57	60	1.9	2.5	**6.6**	**7.2**	103	103	OK: Max. Safe CD > Max. CD @ 79 mph	3.6
54	1657	54	955	**54A**	1.45	1.05	64	3.1	3.5	**7.3**	**7.7**	92	90		5.2
54	955	54	311	**54**	-1.53	-0.77	66	3.8	4.2	**4.8**	**5.2**	73	72		5.8
53	5021	53	4414	**53B**	1.02	0.69	70	2.7	3.3	**3.5**	**4.1**	78	77	OK: Max. Safe CD > Max. CD @ 79 mph	3.7
53	4414	53	3960	**53A**	-1.47	-1.00	72	4.2	4.9	**3.2**	**4.0**	65	65	EXCEPTION: F59, g=-.36	5.3
53	274	52	5121	**53**	-1.05	-0.97	80	3.6	4.0	**7.3**	**7.6**	107	105	OK: Achieved Track Class Speed, 79 mph	3.5
52	4192	52	1848	**52A**	0.50	0.87	81	1.4	3.5	**5.4**	**7.6**	135	113	OK: Achieved Track Class Speed, 79 mph	1.3
52	179	51	4672	**52**	-1.60	-2.33	80	4.7	5.0	**6.7**	**7.1**	91	91	OK: Achieved Track Class Speed, 79 mph	4.6
51	3764	51	2893	**51A**	-1.95	-3.84	79	4.5	4.9	**3.4**	**3.7**	73	74	EXCEPTION: F40, g=-.36	4.5
51	1884	51	913	**51**	2.60	5.20	78	5.6	6.3	**7.6**	**8.3**	84	84	OK: Achieved Track Class Speed, 79 mph	6.0
50	3421	50	718	**50**	0.70	1.03	79	2.0	2.9	**7.2**	**8.2**	131	124	OK: Achieved Track Class Speed, 79 mph	2.0
47	4936	47	3648	**47B**	2.95	4.64	75	6.9	7.3	**8.0**	**8.4**	79	79	OK: Max. Safe CD > Max. CD @ 79 mph	8.0
47	3648	47	2713	**47A**	-1.97	-4.09	77	3.9	4.2	**8.2**	**8.6**	95	95	OK: Achieved Track Class Speed, 79 mph	4.4
47	865	46	4488	**47**	-1.95	-3.94	79	4.4	4.9	**6.7**	**7.1**	89	89	OK: Achieved Track Class Speed, 79 mph	4.4
46	1953	46	95	**46**	-2.02	-4.31	79	4.3	4.8	**7.4**	**7.9**	92	91	OK: Achieved Track Class Speed, 79 mph	4.4
42	4260	42	2333	**42**	-0.97	-2.16	80	2.1	2.7	**5.4**	**5.9**	106	104	OK: Achieved Track Class Speed, 79 mph	2.0
41	3616	41	2159	**41**	1.95	4.93	81	3.8	4.2	**8.1**	**8.5**	99	98	OK: Achieved Track Class Speed, 79 mph	3.5
36	2698	36	1135	**36**	2.00	4.73	79	3.8	4.4	**7.2**	**7.8**	93	93	OK: Achieved Track Class Speed, 79 mph	3.9
34	485	33	4282	**34**	1.95	4.90	77	3.1	3.4	**7.5**	**7.7**	96	96	OK: Achieved Track Class Speed, 79 mph	3.5
28	448	27	3659	**28**	-1.67	-4.20	79	3.0	3.6	**5.2**	**5.8**	90	90	OK: Achieved Track Class Speed, 79 mph	3.0
26	4931	26	3891	**26**	0.97	2.20	78	1.9	2.2	**6.9**	**7.2**	117	116	OK: Achieved Track Class Speed, 79 mph	2.0

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
25	3141	25	533	**25A**	-3.03	-4.83	72	6.0	6.8	**3.0**	**3.0**	61	59	**EXCEPTION**: F40, Max g=-.63; F59, Max g=-.46	8.2
25	332	24	4239	**25**	2.98	4.28	71	6.0	6.3	**8.4**	**8.7**	78	78		8.5
24	2919	24	1536	**24A**	3.15	4.24	71	6.7	6.9	**7.9**	**8.1**	75	75		9.3
24	512	23	4546	**24**	-3.38	-4.58	69	6.5	7.4	**3.1**	**4.0**	57	58	**EXCEPTION**: F40, Max g=-.44; F59, Max g=-.37	10.0
23	1547	23	543	**23**	2.10	3.00	70	4.1	4.3	**8.1**	**8.4**	88	88		6.0
22	4593	22	3310	**22B**	3.22	5.15	72	6.3	6.6	**8.2**	**8.5**	78	78		8.7
22	2085	22	1219	**22A**	1.83	4.08	72	2.5	3.0	**6.2**	**6.7**	90	91	**OK**: Max. Safe CD > Max. CD @ 79 mph	3.8
22	1082	21	4625	**22**	-3.07	-4.85	73	6.3	6.8	**8.1**	**8.6**	78	78		8.3
21	4276	21	3453	**21A**	0.95	1.95	73	1.5	2.0	**4.3**	**4.8**	98	97	**OK**: Highest CD at Track Class Speed <=3	2.1
21	2164	21	1272	**21**	1.95	4.03	77	4.0	4.3	**7.7**	**8.0**	93	93	**OK**: Achieved Track Class Speed, 79 mph	4.4
20	4377	20	3738	**20B**	1.42	2.85	77	3.0	3.3	**7.7**	**8.0**	104	103	**OK**: Achieved Track Class Speed, 79 mph	3.2
20	3410	20	2217	**20A**	-2.02	-3.81	77	4.5	4.9	**8.0**	**8.5**	92	92	**OK**: Achieved Track Class Speed, 79 mph	4.9
20	1985	20	950	**20**	1.23	3.29	76	1.6	2.0	**7.0**	**7.4**	110	108	**OK**: Achieved Track Class Speed, 79 mph	2.0
19	4720	19	3806	**19B**	2.50	5.10	76	4.9	5.1	**8.3**	**8.5**	88	88	**OK**: Achieved Track Class Speed, 79 mph	5.7
19	2365	19	538	**19A**	2.45	4.74	78	5.4	6.2	**7.9**	**8.7**	86	86	**OK**: Achieved Track Class Speed, 79 mph	5.8
18	5253	18	3606	**19**	-3.12	-4.20	70	6.3	6.6	**8.7**	**9.1**	78	77		9.2
18	1198	17	5074	**18**	-3.17	-4.35	67	5.5	5.7	**9.0**	**9.2**	78	78		9.3
17	4799	17	3954	**17C**	3.25	4.88	72	6.6	6.7	**8.2**	**8.2**	76	77		9.1
17	3732	17	2244	**17B**	-1.67	-3.48	73	2.6	3.5	**5.6**	**6.5**	89	89	**OK**: Max. Safe CD > Max. CD @ 79 mph	3.7
17	1589	17	649	**17A**	2.07	2.54	71	4.6	4.9	**8.3**	**8.6**	87	87		6.3
17	448	16	4704	**17**	-3.22	-4.61	71	6.5	6.7	**8.7**	**8.9**	78	77		9.2
16	2819	16	1330	**16**	1.47	3.09	72	2.2	2.7	**4.2**	**4.7**	85	85	**OK**: Max. Safe CD > Max. CD @ 79 mph	3.2
16	1330	15	4947	**16**	2.90	5.14	72	5.2	5.7	**7.3**	**7.7**	79	79	**OK**: Max. Safe CD > Max. CD @ 79 mph	7.3
15	4340	15	3305	**15B**	-2.22	-2.69	67	4.2	4.8	**3.0**	**3.0**	61	57	**EXCEPTION**: F40, Max g=-.84; F59, g=-.70	6.8
15	2708	15	1615	**15A**	2.97	3.62	67	5.6	6.3	**7.1**	**7.7**	72	72		9.1
15	1346	14	4213	**15**	-3.05	-3.15	70	7.1	7.4	**3.7**	**4.0**	57	56	**EXCEPTION**: F40, Max g=-.44	10.0
14	3379	14	2798	**14A**	2.13	2.32	59	2.8	3.0	**8.4**	**8.6**	85	84		6.9
14	950	13	5274	**14**	-2.92	-2.28	0	-2.3	-2.1						10.3
13	4509	13	3722	**13A**	-2.17	-3.36	0	-3.4	-3.2						6.0
13	2233	13	1140	**13**	2.65	4.43	67	3.8	4.1	**6.8**	**7.1**	79	79		7.0
12	3875	12	607	**12**	0.95	1.92	72	1.5	2.7	**5.6**	**6.8**	107	104	**OK**: Highest CD at Track Class Speed <=3	2.2
11	4076	10	4572	**11**	-1.07	-1.43	74	2.6	3.3	**5.6**	**6.4**	98	95	**OK**: Max. Safe CD > Max. CD @ 79 mph	3.2
10	4366	10	2629	**10A**	2.92	4.91	75	6.4	6.8	**5.0**	**5.3**	70	70	**EXCEPTION**: F40, g=.37	7.6
10	2513	10	1969	**10**	-1.47	-2.40	69	2.4	2.8	**7.4**	**7.8**	99	96		3.9
9	3511	9	2460	**9A**	-3.20	-0.94	66	8.8	9.2	**8.8**	**9.2**	67	67		12.8
9	839	8	5274	**9**	2.18	2.21	46	0.9	1.1	**7.0**	**7.1**	78	77		7.2
8	2930	8	2096	**8**	1.90	3.29	76	4.2	4.5	**8.7**	**9.0**	96	95		4.9
7	4245	7	3347	**7A**	-1.93	-3.07	74	4.3	4.8	**8.9**	**9.4**	95	93		5.2
7	923	6	4150	**7**	-2.10	-2.57	53	1.5	1.7	**8.1**	**8.4**	86	85		6.5
6	2185	6	1462	**6**	3.15	2.86	55	3.8	4.2	**6.6**	**7.0**	66	66		10.7

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph Based On Avg. Cond.
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		
5	1483	4	5047	**5B**	2.50	2.67	62	4.0	5.1	**7.1**	**8.3**	75	74		8.1
4	4319	4	2851	**4A**	1.22	0.85	63	2.5	2.9	**6.9**	**7.4**	96	96		4.4
4	1837	3	5221	**4**	-2.62	-3.06	74	6.8	7.0	**8.6**	**8.8**	81	80		8.2
3	3938	3	3278	**3A**	-0.88	-0.27	76	3.2	3.7	**6.3**	**6.7**	104	102	OK: Achieved Track Class Speed, 79 mph	3.5
3	263	2	4572	**3**	-3.07	-2.95	66	6.4	6.5	**8.9**	**9.1**	75	75		10.2
2	2919	2	2270	**2C**	2.58	1.12	56	4.5	4.8	**9.1**	**9.3**	76	75		10.0
2	2053	2	1314	**2B**	-1.05	-1.17	56	1.1	1.4	**6.6**	**6.9**	104	102	OK: Achieved Track Class Speed, 79 mph	3.3
2	1103	2	269	**2A**	3.15	0.98	57	6.0	6.4	**8.2**	**8.7**	65	65		12.6
2	137	1	4952	**2**	2.23	1.08	56	3.8	4.1	**8.0**	**8.3**	77	77		8.5
1	4878	1	4102	**1B**	2.35	0.97	56	4.1	4.2	**8.4**	**8.5**	76	76		9.1
1	4102	1	3194	**1A**	-3.07	-0.41	59	6.9	7.8	**3.0**	**3.0**	40	37	EXCEPTION: F40, Max g=-.62; F59, g=-.39	12.8
1	3194	1	2259	**1**	3.75	0.84	51	5.8	6.2	**7.5**	**7.9**	57	57		15.3
0	4324	0	4060	**0C**	-1.43	-0.26	53	2.5	3.0	**7.7**	**8.1**	90	88		5.9
0	4060	0	3004	**0B**	2.52	1.28	53	3.5	3.9	**8.0**	**8.3**	73	73		9.5
0	2207	0	1584	**0A**	3.88	0.97	52	6.3	6.7	**8.1**	**8.4**	58	58		15.7
0	1584	0	950	**0**	-4.20	-1.12	52	6.8	7.2	**6.8**	**7.3**	52	52		16.9
39	5042	39	4477	**39A X**	-5.17	-0.79	34	3.3	3.6	**8.4**	**8.7**	51	52		21.4
39	4451	39	3463	**39 X**	-10.20	-0.32	34	7.8	8.3	**9.0**	**9.4**	36	36		43.5
38	4482	38	3479	**38B X**	6.33	3.10	44	5.5	5.7	**8.7**	**9.0**	52	52		24.1
38	2154	38	1346	**38A X**	-2.10	-0.75	43	1.9	2.2	**7.6**	**7.9**	76	76		8.3
38	797	37	4651	**38 X**	6.22	1.92	45	6.7	7.1	**6.9**	**7.4**	45	45		24.8
37	3669	37	1568	**37A X**	-4.00	-3.55	58	5.7	6.7	**5.8**	**6.7**	58	58		13.7
37	1008	36	4762	**37 X**	5.03	5.18	57	6.0	6.2	**6.3**	**6.5**	57	57		16.5
36	3880	36	2455	**36 X**	-4.17	-3.28	57	6.0	6.6	**8.8**	**9.4**	65	65		14.6
35	5148	35	4197	**35 X**	2.25	4.84	66	2.0	2.3	**7.2**	**7.5**	88	87		4.8
34	3157	34	2001	**34 X**	-4.20	-3.94	62	7.3	7.7	**8.3**	**8.8**	65	65		14.1
30	3183	29	4778	**30 X**	-2.00	-3.56	78	4.9	6.1	**4.7**	**5.9**	78	78	EXCEPTION: F59, g=-.32	5.0
27	4820	27	2391	**27 X**	-1.97	-3.42	80	5.3	6.0	**7.8**	**8.5**	91	90	OK: Achieved Track Class Speed, 79 mph	5.0
21	2877	21	2439	**21 X**	0.22	0.02	0	0.0	-0.2					OK: Highest CD at Track Class Speed <=3	0.9
15	2624	15	1219	**15 X**	-0.47	-0.55	0	-0.6	-0.3					OK: Highest CD at Track Class Speed <=3	1.5
13	3183	13	2867	**13A X**	0.37	0.36	0	-0.4	-0.3					OK: Highest CD at Track Class Speed <=3	1.2
13	2560	13	2143	**13 X**	-0.27	-0.33	0	-0.3	-0.5					OK: Highest CD at Track Class Speed <=3	0.8
12	2280	12	1256	**12B X**	0.97	4.03	0	-4.0	-4.0					OK: Highest CD at Track Class Speed <=3	0.1
12	1145	12	686	**12A X**	0.30	-0.31	0	-0.3	-0.6					OK: Highest CD at Track Class Speed <=3	1.6
12	506	12	174	**12 X**	0.28	0.65	44	-0.3	-0.2	**4.3**	**4.3**	159	138	OK: Highest CD at Track Class Speed <=3	0.6
10	3653	10	2001	**10 X**	-3.03	-4.33	68	5.3	5.7	**3.5**	**3.8**	61	61	EXCEPTION: F59, g=-.39	8.7
9	2782	9	1906	**9A X**	1.00	1.18	76	2.8	3.4	**7.0**	**7.6**	109	107	OK: Achieved Track Class Speed, 79 mph	3.1
9	448	8	4435	**9 X**	-3.03	-3.85	72	6.9	7.3	**7.4**	**7.7**	73	73		9.2
8	4308	8	2333	**8A X**	1.58	3.81	72	1.8	2.0	**6.7**	**7.0**	98	98	OK: Highest CD at Track Class Speed <=3	3.0
8	1404	8	79	**8 X**	-1.50	-3.46	71	1.7	2.0	**6.2**	**6.5**	97	96	OK: Highest CD at Track Class Speed <=3	3.0

Curve Start		Curve End		Curve Number	Average Curvature (deg)	Average Xlevel (in)	Max. Test Speed (mph)	Maximum Test CD		Maximum Safe CD (Extrapolated From Acceleration Data)		Maximum Safe Speed (mph)		Comments	CD at 79 mph
MP	FT	MP	FT					Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions	Based On Average Conditions	Based On Limiting Conditions		Based On Avg. Cond.
7	3215	7	1605	**7A X**	0.32	0.89	0	-0.9	-0.8						0.5
7	353	6	4583	**7 X**	0.93	1.82	71	1.4	1.8	**7.0**	**7.4**	117	115	**OK**: Highest CD at Track Class Speed <=3	2.2
6	1203	5	5232	**6 X**	0.62	0.75	78	1.9	2.2	**6.3**	**6.7**	129	126	**OK**: Achieved Track Class Speed, 79 mph	1.9
5	733	4	4493	**5 X**	-1.72	-3.90	78	3.3	4.2	**6.4**	**7.2**	93	93	**OK**: Achieved Track Class Speed, 79 mph	3.5
3	4783	3	4266	**3C X**	0.42	0.77	79	1.0	1.5	**6.1**	**6.5**	154	143	**OK**: Highest CD at Track Class Speed <=3	1.0
3	2180	3	1483	**3B X**	0.87	0.35	61	1.8	2.9	**4.0**	**5.0**	85	89	**OK**: Max. Safe CD > Max. CD @ 79 mph	3.4
3	1013	3	322	**3A X**	-2.42	-0.19	68	7.5	7.7	**6.6**	**6.9**	64	64	**EXCEPTION**: F40, g=-.35	10.2
3	322	2	5206	**3 X**	0.33	-0.20	0	-0.2	-0.6					**OK**: Highest CD at Track Class Speed <=3	1.6
2	2835	2	1504	**2 X**	3.95	1.49	58	7.8	8.0	**8.9**	**9.1**	62	53		15.5
1	2914	1	2444	**1A X**	-3.37	-0.95	0	-1.0	-0.9						13.5
1	2444	1	1953	**1 X**	3.40	0.82	0	-0.8	-0.7						13.8

ENSCO PUB. NO. DOT-FR-99-05

HIGH CANT DEFICIENCY OPERATION OF THE TALGO TRAIN ON THE PACIFIC NORTHWEST CORRIDOR

VOLUME II of III

WAYSIDE MEASUREMENT OF WHEEL/RAIL FORCES AS GENERATED BY THE TALGO TRAIN

MARCH 1999

Sponsored by:

Federal Railroad Administration
Office of Research and Development
Washington DC

Prepared by:

ZETA-TECH Associates, Inc.
900 Kings Highway North
P.O. Box 8407
Cherry Hill, NJ 08002

for

ENSCO, INC.
APPLIED TECHNOLOGY AND ENGINEERING DIVISION
5400 Port Royal Road
Springfield, VA 22151

PREFACE

In an effort to evaluate the impact of high cant deficiency operation on track loading, as well as to provide initial evaluation of operational safety, three (3) test curves were instrumented at locations in the spiral and curve body in order to measure lateral force (L), vertical force (V), and the L/V ratio on both the high and low rails as each axle of a given trainset passed by. Volume II details the collection and analysis of wayside force measurements taken for the Talgo trainset as well as for other typical revenue service equipment. Results presented in this volume of the report pertain to the effects of high cant deficiency operation on track loading.

Reporting contained within Volume II was provided by ZETA-TECH Associates, Inc., under subcontract to ENSCO, Inc. In this test program, ZETA-TECH under-took responsibility for the wayside instrumentation of the test curves and the analysis of wayside data. As a consultant to the BNSF Railroad at the inception of this project, ZETA-TECH was uniquely qualified and prepared to conduct this effort. Instrumentation and installation services were provided to the subcontractor by Advanced Measurements, Inc.

MEASUREMENT OF WHEEL/RAIL FORCES AS GENERATED BY TALGO TRAIN IN HIGH CANT DEFICIENCY OPERATION ON THE PACIFIC NORTHWEST CORRIDOR

Report of Field Testing Performed
on
BNSF
in Mt. VERNON - TACOMA AREA

Report

October, 1997

Prepared by:

ZETA-TECH Associates, Inc.
900 Kings Highway North
P. O. Box 8407
Cherry Hill, NJ 08002

Phone: (609) 779-7795
Fax: (609) 779-7436
email: zetatech@zetatech.com
http://www.zetatech.com

MEASUREMENT OF WHEEL/RAIL FORCES AS GENERATED BY TALGO TRAIN IN HIGH CANT DEFICIENCY OPERATION ON THE PACIFIC NORTHWEST CORRIDOR

TABLE OF CONTENTS

APPENDICES

1. Introduction

This report presents the results of wayside field testing series of dynamic wheel/rail forces (both lateral and vertical) applied by the Talgo trainset, as well as regular traffic trains. These tests were conducted on the Pacific Northwest Corridor of the Burlington Northern Santa Fe Railroad (BNSF). The specific test sites were in the vicinity of Seattle, Washington, in the Mt. Vernon-Tacoma area.

The objective of this activity was to perform a comprehensive set of wayside measurements for the monitoring of lateral (L) and vertical (V) wheel/rail forces and corresponding L/V ratios (Lateral force/Vertical force) associated with the Talgo trainset. Depending on the attained levels of the lateral and vertical dynamics, the tests were intended to assess the suitability of the Talgo trainset for operation at elevated cant deficiencies in Amtrak's Pacific Northwest Corridor.

Wayside instrumentations to measure lateral and vertical wheel/rail forces were installed at two locations north of Seattle, in the Mt. Vernon area, and at one location south of Tacoma. During the testing period (August 4th - August 14th, 1997) both Talgo trainsets (64) and regular traffic trains (19) were successfully measured, including northbound and southbound movements, speed deviations, empty and loaded freight trains, as well as regular Amtrak trains. Lateral and vertical force data was collected for each axle of each car and locomotive, for both the high and low rails. These measurements were taken in a mainly dry rail conditions, with the low level moisture and wet rails only at the PM hours, August 6th. A statistical analysis was performed on this data to determine the levels of dynamic loads generated by the Talgo trainset under testing, and regular traffic.

Also included in this report is a description of the test sites, the instrumentation and data recording system, and a discussion of the procedure used to calibrate the instrumentation.

The collected information and the follow-up statistical study provide direct measurement data about the test train's dynamic behavior in selected curves, representative of high cant deficiency main-line track on BNSF. Resulting analysis shows the comparative performance of the tested trains in this track environment. The analysis presented here includes the effects of speed, cant deficiency, track curvature and train configurations, as well as the direct comparison of the Talgo and regular trains.

The Wayside Instrumented Curve Tests represent an important part of the overall test program, allowing the evaluation of the impact of high cant deficiency operation on track loading, and providing initial evaluation of operational safety prior to full scale corridor tests.

2. Description of Test Site

The test sites were selected to reflect required combination of the curvature, adequate cant deficiency and conditions of approach to selected curves, as well as the level of regular traffic. In the case of these tests, cant deficiency was desired and used as a basis for test site selection. The site selection characteristics used for the final test site selection were as follows:

a. Typical for the BNSF Northwest Corridor track conditions and geometry.

b. Curve with curvatures between 3 and 5 degrees, and superelevation in the range of 3 to 5 inches.

c. Both curve body and spiral site locations, with the spiral instrumentation typically located south of the curve body.

d. A traffic mix of required types, including freight trains and regular Amtrak traffic.

Based on the above factors, three test locations were chosen, with two north of Seattle, in the Mt. Vernon area, and one location south of Tacoma.

The test site characteristics were as follows (from North to South):

Site 1. MP 76.

Spiral
South end of curve at MP 76
Curvature at test site: Spiral 2°
Superelevation : 3"
Track gage 56 5/8"

Curve body MP 76
Curvature at test site: 3.25°
Superelevation : 5 1/8"
Track gage 56 3/4"

Site 2. MP 74.

Spiral
South end of curve at MP 74
Curvature at test site: Spiral 2 3/4°
Superelevation : 2 1/4"
Track gage 56 1/4"

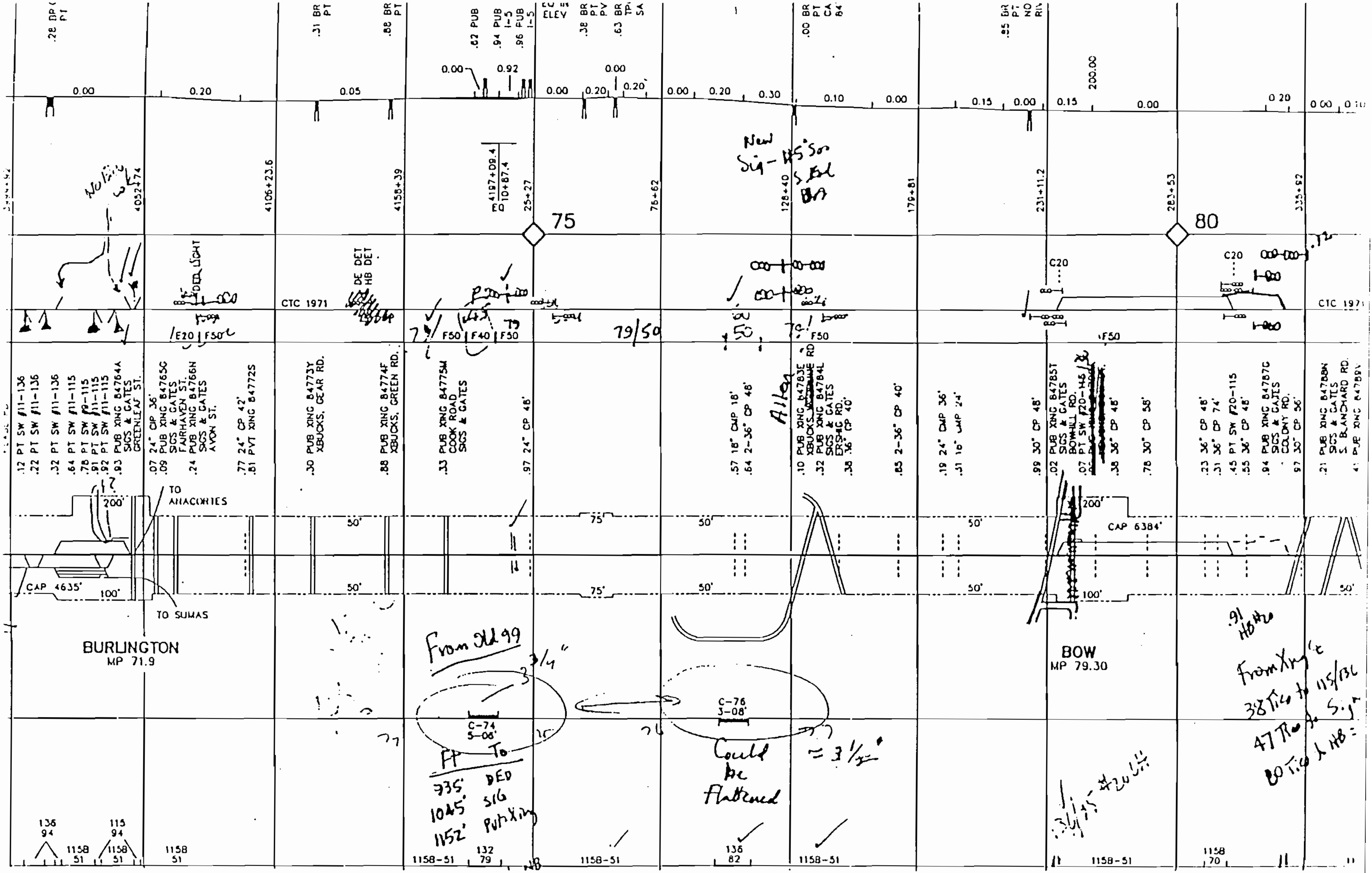
Curve body MP 74
Curvature at test site: 4 7/8°
Superelevation : 4"
Track gage 56 1/4"

Site 3. MP 34.

Spiral		South end of curve at MP 34 Curvature at test site: Spiral 2 1/4° Superelevation : 3 1/8" Track gage"
Curve body	MP 34	Curvature at test site: 4 1/2° Superelevation : 4 3/8" Track gage"

Figure 1 shows the track chart for the North test sites. Figure 2, 3 and 4 present the photographs of test curves MP 76, 74 and 34 respectively. For all sites, Appendix A contains detailed field sketches of track geometry and main parameters.

The track structure was 136 RE rail on wood ties on ballast of satisfactory to good condition. The cut spike fasteners, anchors and drainage, with the few exceptions, were also in fair condition.



BURLINGTON
MP 71.9
BOW
MP 79.30
75
80
CTC 1971
TO ANACORTES
TO SUMAS
CAP 4635'
CAP 6384'
200'
100'
50'
75'
C-74
5-08'
C-76
3-08'
.12 PT SW #11-136
.22 PT SW #11-136
.32 PT SW #11-136
.64 PT SW #11-115
.78 PT SW #9-115
.91 PT SW #11-115
.92 PT SW #11-115
.93 PUB XING 84764A SIGS & GATES GREENLEAF ST.
.07 24" CIP 36'
.09 PUB XING 84765G SIGS & GATES FAIRHAVEN ST.
.24 PUB XING 84766N SIGS & GATES AVON ST.
.77 24" CP 42'
.81 PVT XING 84772S
.30 PUB XING 84773Y XBUCKS, GEAR RD.
.88 PUB XING 84774F XBUCKS, GREEN RD.
.33 PUB XING 84775M COOK ROAD SIGS & GATES
.97 24" CP 48'
.57 18" CMP 18'
.64 2-36" CP 48'
.10 PUB XING 84783E XBUCKS
.32 PUB XING 84784L SIGS & GATES ERSHIG RD.
.38 16" CP 40'
.85 2-36" CP 40'
.19 24" CMP 36'
.31 16" CMP 24'
.99 30" CP 48'
.02 PUB XING 84785T SIGS & GATES BOWHILL RD.
.07 PT SW #20-115
.38 36" CP 48'
.78 30" CP 58'
.23 36" CP 48'
.31 36" CP 74'
.45 PT SW #20-115
.55 36" CP 48'
.94 PUB XING 84787G SIGS & GATES COLONY RD.
.97 30" CP 56'
.21 PUB XING 84788N SIGS & GATES S. BLANCHARD RD.
.41 PUB XING 84789V
4052+74
4106+23.6
4158+39
4197+09.4
EQ 10+87.4
25+27
76+62
128+40
179+81
231+11.2
283+53
335+92
.28 DP PT
.31 BR PT
.88 BR PT
.62 PUB
.94 PUB I-5
.96 PUB I-5
ELEV
.38 BR PT PV
.63 BR TP SA
.00 BR PT CA 84
.85 BR PT NO RIV
0.00
0.20
0.05
0.92
0.30
0.10
0.15
200.00
DE DET
HB DET
DED LIGHT
C20
E20
F50
F40
1158 51
136 94
115 94
1158-51
132 79
136 82
1158 70
From Old 99
3/4"
FP To
735' DED
1045' SIG
1152' Pub Xing
Could be Flattened
= 3 1/2"
New Sig - 145' So S End BA
Allen
79/50
.91 HB
From Xing
38 Ties to 115/136
47 Ties
80 Ties

Figure 1

Figure 2

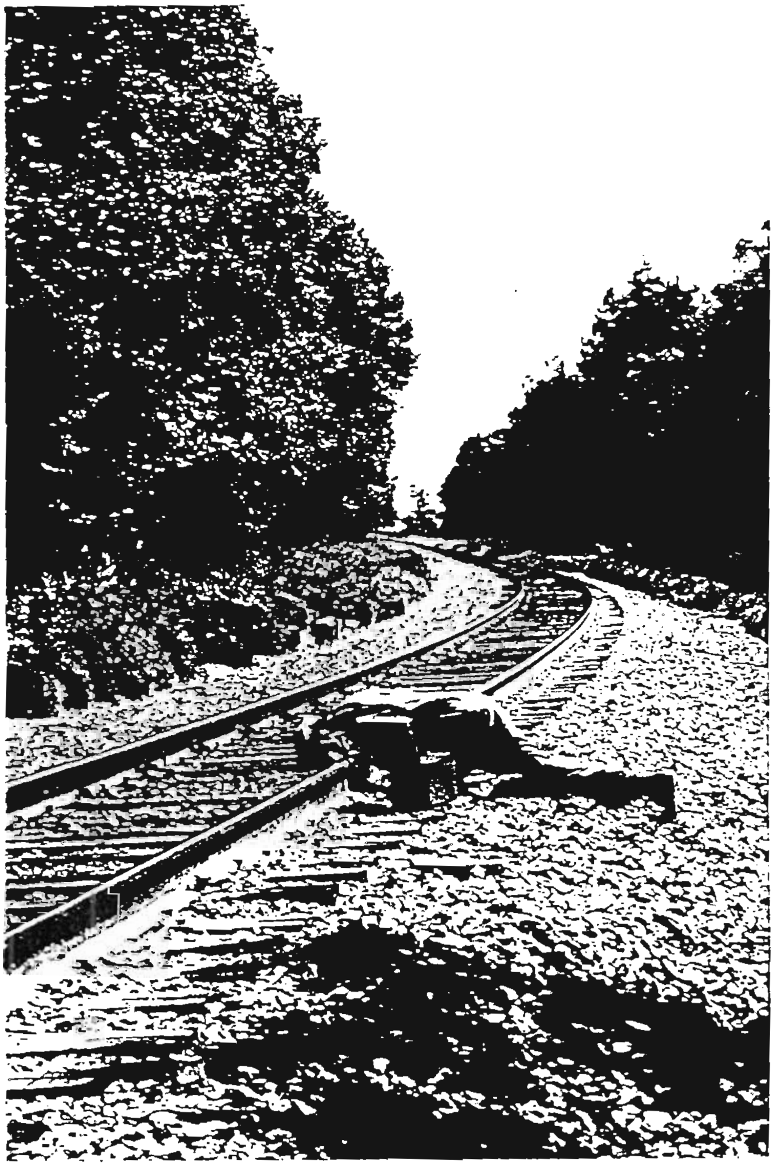


Figure 3

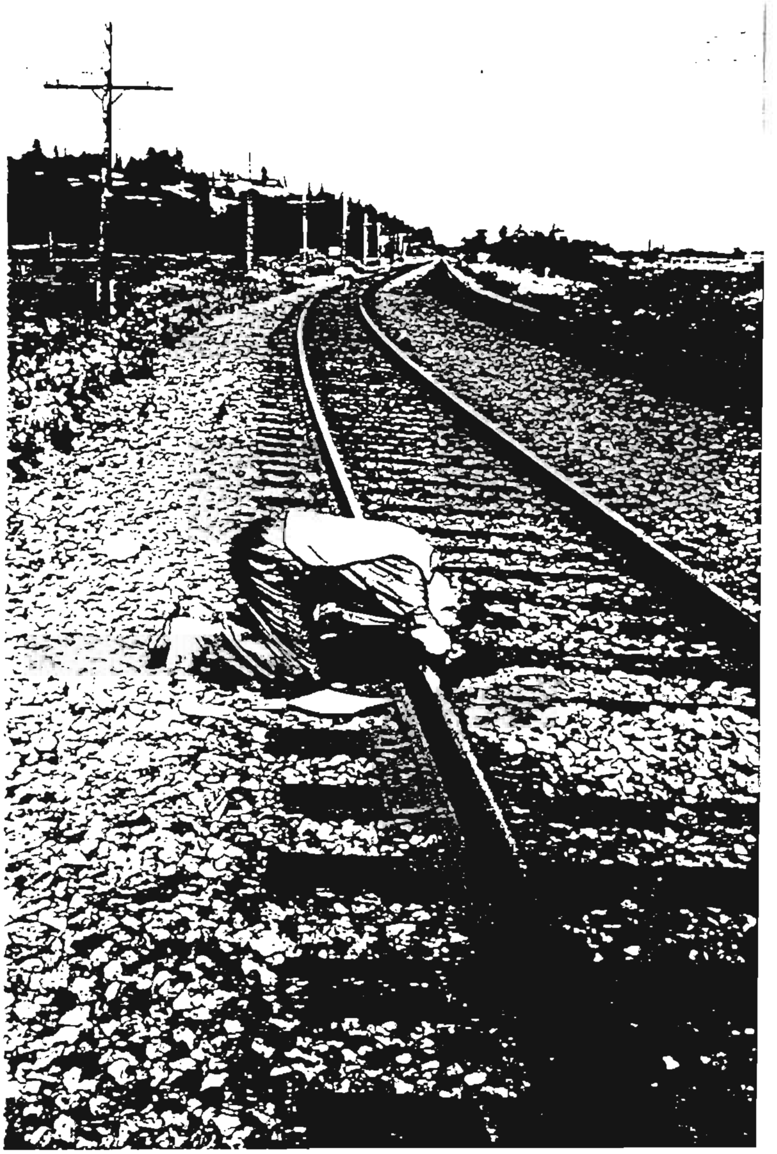


Figure 4

3. Description of Instrumentation

The focus of the testing was on the measurement of the dynamic wheel/rail forces, both vertical (V) and lateral (L) generated by the Talgo trainset, as well as different train types. As such, the instrumentation used was wayside mounted, i.e., mounted directly on the track, and was designed to measure the instantaneous dynamic forces generated by the cars and locomotives as they went over the test sites.

The instrumentation selected provided a direct measure of the dynamic vertical and lateral forces applied to each rail, i.e. the low and high rails. The instrumentation consisted of rail mounted strain gage arrays located on the rails. These strain gage arrays generated electronic signals which were transmitted to a data recording system, which collected the strain data, calculated the lateral and vertical loads placed on the rail, and created a report of these loads for each axle.

Both test sites (in the body and spiral of the curve) were instrumented with strain gages on both the low and high rails. Thus a total of four complete instrumentation arrays were installed on each side. Each of these instrumentation arrays consisted of one array of four strain gages for measuring the lateral force (Figure 5) and one array of eight gages for measuring the vertical force (Figure 6). CEA-Series type precision strain gages were chosen for optimum output under the operating conditions of this test. Each strain gage array represented an individual channel, which was connected to a system amplifier. The output from this amplifier was a voltage signal proportional to the load placed on the strain gage. A photograph of the strain gage installation is shown in Figure 7.

Note that special precautions were taken to protect the instrumentation, both during installation and during testing.

The strain gage arrays generated a series of voltage signals proportional to the applied loads (lateral and vertical respectively). These voltage signals were acquired by the data collection system and then sent to the system computer for analysis. The analysis system consisted of processors and monitors along with various acquisition hardware and software, including analog to digital conversion boards, and peak-and-hold software for capturing maximum signal values (Figure 8).

The software package made use of the LabVIEW 2 package, which used a graphical programming language "G" and a block diagram as a virtual instrument program. The block diagram is composed of objects that send or receive data, objects that perform specific functions, and objects that control the flow of execution. The code for acquiring data and analyzing the data involved sorting through the stored data set and selecting the data for each wheel pass.

Lateral Force
Strain Gage Array

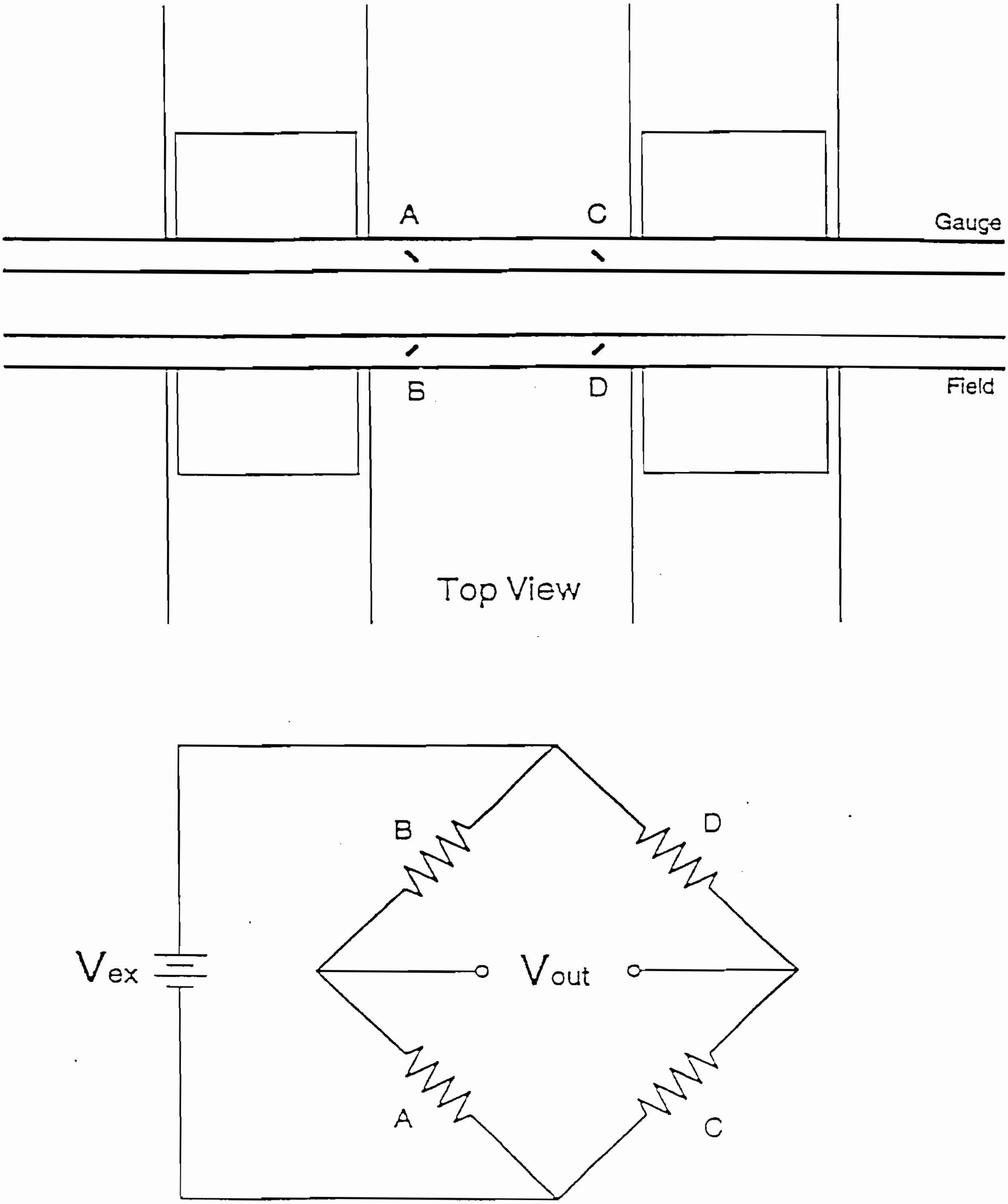


Figure 5

Vertical Force Strain Gage Array

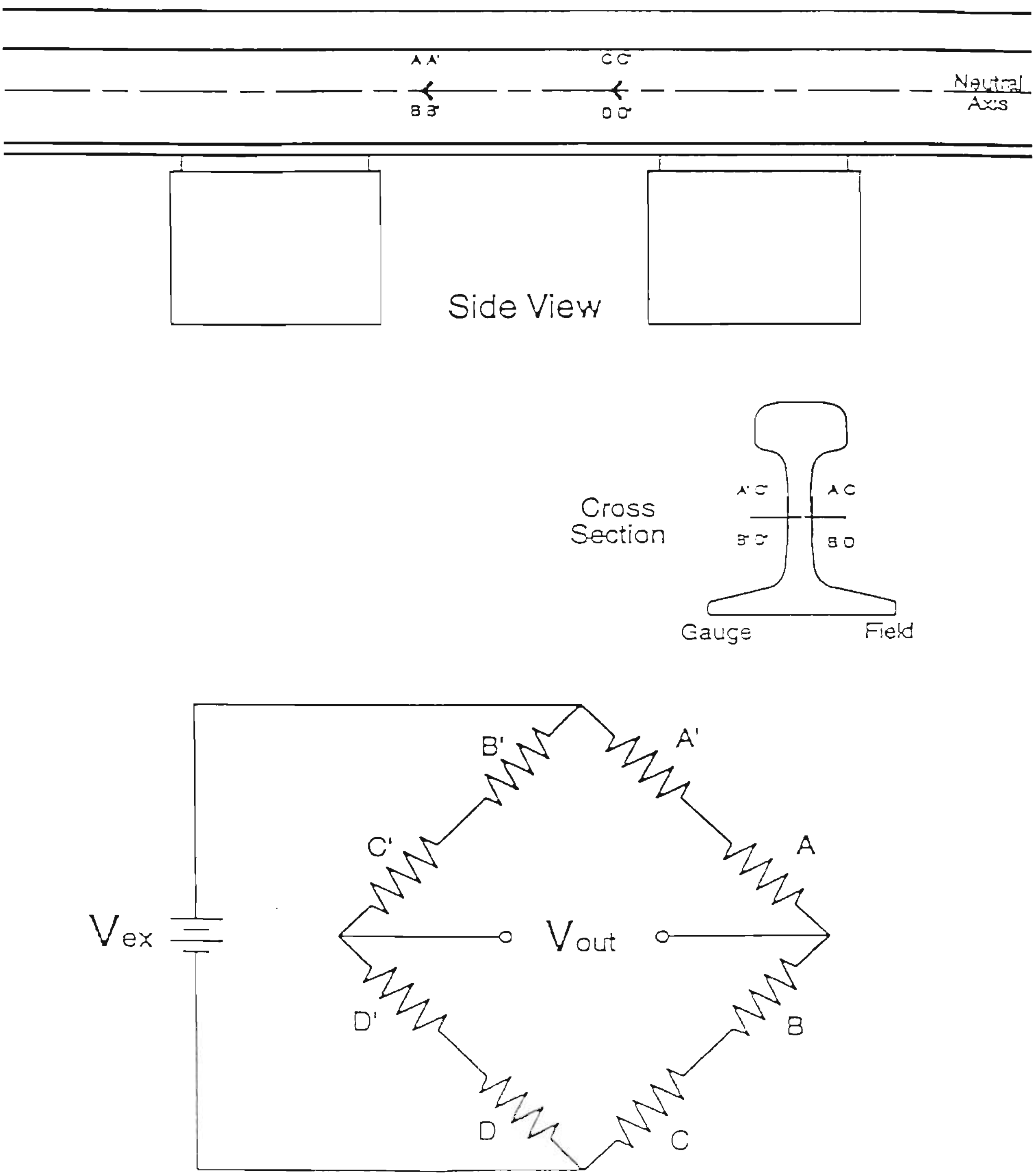


Figure 6

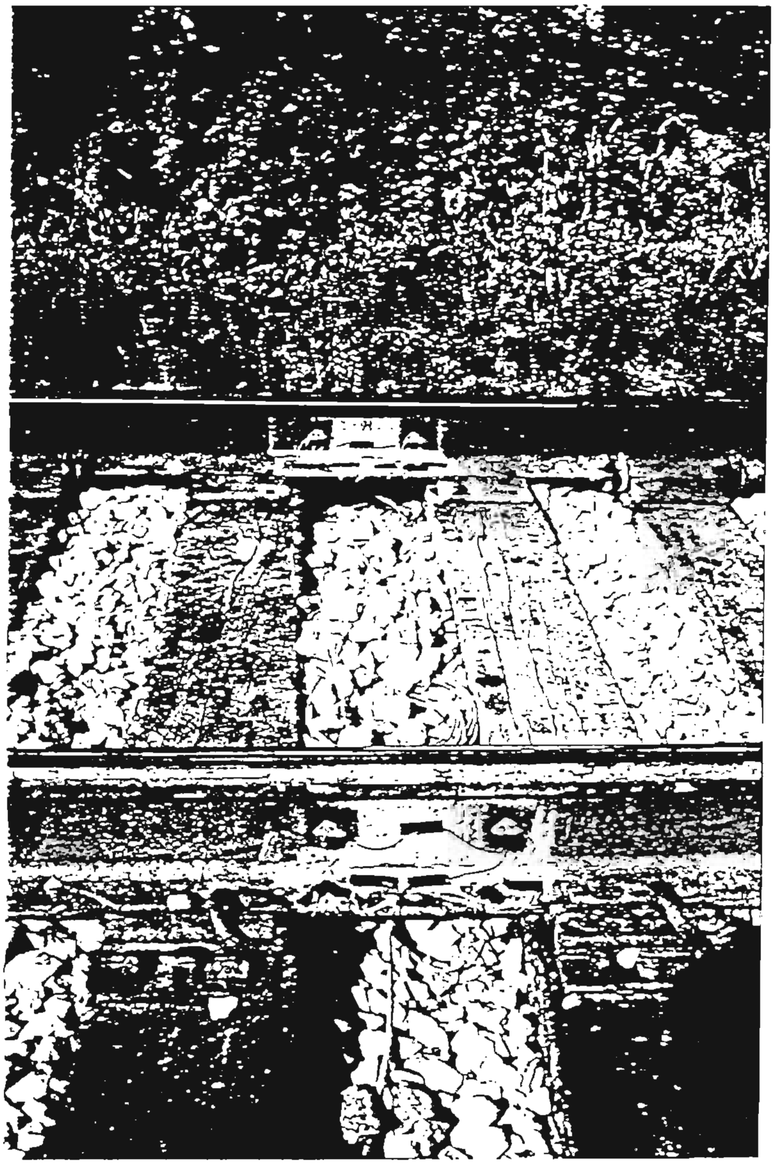


Figure 7

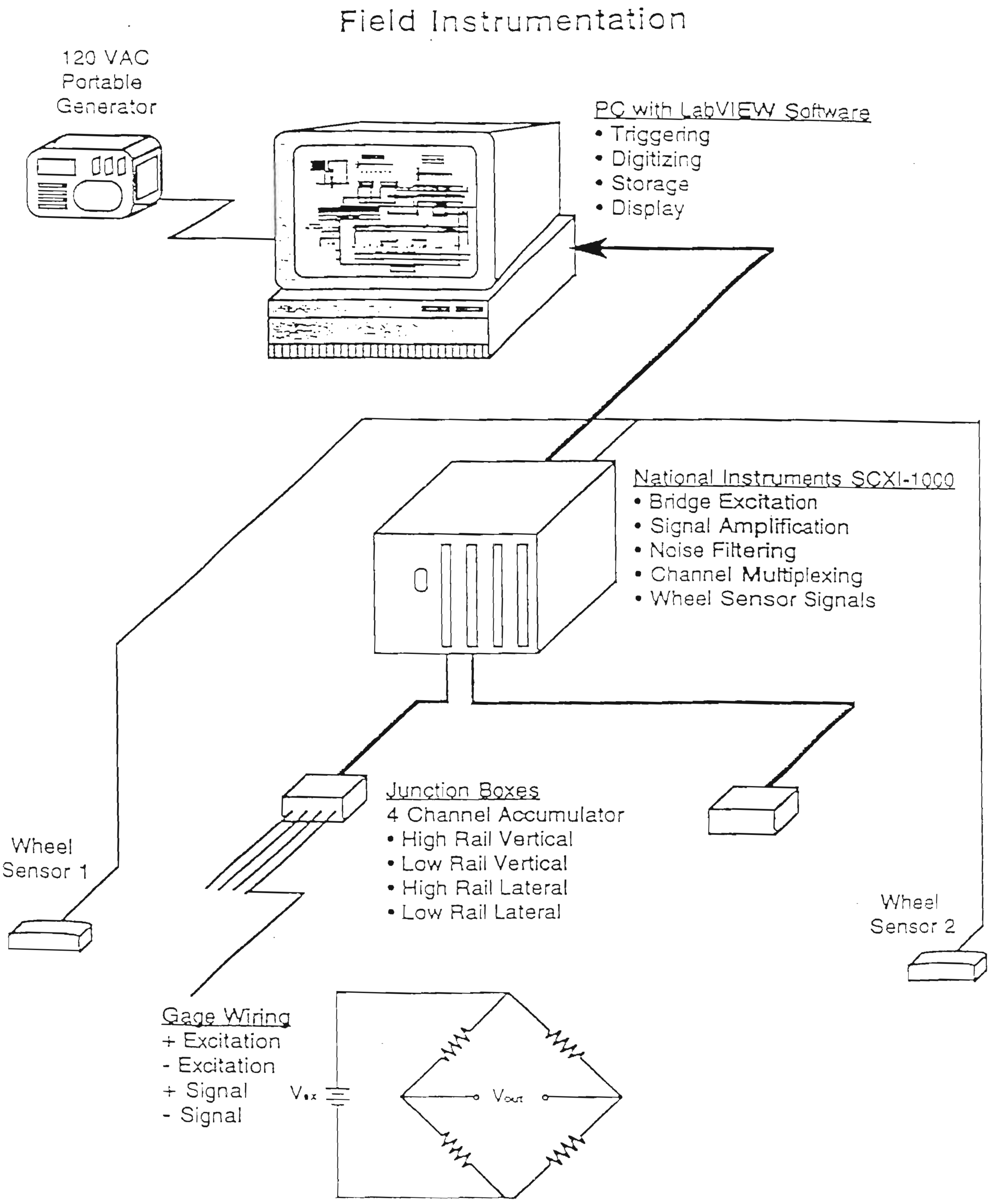

Field Instrumentation

Figure 8

Peak data, corresponding to the maximum load applied by each wheel set, was separated from the data set and recorded. This peak data was obtained for both Lateral force (L) and Vertical force (V), for both high and low rails.

The output computer report consisted of a header detailing the date and time at which the train passed, the train speed, and a table of the data as shown in Appendices B and C for the various types of trains tested. This data included lateral (L), vertical (V) and L/V values for each wheel, on both the high and low rails at each test site.

Note that all passing trains in two north curves were tested simultaneously, using two similar hardware and software systems, which provided the same environmental conditions and collect maximum data for each test run.

4. Calibration of Instrumentation

In order to obtain accurate force readings, the measurement system had to be calibrated for both the lateral and vertical wheel loads.

To calibrate the vertical force measurements, a train with a known car weight was stopped with a car wheel directly over vertical gage array. Knowing the weight of the car, and thus the wheel load, a scale factor was determined for the vertical wheel load. This scale factor was then used for the development of the required calibration constants for the measured test values (vertical).

To calibrate the lateral force measurements, a special loading fixture was used. This fixture is a ZETA-TECH modified Light Weight Track Loading Fixture (ZTLF), patterned after the initial LTLF design, developed by the US Department of Transportation. The initial LTLF design was such as to apply the lateral force to the neutral axis of the rail. This was not appropriate for lateral wheel/rail force measurements simulating forces developed at the wheel/rail interface on the head of the rail. As a result, changes were made in the LTLF design, and a new more rigid fixture with a set of special contact shoes was developed and used for testing. When the ZTLF is placed between the rails, the new contact shoe is resting on the rail head, which makes the conditions of calibration comparable to those for actual wheel/rail loadings and increased the accuracy of calibration. A photograph of the loading fixture with the modified contact shoes is shown in Figure 9.

Using the ZLTLF, a set of known lateral loads was applied to the track structure at each test site, and a separate scale factor was determined for use with the measured lateral wheel load data.

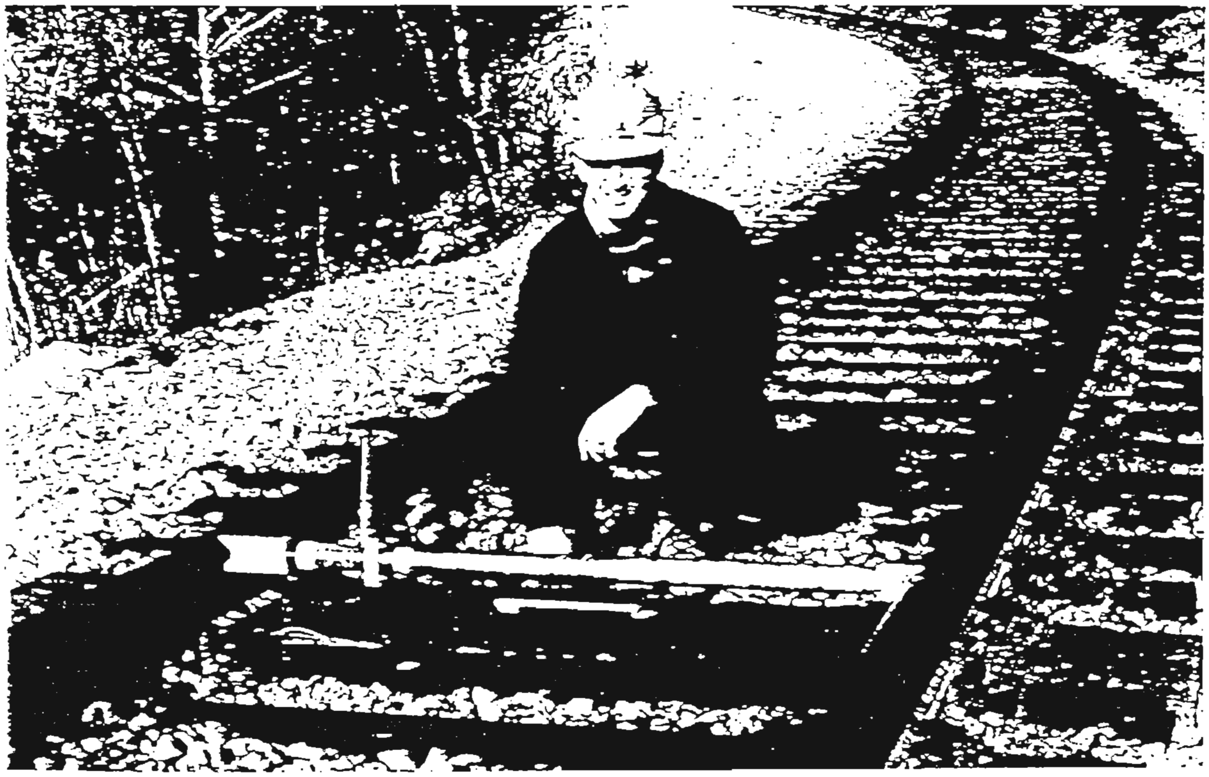


Figure 9

5. Analysis of Talgo Train Wheel/Rail Load Data

Using the instrumentation arrays defined above, vertical and lateral force data was collected for a total of 83 train runs through all test sites. The collected data included (for both high and low rails):

1. Date, Time and Speed (mph)
2. Axle Number
3. Stock Type
4. Direction
5. Test Site Location
6. Vertical Force V (lbs)
7. Lateral Force L (lbs)
8. L/V Ratio

It should be noted that while Talgo trainsets under investigation were measured going through the test sites both northbound and southbound, additional measurements were made of regular freight and Amtrak traffic, as well as sets of locomotive only consists.

In order to facilitate the analysis of these diverse measurements, all runs were divided into the following groups:

1. TalgoTrainset testing runs.
   Total number of runs: 64

2. Freight Trains (locomotives plus cars)
   Total number of runs: 15

3. Regular Amtrak Trains
   Total number of runs: 3

4. Sets of Locomotive only
   Total number of runs: 1

In addition to the consolidated data analyses for each group above, statistical investigations were performed within those groups, using following main parameters:

- cant deficiency

- track curvature

- train consist

For the Talgo trainset under testing, the general test matrix can be outlined as follows:

- Grouped by Direction:

Northbound	(33 runs)
Southbound	(31 runs)

- Grouped by Speed:

V < 55 mph	(3 runs)
35 to 55 mph	(21 runs)
55 to 65 mph	(18 runs)
65 to 75 mph	(21 runs)
V > 75 mph	(1 run)

Table 1 represents complete test matrix, including test site locations, dates and train types.

Other main parameters, including cant deficiency and curvature, are discussed below, in the corresponding chapters of report.

The rolling stock under testing was as follows:

- Talgo trainset-Standard 13-car: (coach cars, 1 bistro, 1 diner, 2 end cars).

- One F40-PH locomotive-used for motive power, A-end of train

- One F59-PH locomotive-used for motive power, A or B-end of train

The regular freight traffic was comprised of a mixed stock, including all types of loaded and empty cars, as well as sets of locomotives.

In order to define each run sequence accurately, a system of computer file codes was developed to identify each test runs uniquely. This system, as used in this report, is defined in Appendix D. The corresponding raw measurement data collected for the test trains is contained in Appendices B and C.

MEASUREMENT STATISTICS of TALGO TEST

Total number of wheels measured in all test curves (hi- and low rails)	Nw = 15,832

Total number of registered measurements (vertical and lateral channels)	Nm = 31,664

CURVE #		MP 74				MP 76				MP 34			Total Number of Trains
TRAINS	*Talgo*	*Freight*	*Amtrak*	*Locomotive*	*Talgo*	*Freight*	*Amtrak*	*Locomotive*	*Talgo*	*Freight*	*Amtrak*	*Locomotive*	
DATE													
08 - 05 - 97	12	2			12	2							
08 - 06 - 97	13	1	1		13								
08 - 07 - 97	5	1			5								
08 - 11 - 97	2				1	1							
08 - 12 - 97										3	2		
08 - 13 - 97									1	5		1	
Talgo Trainsets	32				31				1				64
Freight Trains		4				3				8			15
Amtrak Trains			1								2		3
Locomotive only												1	1
Total Number of Trains													83

Table 1

These measurement results were analyzed statistically in order to define any patterns or behavior trends. The following statistical parameters were used in this analysis and form the basis for the presentation of results in this report:

M = Mean (μ); Statistical mean or "average" of data sample

S = Standard Deviation (σ); Statistical standard deviation of data sample

M + 3S = $\mu + 3\sigma$; Mean + 3 × Standard Deviation
corresponding to 99.7% exceedance level

MAX = Maximum value of data sample

The $\mu + 3\sigma$ parameter is considered to be particularly important for our applications and conclusions since 99.7% of all distribution values can be found below the μ+3σ point. Thus, this value represents a low probability high force level event of the type that can result in track damage or a derailment; e.g. rail overturning or wheel climb. It thus represents a maximum set of values (together with their MAX value itself) that could result in derailment potential.

For each of the data group noted above, the statistical distribution of the data was analyzed. The key distributions of lateral forces and (L/V) ratio were studied for different combinations of main parameters.

5.1. Talgo Trainset Test Results and Trends

The first group to be analyzed and compared is the Talgo Trainsets. In this set of analyses, full test train consists of all of the ***tilting Talgo cars and two locomotives*** were analyzed. The main goal of the statistical study performed was an investigation of the Vertical and Lateral wheel/rail force levels and L/V ratios.

The L/V ratio is the ratio of Vertical wheel/rail force to Lateral wheel/rail force and represents a parameter which provides valuable insight into the potential for derailments, both wheel climb and rail overturning. In general, L/V ratios below 0.8 (the Nadal limit) do not result in a risk of wheel climb, while L/V ratios less than 0.6 have a reduced risk of rail overturning.

Note, that L/V ratio was an analysis parameter, derived from the simultaneous measurement of the Lateral (L) and Vertical (V) forces.

Examination of the full data set ***for all curves*** (for both curve body and spiral sites) produces a distribution of L/V ratio for the high and low rails. These distributions are presented in Figures 10 and 11 for the spirals and curve bodies respectively. Note that each table contains two distributions, one each for the high and low rails.

Table 2 contains comprehensive results of the test statistics study ***for all curves***, which allows for a direct comparison of main parameters between the spiral and curve body, as well as high and low rails. Note that this table (as well as tables that follow) shows the mean (M), standard deviation (S), M+3S, and maximum values of main parameters distributions.

TALGO TRAINSETS STATITICS (INCLUDES F40-PH LOCOMOTIVE & F59-PH LOCOMOTIVE)

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
TALGO	Max	48111	55792	15342	11728	57278	46988	23735	12770	0.46	0.59	0.48	0.53
TRAINSETS	M	26026	19943	3692	2068	30595	16398	4115	1682	0.15	0.11	0.12	0.10
	S	10335	7744	2511	2561	12633	6425	3889	1918	0.07	0.14	0.08	0.09
	3S	31005	23232	7532	7682	37900	19276	11666	5753	0.22	0.42	0.25	0.26
	M+3S	57030	43175	11225	9750	68495	35674	15782	7436	0.37	0.53	0.37	0.35

Note: Statistics Do Not Differentiate Between Vehicle Types (Talgo Coach, Locomotives) But Address the Train Consist as a Whole.

Table 2

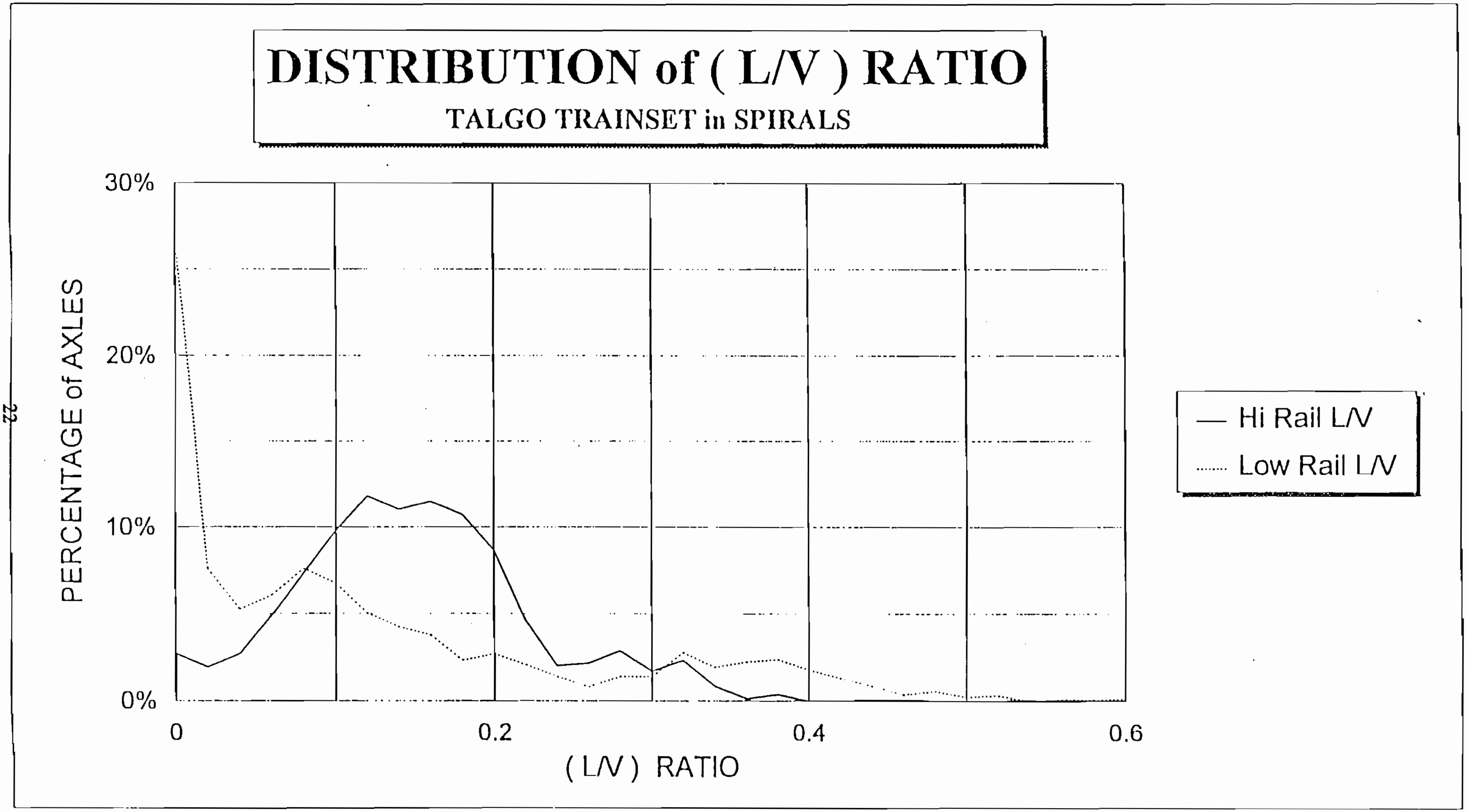

DISTRIBUTION of (L/V) RATIO
TALGO TRAINSET in SPIRALS
PERCENTAGE of AXLES
30%
20%
10%
0%
0
0.2
0.4
0.6
(L/V) RATIO
— Hi Rail L/V
······ Low Rail L/V

Figure 10

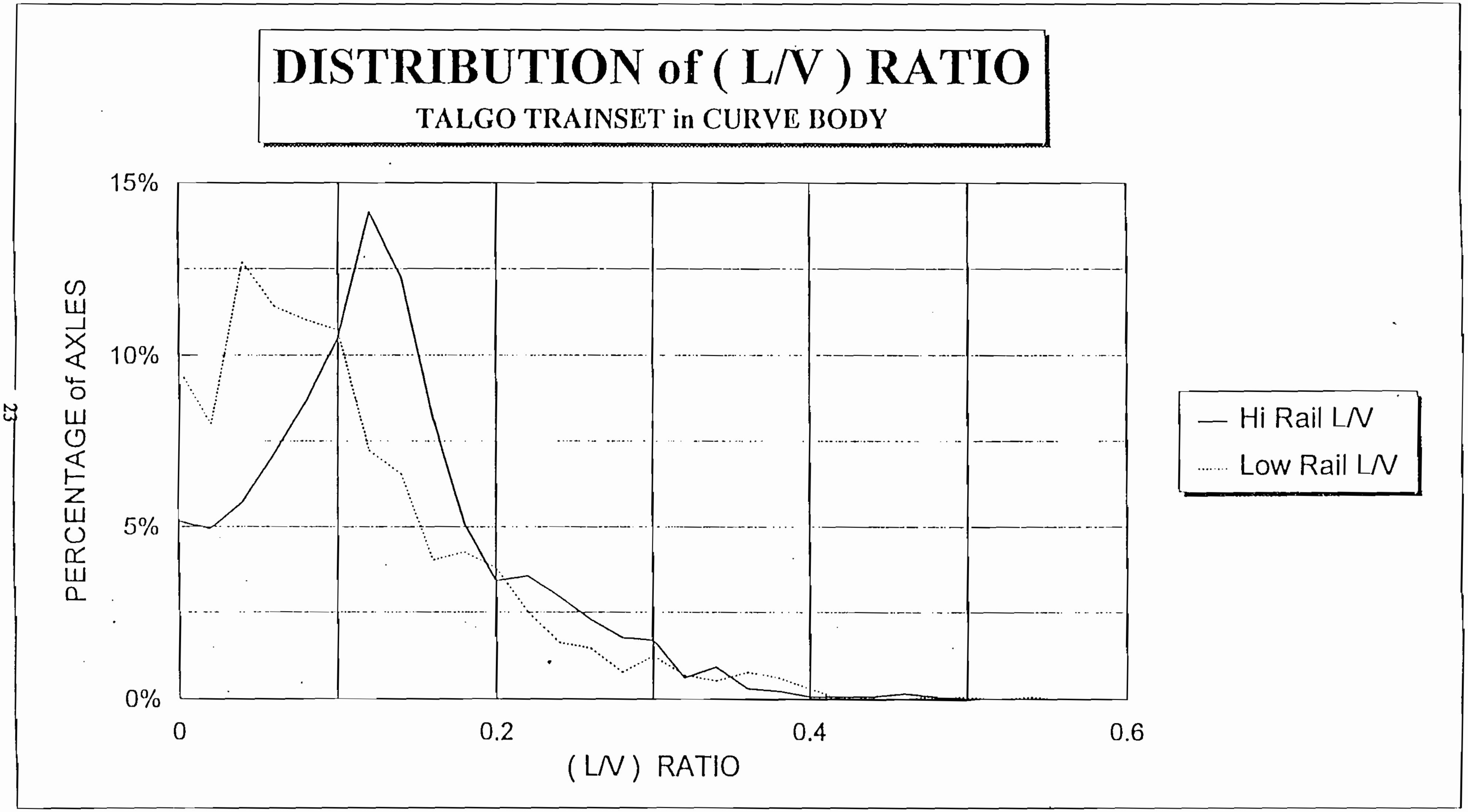

DISTRIBUTION of (L/V) RATIO
TALGO TRAINSET in CURVE BODY
15%
10%
5%
0%
PERCENTAGE of AXLES
0
0.2
0.4
0.6
(L/V) RATIO
Hi Rail L/V
Low Rail L/V

Figure 11

Based on the data developed in this table and figures, which represent general Talgo Trainset statistics in ***all curves under all conditions***, the following observations are presented:

General Statistics (Table 2)

Vertical Forces:

1. Mean vertical forces have approximately the same levels in both curve body and spiral, with the high rail loading averaging from 30% higher than the low rail in spirals to 86% higher than that in curve bodies.

2. The maximum vertical force measured in the curve body high rail was 57,278 lbs., comparing to the M+3S value for the same rail reaching 68,495 lbs. Note that high rails have a higher variation about the mean (*standard deviation S*). This parameter, which is a measure of the range of variation in the test data, shows that high rail standard deviation is 33% to 97% higher than the low rail values.

Lateral Forces:

1. Mean lateral forces have approximately the same levels in both curve body and spiral, with the high rail loading averaging from 78% higher than the low rail in spirals to 145% higher than that in curve bodies (M=4,115 lbs.).

2. The maximum lateral force measured in body high rail was 23,735 lbs., compared to the M+3S value for the same rail reaching 15,782 lbs.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have the same tendency as for the lateral forces.

2. The average (mean) value of the L/V ratios is generally higher for the high rail (in both the spiral and body). However, the actual values for the mean L/V ratios, in the range of 0.10 to 0.15, are very moderate.

3. Greater variations in L/V ratios were measured on the low rail in spirals, leading to a higher level of standard deviation (S) than for those measured on the high rail and on both rails in the curve body; 100% higher as compared to the high rail, 75% and 55% higher for the high and low rail in curve body respectively.

4. As a result of this standard deviation effect, the Talgo Trainset has higher M + 3S values for the low rail in spiral, reaching 0.53.

5. The maximum levels of the M+3S L/V ratio values are in the range of 0.35 to 0.53 for all test data under investigation; these are below the wheel climb/rail overturning limits.

6. The *maximum* measured L/V ratios, developed by the Talgo Trainsets in the low rails, are 28% and 10% greater than those for the high rails (spiral and curve body respectively).

7. The highest overall L/V level, 0.59, measured in the low rail spiral falls below the wheel climb/rail overturning limits.

Statistical Distributions (Figures 10 and 11)

1. Figure 10 presents distribution of (L/V) ratio in spirals ***for all curves and conditions.*** Note that this figure contains two distributions, one each for the high and low rail.

2. Unlike the high rail distribution, which has a typical and close to symmetrical bell curve, low rail shows asymmetrical distribution with the maximum shifted towards lower L/V ratios. It can be seen from these graphs, that most of the L/V ratios for high rail wheels are between 0.10 and 0.20. At the same time, the picture for the low rail is completely different, with the majority of L/V ratios in the 0 to 0.12 diapason.

3. The right branches of the distribution graphs confirm the analytical data above, and clearly show that all L/V maximums are below the wheel climb/rail overturning thresholds.

4. Figure 11 presents the distribution of L/V ratios in curve bodies ***for all curves and conditions.*** Note that this figure contains two distributions, one each for the high and low rail.

5. Both distributions correlate well, with a relative shift towards lower L/V ratios for the low rail wheels. The majority of L/V ratios are in the range of 0.03 to 0.20, and 0 to 0.12 for high and low rails respectively.

In addition to the statistical analysis and discussion, typical patterns of the Talgo Trainset and Freight train wayside records are shown in Appendix F, Figures F1 to F5, which present the recorded traces of the vertical and lateral forces with time. Figures F1, F2 and F3 present the typical pattern of the lead and trailing Talgo trainset axles, with the lateral load higher than that for the mid-axles. Figures F4 and F5 reflect some higher values of L/V ratios recorded for the Freight trains during the tests.

It has to be recognized that the above discussed distributions actually represent the combination of two separate statistics for ***Talgo cars and locomotives***. Therefore, further investigation of discrete data sets (i.e., of the next statistical "layer") based on the test data separation, is required.

5.2. Talgo Locomotive Statistics

The second group to be analyzed and compared is the Talgo Trainset Locomotives. In this and following sets of analyses, the contribution of the locomotive lateral dynamic was separated, analyzed and compared with that for Talgo cars to find the main source of rail loading. As above, the goal of the statistical study performed was an investigation of the Vertical and Lateral wheel/rail force levels and the L/V ratios.

Table 3 contains comprehensive results of the test statistics study *for all curves*, which allows for a direct comparison of main parameters between the spiral and curve body for the high and low rails. Note, that this table (as well as tables that follow) shows the mean (M), standard deviation (S), M+3S, and maximum values of the parameter distributions.

A special statistical study was performed for Talgo Locomotive group to investigate the most important and crucial part of the test matrix, **the dependence of the levels of lateral dynamics on cant deficiency.**

Using the examination of the full data set *for all curves* (for both curve body and spiral sites), regression analyses were performed for the lateral forces L and L/V ratios for the high rails. These regressions are presented in Figures 12, 13, 14 and 15. Note that each figure contains graphical part with the test data and linear regression, as well as main analytical data, including regression output and cant deficiency group distribution (all plots utilize ***intended*** cant deficiency, not the actual cant deficiency realized for a given test run).

TALGO LOCOMOTIVES STATISTICS

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
TALGO	Max	48111	55792	15342	11728	57278	46988	23735	12770	0.38	0.51	0.48	0.53
LOCOMOTIVES	M	39375	28057	5060	2762	46689	23026	7513	2840	0.13	0.10	0.16	0.12
	S	3632	5737	3337	2960	5213	5765	4350	2544	0.08	0.11	0.09	0.10
	3S	10895	17211	10011	8881	15638	17295	13049	7631	0.25	0.33	0.27	0.31
	M+3S	50270	45268	15071	11644	62327	40321	20562	10471	0.37	0.43	0.42	0.43

Table 3

Regression Output:

Constant		3348.047
Std Err of Y Est		214.7869
R Squared		0.903803
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	314.7557	
Std Err of Coef.	51.34388	

Y = 3348.047 + 314.756*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	44
4	28
5	60
6	92
7	158
8	62

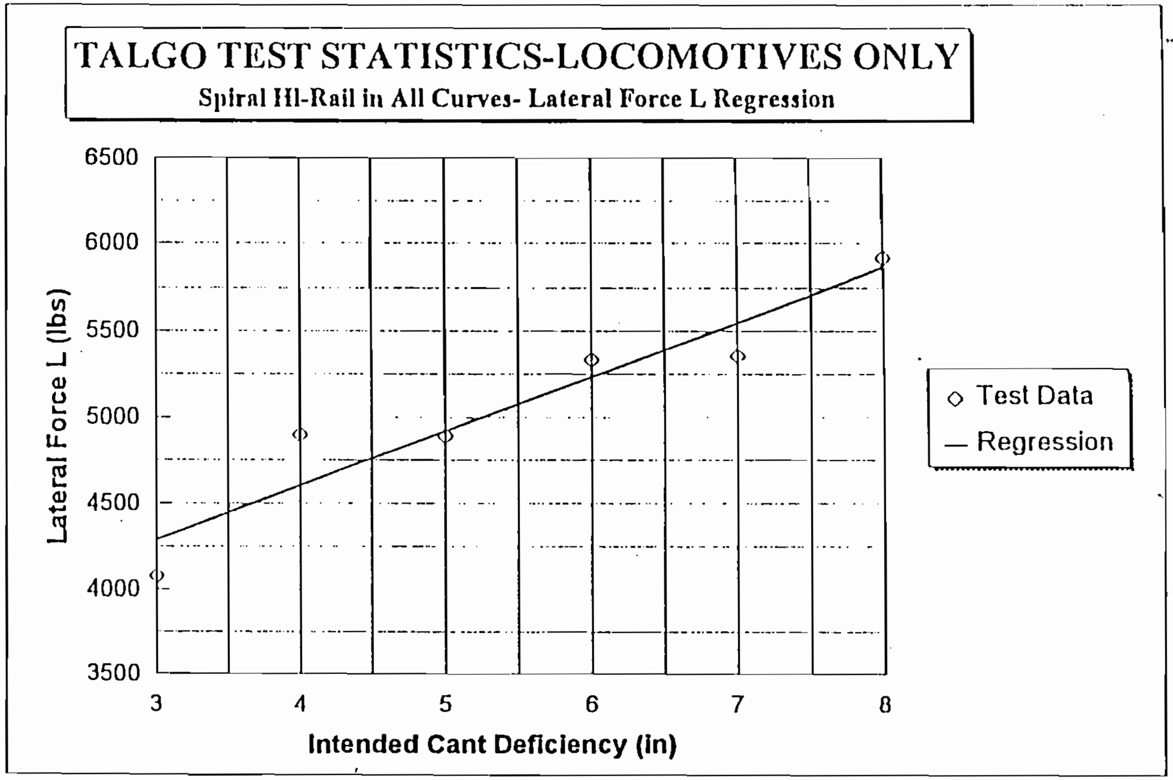


Figure 12

Regression Output:		
Constant		4951.5
Std Err of Y Est		440.0478
R Squared		0.83259
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	469.1762	
Std Err of Coef.	105.1916	

Y = 4951.500 + 469.176*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	44
4	28
5	60
6	92
7	158
8	62

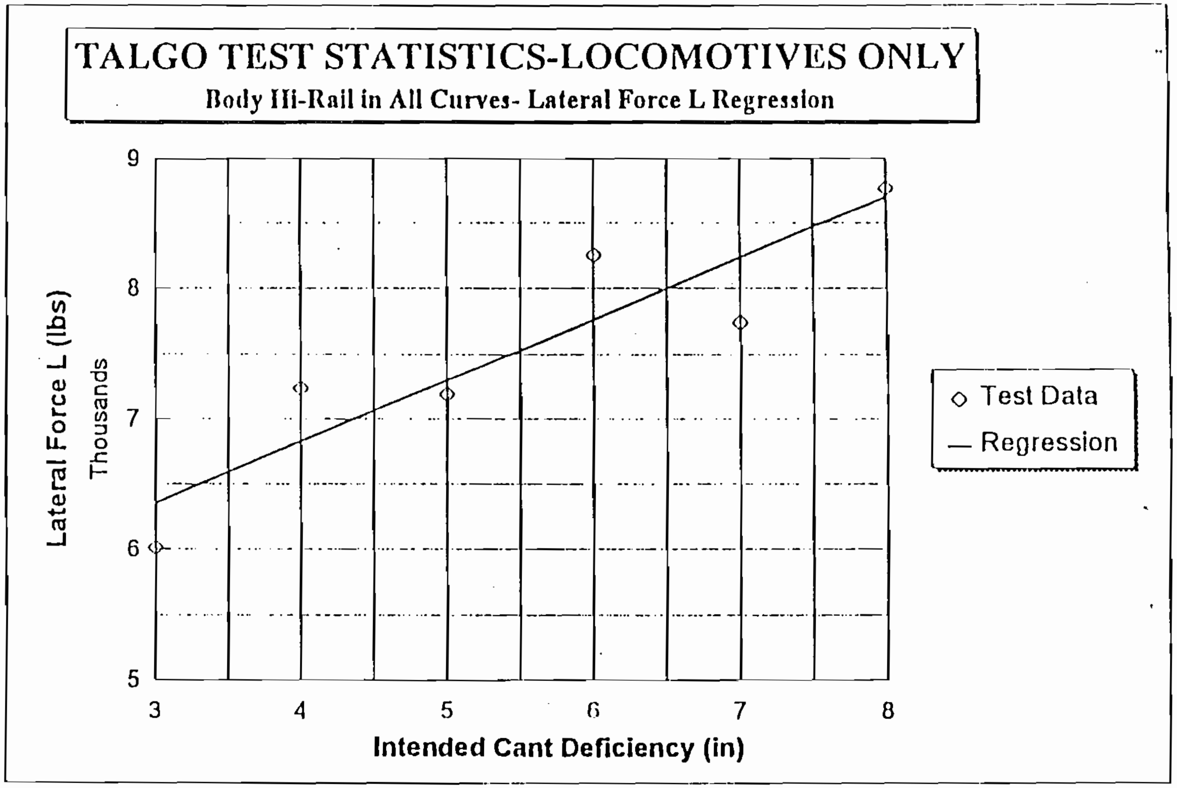


Figure 13

Regression Output:

Constant		0.098558
Std Err of Y Est		0.005656
R Squared		0.798284
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.00538	
Std Err of Coef.	0.001352	

Y = 0.098558 + 0.00538*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	44
4	28
5	60
6	92
7	158
8	62

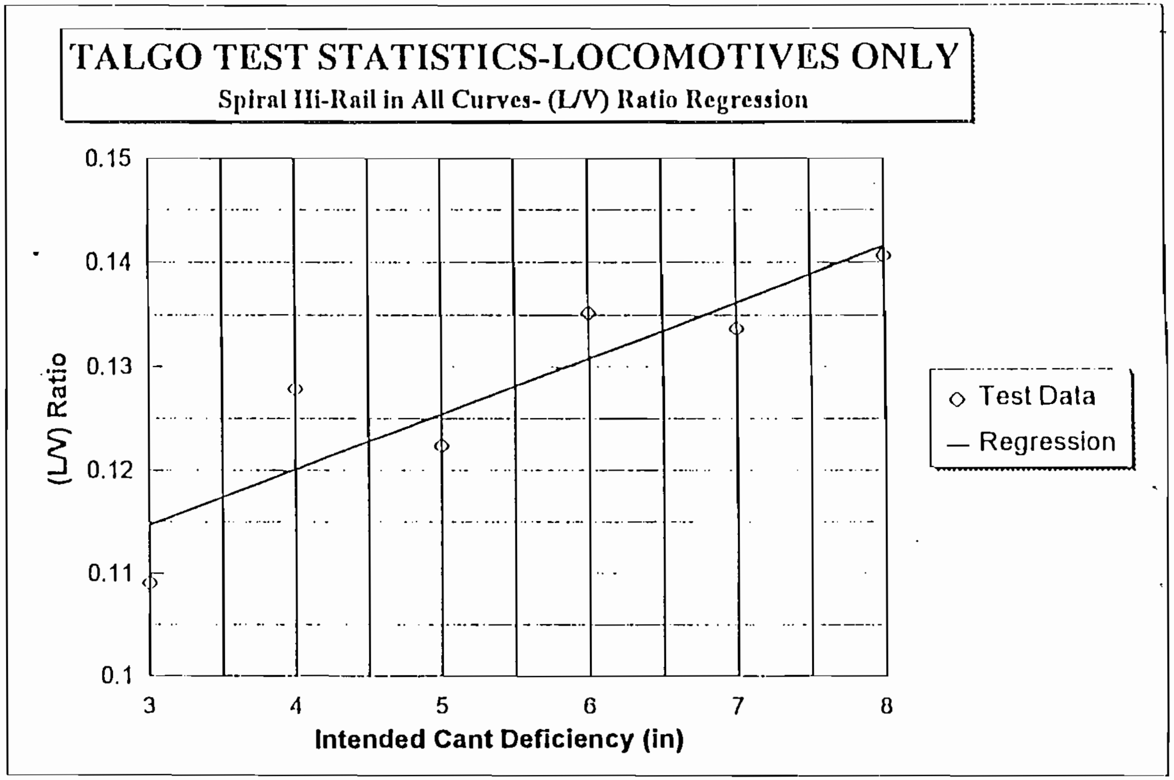


Figure 14

Regression Output:		
Constant		0.130066
Std Err of Y Est		0.011038
R Squared		0.51739
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.005464	
Std Err of Coef.	0.002639	

Y = 0.130066 + 0.005464*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	44
4	28
5	60
6	92
7	158
8	62

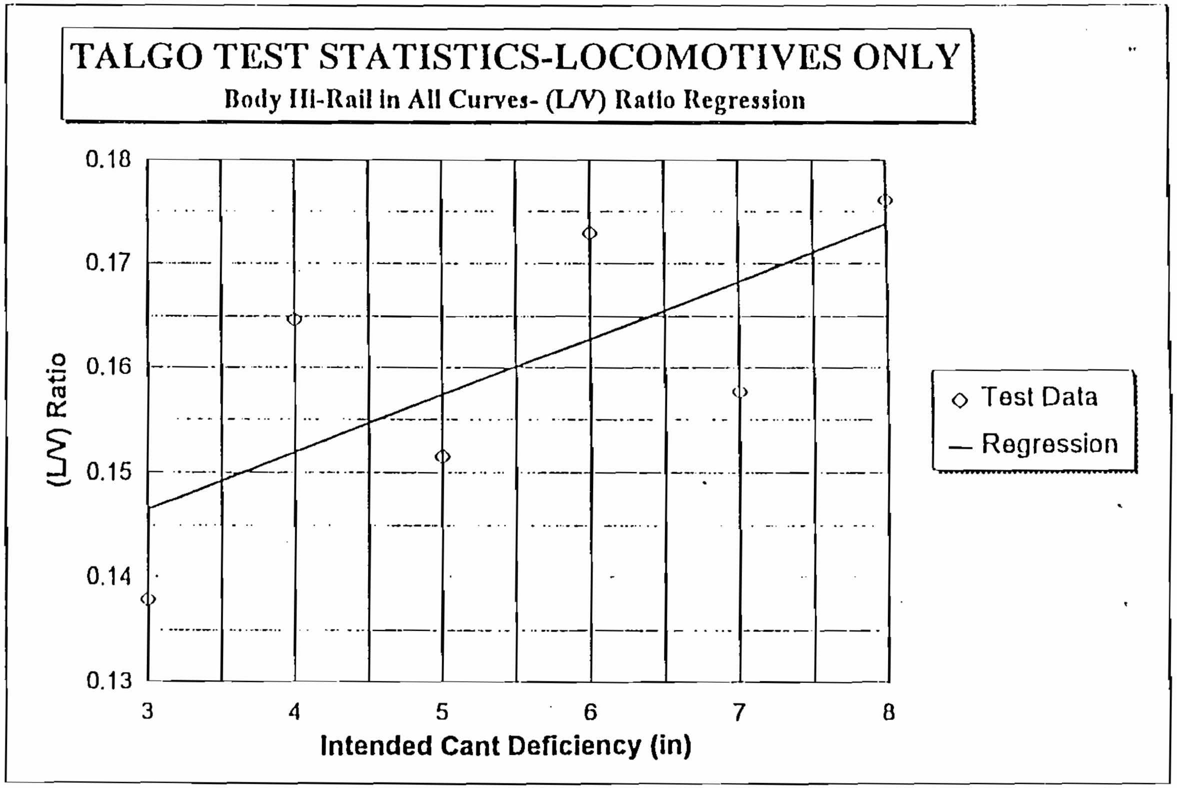


Figure 15

Based on the data developed in the table and figures, which represent general Talgo Locomotives statistics in ***all curves under all conditions***, the following observations are presented:

General Statistics (Table 3)

Vertical Forces:

1. Mean vertical forces have roughly the same levels in both curve body and spiral, with the high rail loading averaging from 40% higher than the low rail in spirals to 103% higher than that in curve bodies.

2. The maximum vertical force measured in the curve body high rail was 57,278 lbs. The M+3S value for the same rail reached 62,327 lbs. Note that vertical forces on the low rail have a higher variation about the mean (*standard deviation S*) in the spiral (5,737 lbs.) than that for the high rail (3,632 lbs.). The maximum vertical force of 57,278 lbs. represents the highest vertical force measured (see Chapter 5.1).

Lateral Forces:

1. Mean lateral forces have approximately the same levels in both curve body and spiral, with one exception for the high rail in curve body (7,513 lbs. vs. 5,060 lbs. for spiral). The high rails have typical loading averaging from 83% higher than the low rails in spirals to 164% higher than that in curve bodies (M=7,513 lbs).

2. The maximum lateral force measured in body high rail was 23,735 lbs., with the M+3S value for the same rail reaching 20,562 lbs. Note that this maximum is much higher than those measured on other rails, which are in the range of 12,000 to 15,000 lbs.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have roughly the same tendency as for the lateral forces, although the scatter is much greater.

2. The average (mean) value of the L/V ratios are generally higher for the high rail (in both the spiral and body). However, the actual values for the mean L/V ratios, in the range of 0.10 to 0.16, are very moderate.

3. The standard deviation (S) of L/V ratios measured for the Talgo Locomotives were approximately the same (0.08 to 0.11 range) for all rails under investigation.

4. Higher M + 3S values (reaching 0.43) are determined for the low rail, both in spiral and curve bodies, as compared to those for the high rail.

5. The maximum levels of the M+3S L/V ratio values are in the range of 0.38 to 0.53 for all test data under investigation; these are below the wheel climb/rail overturning limits.

6. The *maximum* measured L/V ratios, developed by the Talgo Locomotives in the low rails, are 34% and 10% greater than those for the high rails (spiral and curve body respectively).

7. The highest overall L/V level, 0.53, measured in the low rail of the curve body falls below the wheel climb/rail overturning limits.

Regression Analyses (Figures 12-15)

One of the most important parameters of the regression investigation performed is the "R Squared" value (coefficient of determination), showing which part of lateral force variation can be "explained" by regression output.

1. Figures 12 and 13 present the regression outputs for the Lateral Forces in high rails *for all curves* (spiral and curve body respectively). Note that in both cases, "R Squared" values of 0.904 and 0.832 are well above the assurance threshold of 0:5. This, in communication with the number of measured wheels, provides the necessary level of certainty.

2. It can be seen from both figures that wheel/rail lateral forces are directly proportional to the intended cant deficiency level, as expected. However, the curve body regression line predicts consistently higher lateral forces, specifically in the range of 6,400 to 8,700 lbs., compared to those predicted for spirals of 4,300 to 5,800 lbs.

3. Figures 14 and 15 show the regression outputs for the L/V ratios in high rails *for all curves* (spiral and curve body respectively), with adequate "R Squared" values, 0.798 and 0.517.

4. The corresponding values and relationships for L/V ratio have the same tendency as for the lateral forces.

5. Both figures show that L/V ratios are, as expected, directly proportional to the intended cant deficiency level. However, the curve body regression line provides consistently higher levels of L/V, specifically in the range of 0.147 to 0.174, compared to the 0.115 to 0.142 range for spirals.

6. Regressions for the full diapason of the intended cant deficiencies, from 3 to 8 inches represent very moderate *statistical* levels of L/V ratios for both curve bodies and spirals.

5.3. Talgo Car Statistics

The third group to be analyzed is the Talgo Trainset Cars, which represent the vast majority of the measured axles. In this and following sets of analyses, the level of the car lateral dynamics was separated and analyzed in the same manner as the Talgo Locomotives, which allows for the comparative study below. As above, the goal of the statistical study performed was an investigation of the Vertical and Lateral wheel/rail force levels and the L/V ratios.

Table 4 contains comprehensive results of the test statistics study *for all curves*, which allows for a direct comparison of main parameters between the spiral and curve body for the high and low rails. Note, that this table (as well as the previous one) shows the mean (M), standard deviation (S), M+3S, and maximum values of the parameter distributions.

Special statistical study was also performed for Talgo Car group, to investigate the most important and crucial part of the test matrix, **the dependence of the levels of lateral dynamics and intended cant deficiency.**

Using the examination of the full data set ***for all curves*** (for both curve body and spiral sites), regression analyses were performed for the lateral forces L and L/V ratios for the high rails. These regressions are presented in Figures 16, 17, 18 and 19. Note that as previously presented, each figure contains graphical part with the test data and linear regression, as well as main analytical data, including regression output and cant deficiency group distribution. As was the case with the previous analysis, ***all plots utilize intended cant deficiency, not the actual cant deficiency realized for a given test run.***

TALGO CARS STATISTICS

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
TALGO CARS	Max	25409	45294	7854	10254	29109	25207	10770	6673	0.46	0.59	0.46	0.39
	M	18542	15395	2926	1679	21573	12682	2211	1034	0.16	0.12	0.10	0.08
	S	1813	4187	1403	2215	2665	2714	1704	972	0.07	0.16	0.07	0.07
	3S	5440	12562	4208	6646	7990	8142	5113	2817	0.20	0.47	0.22	0.21
	M+3S	23982	27958	7134	8325	29569	20824	7324	3950	0.36	0.59	0.32	0.29

Table 4

Regression Output:		
Constant		2107.96
Std Err of Y Est		180.9045
R Squared		0.746439
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	148.3939	
Std Err of Coef.	43.24446	

Y = 2107.96 + 148.39*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	84
4	42
5	110
6	158
7	264
8	122

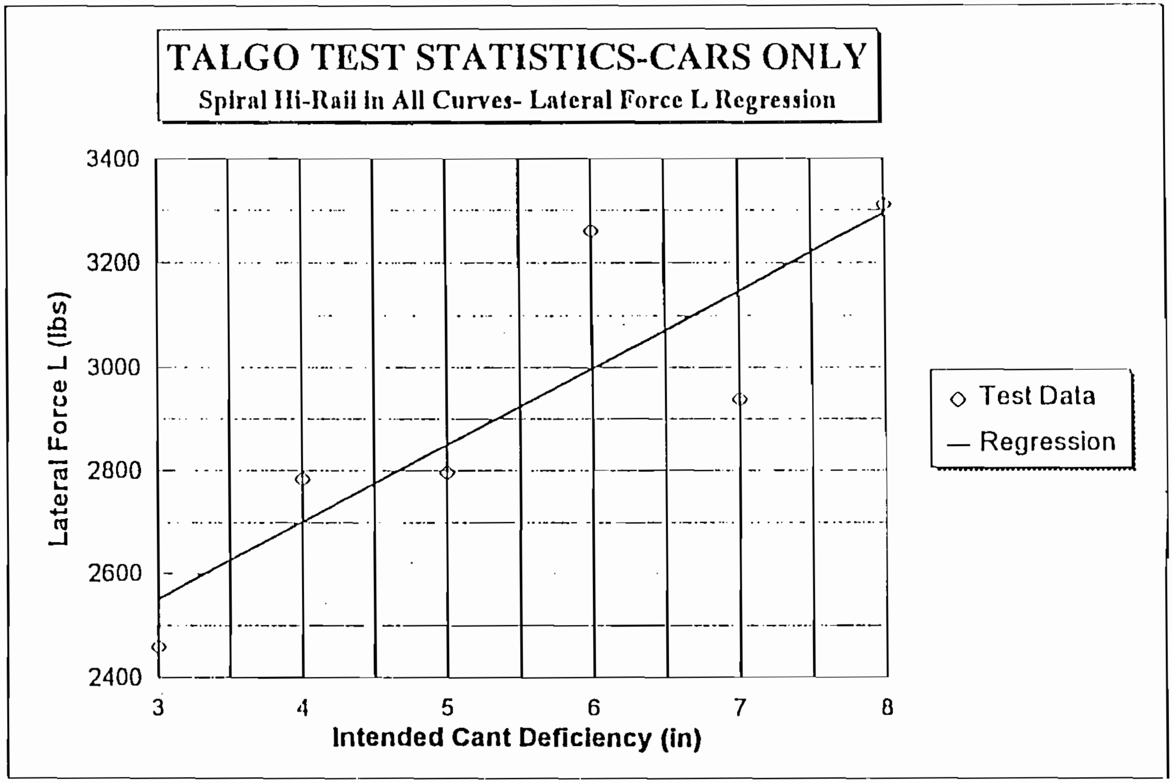


Figure 16

Regression Output:

Constant		1017.649
Std Err of Y Est		368.6428
R Squared		0.570828
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	203.2609	
Std Err of Coef.	88.12248	

Y = 1017.649 + 203.261*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	84
4	42
5	110
6	158
7	264
8	122

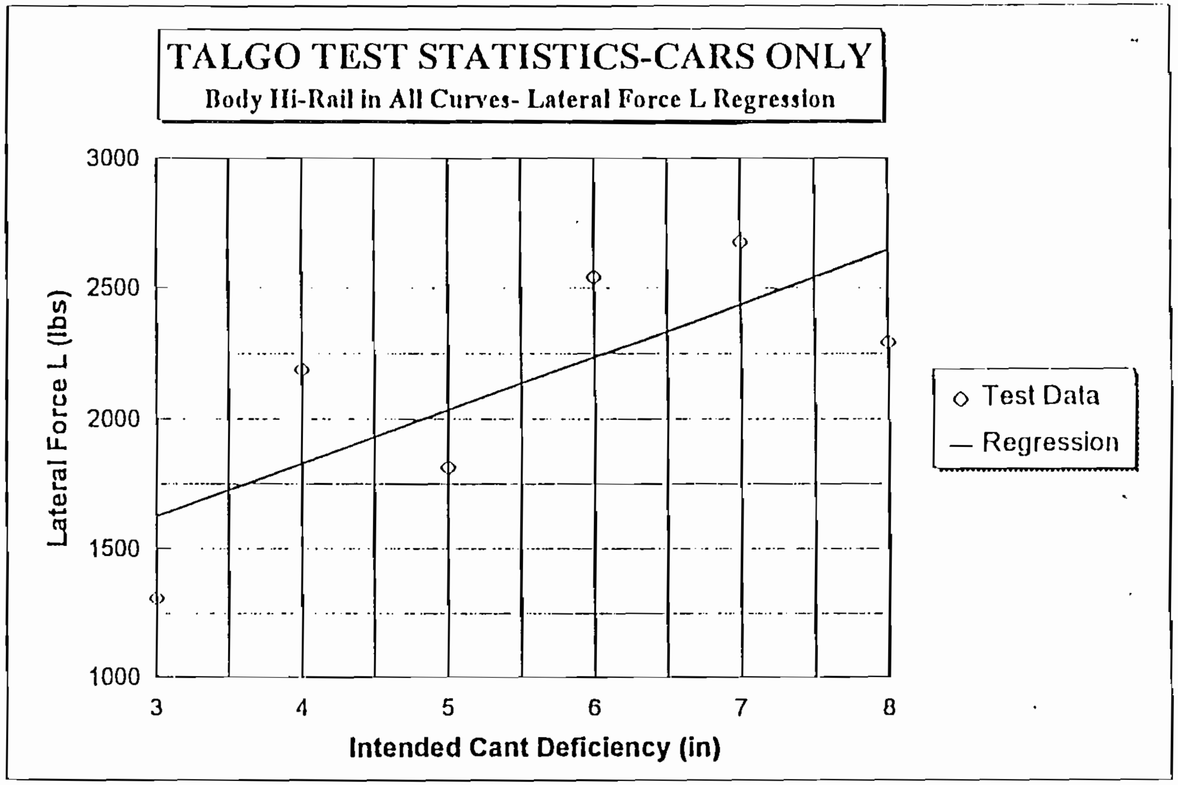


Figure 17

Regression Output:

Constant	0.124234
Std Err of Y Est	0.009155
R Squared	0.638855
No. of Group Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.005822
Std Err of Coef.	0.002189

Y = 0.124234 + 0.005822*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	84
4	42
5	110
6	158
7	264
8	122

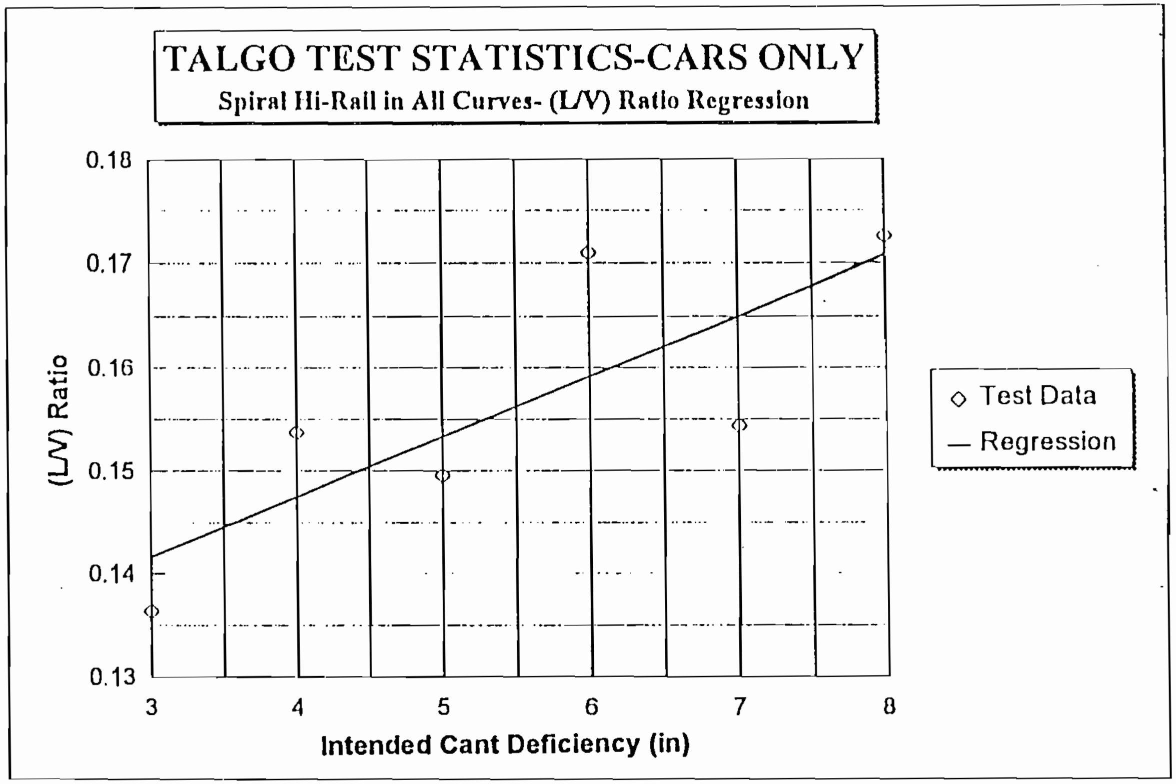


Figure 18

Regression Output:

Constant		0.059608
Std Err of Y Est		0.01799
R Squared		0.388445
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.006855	
Std Err of Coef.	0.0043	

Y = 0.05908 + 0.006855*X

Cant Deficiency Observation Group (in)	Number of Wheels
3	84
4	42
5	110
6	158
7	264
8	122

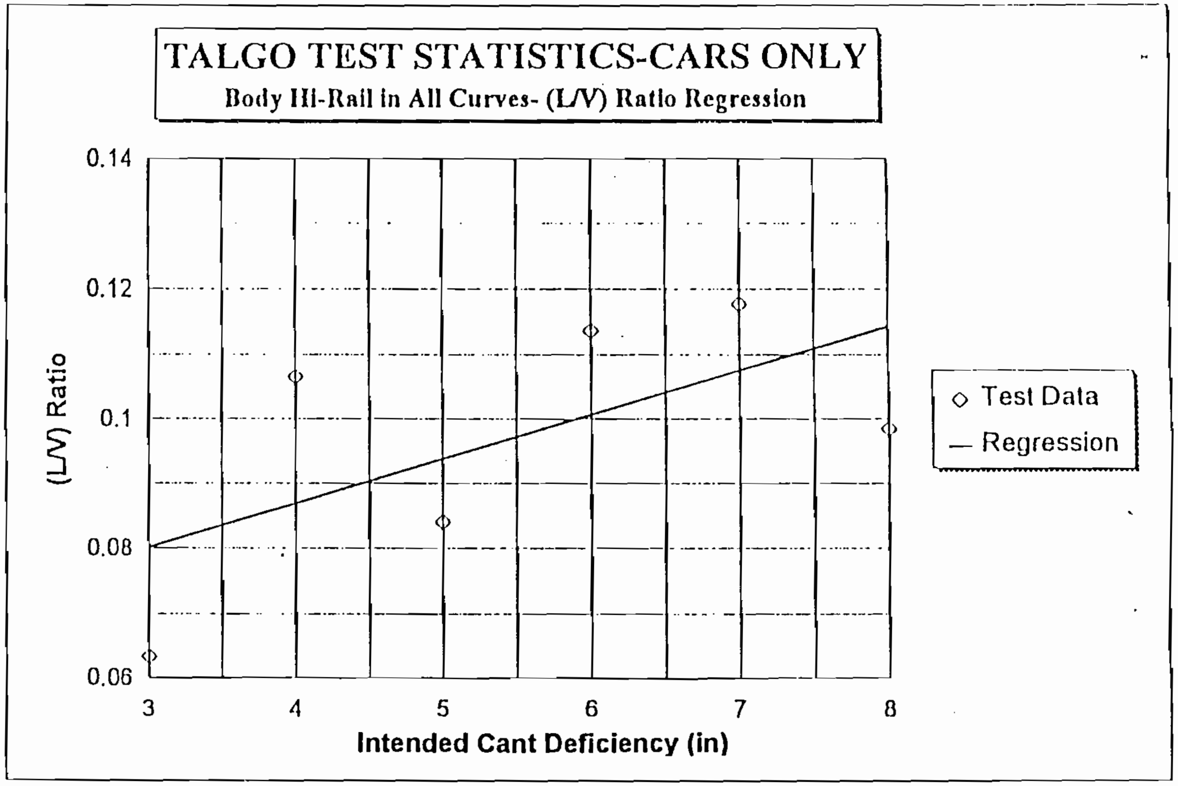


Figure 19

Based on the data developed in this table and figures, which represent general Talgo Cars statistics in ***all curves under all conditions***, it was found that the distributions show the following patterns:

General Statistics (Table 4)

Vertical Forces:

1. Mean vertical forces have roughly close levels for both rails in spiral, specifically 18,542 and 15,395 lbs., compared with the heavy high rail loading in curve body (21,573 lbs. vs. 12,682 lbs.).

2. The maximum vertical force measured in spiral low rail was 45,294 lbs, comparing to the M+3S value for the same rail reaching only 27,958 lbs. This unusually large difference could reflect the possibility of a "bad" measurement. Note, that this low rail has a higher variation about the mean (*standard deviation S*) in spirals, 4,187 lbs. vs. 1,813 lbs. for the high rail.

Lateral Forces:

1. Mean lateral forces have moderate levels in both curve body and spiral, with measurements from both rails in the range of 1,034 lbs. to 2,926 lbs. The Talgo Car exhibits a slightly higher level of lateral loading in spirals as compared in curves. The high rails have typical loading averaging from 74% higher than the low rail in spirals to 114% higher than that in curve bodies.

2. The maximum lateral force measured in body high rail was 10,770 lbs., with the M+3S value for the same rail reaching 7,324 lbs. Note transfer of the higher M+3S value for the lateral load from the low rail in spiral to the high rail in curve body.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have roughly the same tendency as for the lateral forces, although the scatter is greater.

2. The average (mean) value of the L/V ratios are generally higher for the high rail (in both the spiral and body). However the actual values for the mean L/V ratios, in the range of 0.08 to 0.16, are very moderate.

3. The standard deviation (S) of measurement L/V ratios for the Talgo Cars were the same (0.07) for all rails under investigation, with the exception of the low rail in the spiral (0.16).

4. As a result of the standard deviation values, the Talgo Cars have higher M + 3S values for the low rail in the spiral, reaching a value of 0.59.

5. The maximum levels of the M+3S L/V ratio values are in the range of 0.29 to 0.59 for all test data under investigation; these are below the wheel climb/rail overturning limits.

6. The *maximum* measured L/V ratios were developed by the Talgo Cars on the low rail of the spiral (0.59) and the high rail of the curve body (0.46).

7. The highest overall L/V level (0.59), which was measured on the low rail of the spiral, falls below the wheel climb/rail overturning limits.

Regression Analyses (Figures 16-19)

1.. Figures 16 and 17 present the regression outputs for the Lateral Forces in high rails *for all curves* (spiral and curve body respectively). Note that in both cases "R Squared" values of 0.746 and 0.571 are above the assurance threshold of 0.5. This, in conjunction with the number of measured wheels, provides the necessary level of certainty.

2. It can be seen from both figures that wheel/rail lateral forces are directly proportional to the intended cant deficiency level. However, unlike locomotives, the ***spiral*** regression lines provide consistently higher levels of lateral force, specifically in the range of 2,550 lbs. to 3,300 lbs., compared to those predicted for curve bodies of 1,630 to 2,650 lbs.

3. Figures 18 and 19 show the regression outputs for the L/V ratios in high rails *for all curves* (spiral and curve body respectively), with the "R Squared" values equal to 0.639 and 0.388.

4. The corresponding values and relationships for L/V ratio have the same tendency as those for the lateral forces.

5. Both figures show that L/V ratios are, as expected, directly proportional to the intended cant deficiency level. However, the spiral regression line provides consistently higher levels of L/V, specifically in the range of 0.142 to 0.171, compared to the 0.08 to 0.117 range for curve body.

6. Regressions for the full diapason of the intended cant deficiencies, from 3 to 8 inches, represent very moderate *statistical* levels of L/V ratios for both curve bodies and spirals.

5.4. Comparative Cant Deficiency Statistics

The statistical data for Talgo cars and locomotives was also compared, using intended cant deficiency as the main test parameter. The ***high rails of spirals*** were analyzed, to find which part of the Talgo Trainset significantly contributes to the level of lateral dynamics.

Tables 5 and 6 contain results of the test statistics study *for all curves*, which allow for a direct comparison of critical parameters associated with the locomotives and cars, the lateral forces L and L/V ratios respectively. These tables show the mean (M), standard deviation (S), M+3S, and maximum values of the parameter distributions, as well as number of measured axles for each statistical group.

Using the examination of the full data set *for all curves*, comparative regression analyses were performed for the lateral forces L and L/V ratios for the high rails. These regressions are presented in Figures 20 and 21. Note that each figure contains a graph with linear regressions, as well as the main analytical data, including regression output and intended cant deficiency group distributions.

TALGO CARS vs LOCOMOTIVES STATISTICS

Spiral Hi - Rail in All Curves - Lateral Force L (lbs)

Talgo	Cant Deficiency (in)=	3"	4"	5"	6"	7"	8"
Talgo	M	4075	4901	4892	5334	5356	5917
Locomotive	S	3634	3039	3748	3468	2882	3272
Statistics	M + 3S	14976	14019	16136	15737	14003	15732
	MAX	13178	11655	15342	14965	13451	13365
	Axles	44	28	60	92	158	62
Talgo	M	2458	2782	2796	3260	2937	3311
Car	S	1300	1425	1340	1550	1278	1427
Statistics	M + 3S	6359	7058	6816	7910	6770	7593
	MAX	6780	6926	7540	7559	7854	7143
	Axles	84	42	110	158	264	122

Table 5

TALGO CARS vs LOCOMOTIVES STATISTICS

Spiral Hi - Rail in All Curves - (L/V) Ratio

Talgo	Cant Deficiency (in)=	3"	4"	5"	6"	7"	8"
Talgo	M	0.109	0.128	0.122	0.135	0.134	0.141
Locomotive	S	0.096	0.077	0.092	0.086	0.072	0.074
Statistics	M + 3S	0.397	0.358	0.399	0.392	0.349	0.362
	MAX	0.330	0.280	0.380	0.360	0.320	0.310
	Axles	44	28	60	92	158	62
Talgo	M	0.136	0.154	0.150	0.171	0.154	0.173
Car	S	0.069	0.076	0.065	0.074	0.060	0.068
Statistics	M + 3S	0.342	0.382	0.346	0.394	0.334	0.376
	MAX	0.370	0.340	0.370	0.460	0.430	0.350
	Axles	84	42	110	158	264	122

Table 6

Car Regression Output:

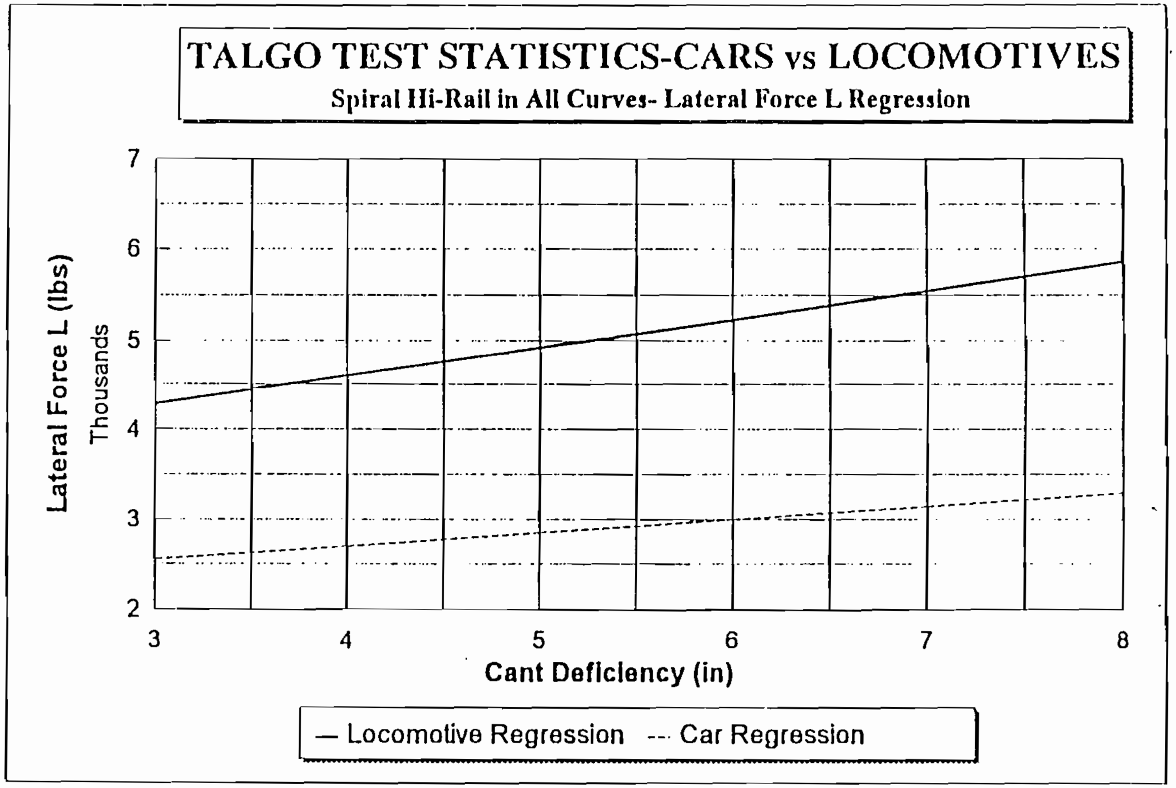
Constant		2107.96
Std Err of Y Est		180.9045
R Squared		0.746439
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	148.3939	
Std Err of Coef.	43.24446	

Y = 2107.96 + 148.39*X

Locomotive Regression Output:

Constant		3348.047
Std Err of Y Est		214.7869
R Squared		0.903803
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	314.7557	
Std Err of Coef.	51.34388	

Y = 3348.047 + 314.756*X



LOCOMOTIVES

Cant Deficiency Observation Group (in)	Number of Wheels
3	44
4	28
5	60
6	92
7	158
8	62

CARS

Cant Deficiency Observation Group (in)	Number of Wheels
3	84
4	42
5	110
6	158
7	264
8	122

Figure 20

Car Regression Output:

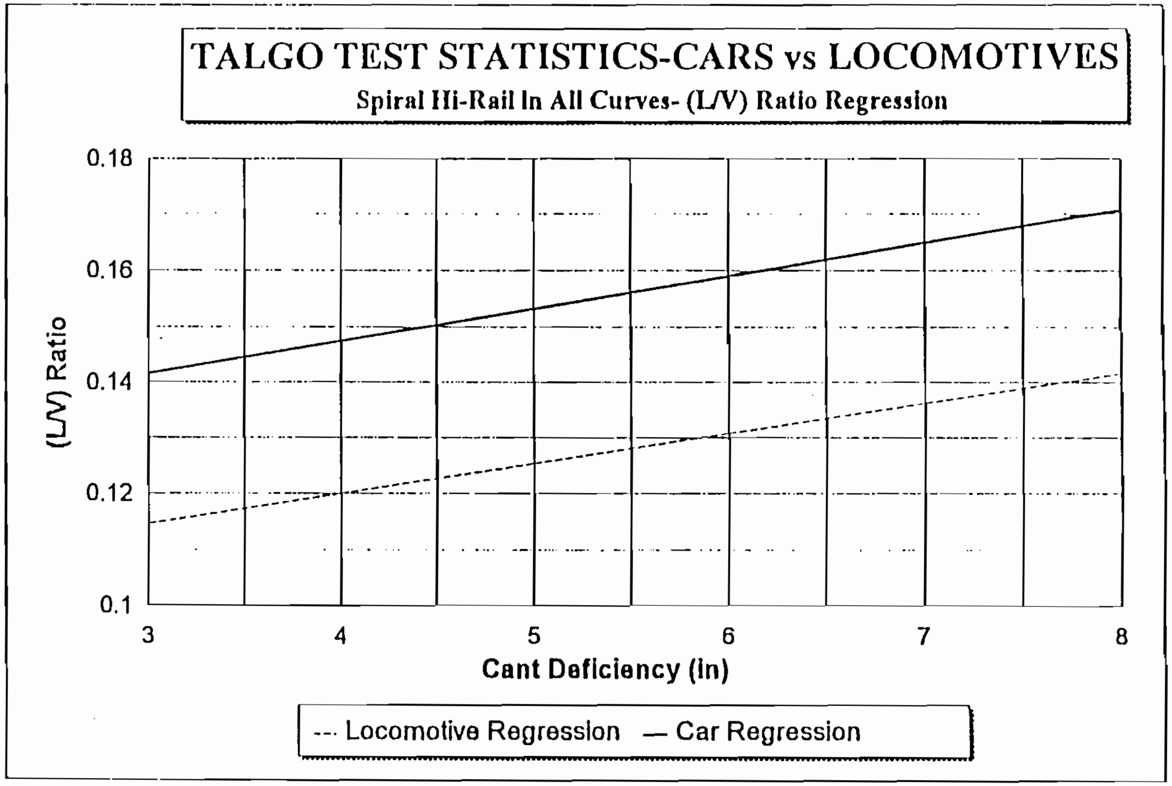
Constant		0.124234
Std Err of Y Est		0.009155
R Squared		0.638855
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.005822	
Std Err of Coef.	0.002189	

Y = 0.124234 + 0.005822*X

Locomotive Regression Output:

Constant		0.098558
Std Err of Y Est		0.005656
R Squared		0.798284
No. of Group Observations		6
Degrees of Freedom		4
X Coefficient(s)	0.00538	
Std Err of Coef.	0.001352	

Y = 0.098558 + 0.00538*X



LOCOMOTIVES

Cant Deficiency Observation Group (in)	Number of Wheels
3	44
4	28
5	60
6	92
7	158
8	62

CARS

Cant Deficiency Observation Group (in)	Number of Wheels
3	84
4	42
5	110
6	158
7	264
8	122

Figure 21

Based on the data developed in the table and figures, which represent comparative Talgo statistics in *all curves*, it was found that the distributions show the following patterns:

General Statistics (Table 5 and 6)

Lateral Forces:

1. Comparative Table 5 shows across the observed range of intended cant deficiencies that the Talgo locomotives have, in general, a higher level of lateral dynamics (by factors ranging from 1.6 to 2.4) for all statistical parameters when compared to those corresponding to the Talgo cars. ***Therefore, Talgo locomotives, not tilting cars, will define the level of a rail wear and future maintenance problems.***
2. Maximum mean lateral force reached at an intended cant deficiency of 8 inches are equal 5,917 lbs. and 3,311 lbs. for the locomotives and cars respectively. The corresponding absolute maximum values of lateral force are equal to 15,342 lbs. and 7854 lbs. respectively.

L/V Ratios:

1. Comparative Table 6 shows that L/V ratio distributions for corresponding values and relationships have the opposite tendency as that for the lateral forces.
2. The average (mean) value of the L/V ratios are generally higher for the Talgo cars (for all intended cant deficiencies observed) than for the locomotives. However, the actual values for the mean L/V ratios, in the range of 0.109 to 0.173, are very moderate.
3. Both Talgo cars and locomotives generated roughly the same levels of L/V standard deviation (S) for all intended cant deficiencies under investigation, in the range of 0.06 to 0.096.
4. The maximum L/V ratio measured (within the range of 3 to 8 inches of intended cant deficiency) was 0.46, developed by the Talgo cars at 6 inches of intended cant deficiency. This is compared to a maximum L/V ratio of 0.38 for Talgo locomotives, developed at an intended cant deficiency of 5 inches.

Regression Analyses (Figures 20 and 21)

1. Figure 20 presents the comparative regression outputs for the Lateral Forces L in spiral high rails ***for all curves***. This part of the statistics confirms the conclusion above, showing that ***Talgo locomotives appear to be a main source of Trainset lateral dynamics.*** Note, again, that in both cases "R Squared" values (0.746 and 0.904) are above the assurance threshold, 0.5. This, in conjunction with the number of measured wheels, provides the necessary level of certainty.
2. Figure 20 shows that wheel/rail lateral forces, which are directly proportional to the intended cant deficiency level, are not only consistently higher for locomotives, but has a higher slope for the locomotive regression.

3. Figure 21 presents the comparative regression outputs for the L/V ratios in spiral high rails *for all curves*. This part of the analysis shows that L/V ratios are directly proportional to intended cant deficiency.

4. Talgo cars appear to have a consistently higher level of L/V ratios. Both regression lines are almost parallel, with the permanent shift between them approximately equal to 0.028. Note that in both cases "R Squared" values (0.639 and 0.798) are above the assurance threshold of 0.5. Thus, in conjunction with the number of measured wheels, provides the necessary level of certainty.

5. Regressions for the full diapason of the intended cant deficiencies, from 3 to 8 inches, represent very moderate *statistical* levels of L/V ratios for both Talgo cars and locomotives.

5.5. Comparative Statistics by Track Curvature

The statistical data for Talgo cars and locomotives was also compared, using track curvature as the second main test parameter. The high rails of spirals and curve body were analyzed to find which part of the Talgo Trainset significantly contributes to the level of lateral dynamics.

Tables 7 and 8 contain results of the test statistics study *for the curves at MP 74 and MP 76*. Tables 7 and 8 allow for a direct comparison of the critical parameters between the locomotives and cars, the lateral forces L and L/V ratios. These tables show the mean (M), standard deviation (S), M+3S, and maximum values of the parameter distributions.

Using the examination of the full data set, comparative statistical analyses were performed for the lateral forces L and L/V ratios for the high rails, which have shown two completely different patterns of behavior for Talgo cars and locomotives.

TALGO CARS vs LOCOMOTIVES STATISTICS

Hi - Rail- Lateral Force L (lbs)

Test Curve Location		MP 76		MP 74	
Curve Part		Spiral	Body	Spiral	Body
Curvature (DEG) =		2	3.25	2.75	4.875
Talgo	M	5205	7880	5090	7118
Locomotive	S	2795	2650	3953	5047
Statistics	M + 3S	13589	15829	16949	22259
	MAX	13451	14303	15342	17395
Talgo	M	2810	2385	2949	1625
Car	S	1045	949	1335	1411
Statistics	M + 3S	5947	5232	6955	5858
	MAX	7555	5406	6979	6079

Table 7

TALGO CARS vs LOCOMOTIVES STATISTICS

Hi - Rail -(L/V) Ratio

Test Curve Location		MP 76		MP 74	
Curve Part		Spiral	Body	Spiral	Body
Curvature (DEG) =		2	3.25	2.75	4.875
Talgo	M	0.135	0.173	0.122	0.142
Locomotive	S	0.067	0.050	0.097	0.099
Statistics	M + 3S	0.336	0.322	0.414	0.439
	MAX	0.310	0.290	0.380	0.360
Talgo	M	0.155	0.111	0.156	0.071
Car	S	0.058	0.040	0.064	0.060
Statistics	M + 3S	0.329	0.230	0.350	0.251
	MAX	0.430	0.260	0.380	0.270

Table 8

Based on the data developed in these tables, which represent comparative Talgo statistics, it was found that the distributions show the following patterns:

General Statistics (Table 7)

Lateral Forces:

1. Comparative Table 7 shows across the observed range of track curvatures that the Talgo locomotives have a level of lateral dynamics 2 to 3 times higher than similar statistical parameters corresponding to the Talgo cars. ***Of the vehicle types used in the Talgo trainset, the Talgo locomotives, not the tilting cars, will have more of an impact on the level of rail wear and future maintenance issues for typical curves along the Northwest Corridor.***

2. Based on the Table 7 data, ***levels of the lateral forces for Talgo cars and locomotives are moving in different directions for increasing curvature, specifically increasing for locomotives but diminishing for cars.*** This observance was made based on the testing limited by two curves, using the spirals and curve bodies databases.

3. Maximum mean lateral forces are found in the body of the curve at MP 76 for locomotives, and in the spiral of the curve at MP 74 for cars. These maximum mean lateral forces are equal to 7,880 lbs. and 2,949 lbs. respectively.

4. The maximum measured lateral forces L developed by the Talgo cars, (7,555 lbs.) was found in the area with 2 degrees of curvature. This is compared to the maximum measured lateral force developed by the Talgo locomotive (17,395 lbs.), found in the area with the maximum curvature (4.875 degrees).

L/V Ratios:

1. Comparative Table 8 shows that mean L/V ratio distributions show mixed tendencies. Talgo cars have higher L/V ratios in spirals, while locomotives have many higher L/V ratios exhibited in curve bodies.

2. The average (mean) value of the L/V ratios in spirals are higher for the Talgo cars, (0.155, 0.156) than for locomotives (0.122-0.135). The opposite trend can be seen in the curve body, where L/V ratios of locomotives (0.142. 0.173) are much higher than those for cars (0.071, 0.111). Note, again, that the actual values for the mean L/V ratios are very moderate.

3. Both Talgo cars and locomotives generated roughly the same levels of L/V standard deviation (S), in the range of 0.04 to 0.099, for all intended cant deficiencies under investigation.

4. The maximum measured L/V ratios were developed in spirals. The Talgo cars developed an L/V ratio of 0.43 in 2 degree curvature; the Talgo locomotives developed an L/V ratio of 0.38 in 2.75 degree curvature.

6. Comparative Statistics: Talgo vs. Regular Trains

6.1. Talgo Trainset vs. Freight Trains

The next group of trains to be analyzed were comprised of Regular Freight Trains. In this set of analyses, data for full freight trains was analyzed in the same format as Talgo Trainsets. The main goal of the statistical study performed was an investigation of the Vertical and Lateral wheel/rail force levels, and there L/V ratios.

Note again, that L/V ratio was a analysis parameter, derived from the simultaneous measurement of the Lateral (L) and Vertical (V) forces.

Examination of the full data set ***for all curves*** (for both curve body and spiral sites) produced a distribution of V, L and L/V ratio for the high and low rails. These distributions are presented in Tables 9 and 10.

Table 9 contains comprehensive results of the Freight train statistics study for all curves, which allows for a direct comparison of main parameters between the spiral and curve body for both high and low rails. Note that this table shows the mean (M), standard deviation (S), M+3S, and maximum values of the parameter distributions.

Based on the data developed in these tables, which represent general Freight Train statistics in ***all curves under all conditions***, the following observations are presented:

General Statistics (Table 9)

Vertical and Lateral Forces:

1. Mean vertical forces have approximately the same levels in curve body and spirals for both the high and low rails, typical for regular traffic traveling at close to balance speed.

2. Mean lateral forces also have approximately the same levels for high and low rails. The higher level of L is exhibited in curve body (3,030 lbs. - 3,211 lbs.) compared to the results exhibited on spirals (2,142 lbs. - 2,298 lbs.).

3. The maximum vertical force measured was exhibited in spiral low rail (56,546 lbs.), with the M+3S value for the same rail reaching 54,783 lbs. Note that the variations about the mean (*standard deviation S*) are close for all locations observed.

FREIGHT TRAINS STATISTICS

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
FREIGHT TRAINS	Max	50443	56546	16082	19195	48718	53742	22414	17829	0.59	0.65	0.87	0.83
	M	20861	20619	2298	2142	21375	20513	3211	3030	0.12	0.11	0.15	0.15
	S	11544	11388	2346	2623	11869	11318	3392	3099	0.09	0.10	0.12	0.12
	3S	34631	34164	7039	7868	35608	33953	10175	9297	0.26	0.30	0.35	0.36
	M+3S	55492	54783	9337	10011	56982	54466	13387	12326	0.37	0.41	0.50	0.51

Table 9

COMPARATIVE TALGO TRAINSET VS FREIGHT TRAINS STATISTICS

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
TALGO	Max	48111	55792	15342	11728	57278	46988	23735	12770	0.46	0.59	0.48	0.53
TRAINSETS	M	26026	19943	3692	2068	30595	16398	4115	1682	0.15	0.11	0.12	0.10
	S	10335	7744	2511	2561	12633	6425	3889	1918	0.07	0.14	0.08	0.09
	3S	31005	23232	7532	7682	37900	19276	11666	5753	0.22	0.42	0.25	0.26
	M+3S	57030	43175	11225	9750	68495	35674	15782	7436	0.37	0.53	0.37	0.35
FREIGHT TRAINS	Max	50443	56546	16082	19195	48718	53742	22414	17829	0.59	0.65	0.87	0.83
	M	20861	20619	2298	2142	21375	20513	3211	3030	0.12	0.11	0.15	0.15
	S	11544	11388	2346	2623	11869	11318	3392	3099	0.09	0.10	0.12	0.12
	3S	34631	34164	7039	7868	35608	33953	10175	9297	0.26	0.30	0.35	0.36
	M+3S	55492	54783	9337	10011	56982	54466	13387	12326	0.37	0.41	0.50	0.51
Talgo / Freight	Max	95%	99%	95%	61%	118%	87%	106%	72%	78%	91%	55%	64%
	M	125%	97%	161%	97%	143%	80%	128%	56%	124%	100%	79%	63%
Relative	S	90%	68%	107%	98%	106%	57%	115%	62%	87%	142%	73%	72%
%	3S	90%	68%	107%	98%	106%	57%	115%	62%	87%	142%	73%	72%
	M+3S	103%	79%	120%	97%	120%	65%	118%	60%	99%	130%	75%	69%

Table 10

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have the same tendency as for the lateral forces.

2. The average (mean) value of the L/V ratios found in curve bodies (0.15), is generally higher than those found in the spiral (0.11-0.12). Note that the actual values for the mean L/V ratios, in the range of 0.11 to 0.15, are moderate.

3. **The Freight Trains generated significantly high *maximum* levels of L/V ratios, reaching 0.83 and 0.87 for low and high rails respectively, which is in the region of track damage, to include gage widening and rail overturning.**

Comparative Statistics (Table 10)

Table 10 contains comparative results of the Freight Trains and Talgo Trainsets statistics study for all curves. This allows for a direct comparison of main parameters between the spiral and curve body for both high and low rails. This table shows not only absolute values, but includes relative data, which allows for a convenient comparison of statistical parameters between the freight and Talgo stock.

Although each of the analyzed data bases contains a significant number of statistical parameters, the discussion presented here focuses exclusively on the leading and most important for the Talgo Test Program parameters.

Vertical and Lateral Forces:

1. The relative part of the Table 10 shows that Talgo and Freight train levels of the vertical dynamics are roughly similar, except for the mean vertical forces for all high rails locations, which are 25% to 43% higher (spiral and curve body, respectively) for the Talgo Trainsets.

2. Mean lateral forces are higher for the Talgo Trainsets on the high rail (128% and 161%, curve body and spiral, respectively), but lower for low rail (56% and 97%, curve body and spiral, respectively), compared to the Freight Trains.

L/V Ratios:

1. The relative part of Table 10 shows that Talgo Trainsets generated consistently lower average (mean) L/V ratios in curve bodies (63% and 79%, low rail and high rail, respectively) when compared to corresponding Freight Train data. For L/V ratios in spirals, the Talgo Trainsets generated average L/V ratios equal to or greater than those for Freight Trains (100% and 124%, low rail and high rail, respectively).

2. The average (mean) level of the L/V ratios for the Freight Trains in the curve bodies (0.15 for both high and low rails) is generally higher than those for the Freight Trains in

spirals (0.11 and 0.12, low and high rail, respectively). However, all the values of the mean L/V ratios for the Freight Trains are moderate.

3. **The Talgo Trainsets generated significantly lower *maximum* levels of L/V ratios (in the range of 0.46 to 0.59) than those for the Freight Trains.**

4. ***All L/V ratio maximums for Talgo Trainsets are below the wheel climb/rail overturning limits, i.e. less then 0.6, while those for the Freight Trains are approaching the Nadal limit for potential wheel climb 0.8 to 0.85. Freight Train L/V ratio maximums are still below the level of loadings that indicate a real risk of wheel climb.***

6.2. Talgo Trainset vs. Regular Amtrak Train

The next group of trains to be analyzed was comprised of Regular Amtrak Trains. In this set of analyses, data for full Amtrak trains was analyzed in the same manner as that for the Talgo Trainsets. The main goal of the statistical study performed was an investigation of the Vertical and Lateral wheel/rail force levels and L/V ratios.

Note again, that L/V ratio was an analysis parameter, derived from the simultaneous measurement of the Lateral (L) and Vertical (V) forces.

Examination of the full data set ***for all curves*** (for both curve body and spiral sites) produced a distribution of V, L and L/V ratio for the high and low rails. These distributions are presented in Tables 11 and 12.

Table 11 contains comprehensive results of the Amtrak train statistics study for all curves, which allows for a direct comparison of main parameters between the spiral and curve body, for both high and low rails. Note that this table shows the mean (M), standard deviation (S), M+3S, and maximum values of the parameter distributions.

AMTRAK TRAINS STATISTICS

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
AMTRAK	Max	41296	35089	11012	6106	44571	32097	16717	11439	0.27	0.35	0.46	0.40
	M	24193	20410	3406	1121	26137	18888	4630	2396	0.14	0.05	0.17	0.12
	S	7088	5639	2225	1777	8164	5124	4398	2548	0.08	0.09	0.14	0.12
	3S	21263	16916	6675	5332	24492	15372	13193	7845	0.24	0.26	0.41	0.35
	M+3S	45456	37326	10081	6453	50629	34260	17824	10041	0.38	0.32	0.58	0.47

Table 11

COMPARATIVE TALGO TRAINSET VS AMTRAK TRAINS STATISTICS

Train Type	Statistics	SPIRAL				BODY				SPIRAL		BODY	
		Hi Rail V	Low Rail V	Hi Rail L	Low Rail L	Hi Rail V	Low Rail V	Hi Rail L.	Low Rail L.	Hi Rail L/V	Low Rail L/V	Hi Rail L/V	Low Rail L/V
TALGO	Max	48111	55792	15342	11728	57278	46988	23735	12770	0.46	0.59	0.48	0.53
TRAINSETS	M	26026	19943	3692	2068	30595	16398	4115	1682	0.15	0.11	0.12	0.10
	S	10335	7744	2511	2561	12633	6425	3889	1918	0.07	0.14	0.08	0.09
	3S	31005	23232	7532	7682	37900	19276	11666	5753	0.22	0.42	0.25	0.26
	M+3S	57030	43175	11225	9750	68495	35674	15782	7436	0.37	0.53	0.37	0.35
AMTRAK	Max	41296	35089	11012	6106	44571	32097	16717	11439	0.27	0.35	0.46	0.40
	M	24193	20410	3406	1121	26137	18888	4630	2396	0.14	0.05	0.17	0.12
	S	7088	5839	2225	1777	8184	5124	4398	2548	0.08	0.09	0.14	0.12
	3S	21263	16916	6675	5332	24492	15372	13193	7645	0.24	0.26	0.41	0.35
	M+3S	45456	37326	10081	6453	50629	34260	17824	10041	0.38	0.32	0.58	0.47
Talgo / Amtrak	Max	117%	159%	139%	192%	129%	146%	142%	112%	170%	169%	104%	133%
	M	108%	98%	108%	184%	117%	87%	89%	70%	103%	208%	72%	81%
Relative	S	146%	137%	113%	144%	155%	125%	88%	75%	93%	162%	61%	74%
%	3S	146%	137%	113%	144%	155%	125%	88%	75%	93%	162%	61%	74%
	M+3S	125%	116%	111%	151%	135%	104%	89%	74%	97%	169%	64%	75%

Table 12

Based on the data developed in these tables, which represent general Amtrak Train statistics in ***all curves under all conditions*** (but for the limited available database of three trains), the following observations are presented:

General Statistics (Table11)

Vertical and Lateral Forces:

1. Mean vertical forces have approximately the same levels for both the high and low rails in spirals, with the more evident high rail loading (38% higher than low rail) found in the curve body.
2. Mean lateral forces are significantly higher for the high rails, in both spirals and curve bodies. The higher level of L is exhibited in curve bodies, 2,396 lbs. and 4,630 lbs. for low and high rail, respectively, as compared to 1,121 lbs. and 3,406 lbs. found in the spiral - low and high rail, respectively.
3. The maximum lateral force measured in the curve body high rail was 16,717 lbs., comparing to the M+3S value for the same rail reaching 17,824 lbs.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio had the same tendency as those for the lateral forces.
2. The average (mean) value of the L/V ratios found in high rails, equal to 0.14 and 0.17 for spirals and bodies, respectively, is generally higher when compared to the 0.05 and 0.12 levels for the low rails in the spirals and bodies, respectively. However, the actual values for the mean L/V ratios, in the range of 0.05 to 0.17, are moderate.
3. The Amtrak Trains generated relatively moderate *maximum* levels of L/V ratios, reaching values of 0.46 and 0.35 for the high rails of curve bodies and low rails of spirals respectively. However, note that this observation was made for the limited number of trains.

Comparative Statistics (Table12)

Table 12 contains comparative results of the Amtrak Trains and Talgo Trainsets statistics study. This allows for a direct comparison of main parameters between the spiral and curve body, for both high and low rails. This table shows not only absolute values, but includes relative data, which allows for a convenient comparison of statistical parameters between the Amtrak and Talgo stock.

Although each of the analyzed data bases contains a significant number of statistical parameters, the discussion presented here focuses exclusively on the leading and most important for the Talgo Test Program parameters.

Vertical and Lateral Forces:

1. The relative part of the Table 12 shows that Talgo and Amtrak train average (mean) levels of the vertical dynamics *are roughly similar.*

2. The maximum vertical forces are higher for the Talgo Trainsets, especially in the low rail of the spiral (up to 59% higher).

3. Mean lateral forces are greater for the Talgo Trainsets in spirals for both rails (8% and 84% higher for high and low rails, respectively) when compared to those of the Amtrak Trains. The mean lateral forces are lower for the Talgo Trainsets in curve bodies for both rails (70% and 89% of values for low and high rail, respectively).

4. The maximum lateral forces are generally higher for the Talgo Trainsets, especially in the low rail of the spiral, where the force associated with the Talgo Trainsets was 92% higher than that of the Amtrak Trains.

L/V Ratios:

1. The relative part of the Table 12 shows that Talgo Trainsets generated consistently lower average (mean) L/V ratios in curve body, (72% and 81% for high and low rails, respectively) when compared to corresponding Amtrak train data values. For the low rail in spiral, the Talgo/Amtrak relative L/V ratio reached 208%. Note that this discussion is referring to the very moderate levels of L/V ratios for both trains, all less than or equal to 0.17.

2. The Talgo Trainsets generated generally higher relative *maximum* levels of L/V ratios, in the range of 104% to 170%, of those for the Amtrak trains. Note again, that this discussion is referring to the moderate maximum levels of L/V ratios for both trains, with a range of 0.27 to 0.59.

It has to be admitted at this point that the comparative statistics above must be used with caution because of the differences in test conditions for both trains. Specifically, the majority of Talgo trains were tested in the speed range close to 70 mph, while the random speed of Amtrak trains varied between 45 and 60 mph. In addition, the Talgo Trainsets were mainly tested in the curves near MP 74 and 76, while the majority of the Amtrak trains was measured in the curve near MP 34. However, this data can be used for a qualitative analysis and a discussion of tendencies.

7. Threshold and Safety Parameters

In connection with the problem of "cant deficiency vs. safety" of the Talgo Trainset, of particular significance in examining wheel/track interaction is the combined effect of the lateral (L) and vertical (V) dynamic loadings imposed by the trainset on the track. One of the most frequently used parameter in railroad practice, and one used throughout this report, is the L/V ratio, obtained from the field measurements and theoretical analysis. The ratio can provide an indication of potential or "incipient" failure of a train-track system.

One such mode of "failure" is dynamic gage widening because of the outward rail movement under vehicle loading. This is usually the high rail in a curve, which experiences larger lateral loads. Another failure mode is wheel-climb, in which the vehicle wheel climbs over the rail without a preceding structural failure of the track. Both of these failure modes are related to, and can be indicated by, the L/V ratio.

Appendix E presents the set of the tentative thresholds traditionally used for evaluation of the safety levels and requirements. Note, that all threshold recommendations are dependent not only on the L/V ratio, but on the magnitude of the lateral forces themselves.

The L/V ratio at which potential instability occurs varies somewhat with the rail section, and is in general close to 0.7. However, it should be noted that on good track, the rail is usually restrained against rotation by rail fasteners on the gage side-along with the torsional stiffness of the rail section. Thus, the actual amount of rail rotation depends on both L/V ratio and lateral force L magnitude.

Wheel climb can cause a derailment of the vehicle, and has traditionally been associated with the L/V ratio, as a surrogate measure of wheel climbing tendencies. One such measure is given by the *Nadal Limit.* For typical wheel flange and coefficient of friction values, this limit corresponds to an L/V value of 0.8.

Note that full investigation of the specific safety conditions involves not only the main thresholds above, but also additional important parameters, such as angle of attack, duration of the high stressed wheel-rail interaction, level of lubrication, wheel/rail wear, etc.

However, the statistical information about typical levels of L/V ratios and lateral forces L, which represents the main core of the test data, is of primary concern for analyzing and separation of the area of potential train instability and derailment. Note also that according to some sources of European and American research [C.Esveld, W.Hay, etc.], the critical L/V values retained as criterion for safety against derailment (especially for new rail/wheels) can reach the range of 1.2 to 1.29.

8. Discussion and Summary of Observations

A total of 83 test runs were made over the all test sites, consisting of the following specific train runs:

1. TalgoTrainset testing runs.
   Total number of runs: 64

2. Freight Trains (locomotives plus cars)
   Total number of runs: 15

3. Regular Amtrak Trains
   Total number of runs: 3

4. Set of Locomotive only
   Total number of runs: 1

In addition to the consolidated data analyses for each group above, statistical investigations were performed within those groups, using following main parameters:

- cant deficiency

- track curvature

- train consist

For the Talgo trainset under testing, the general test matrix can be outlined as follows:

- Grouped by Direction:

Northbound	(33 runs)
Southbound	(31 runs)

- Grouped by Speed:

V < 55 mph	(3 runs)
35 to 55 mph	(21 runs)
55 to 65 mph	(18 runs)
65 to 75 mph	(21 runs)
V > 75 mph	(1 run)

The results of these test runs, and the analysis of the test data are as follows:

TALGO TRAINSETS

General Statistics

Vertical Forces:

1. Mean vertical forces have approximately the same levels in both curve body and spiral, with the high rail loading averaging from 30% higher than the low rail in spirals to 86% higher than that in curve bodies.

2. The maximum vertical force measured in the curve body high rail was 57,278 lbs., comparing to the M+3S value for the same rail reaching 68,495 lbs. Note that high rails have a higher variation about the mean (*standard deviation S*). This parameter, which is a measure of the range of variation in the test data, shows that high rail standard deviation is 33% to 97% higher than the low rail values.

Lateral Forces:

1. Mean lateral forces have approximately the same levels in both curve body and spiral, with the high rail loading averaging from 78% higher than the low rail in spirals to 145% higher than that in curve bodies (M=4,115 lbs.).

2. The maximum lateral force measured in body high rail was 23,735 lbs., compared to the M+3S value for the same rail reaching 15,782 lbs.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have the same tendency as for the lateral forces.

2. The average (mean) value of the L/V ratios is generally higher for the high rail (in both the spiral and body). However, the actual values for the mean L/V ratios, in the range of 0.10 to 0.15, are very moderate.

3. Greater variations in L/V ratios were measured on the low rail in spirals, leading to a higher level of standard deviation (S) than for those measured on the high rail and on both rails in the curve body; 100% higher as compared to the high rail, 75% and 55% higher for the high and low rail in curve body respectively.

4. As a result of this standard deviation effect, the Talgo Trainset has higher M + 3S values for the low rail in spiral, reaching 0.53.

5. The maximum levels of the M+3S L/V ratio values are in the range of 0.35 to 0.53 for all test data under investigation; these are below the wheel climb/rail overturning limits.

6. The *maximum* measured L/V ratios, developed by the Talgo Trainsets in the low rails, are 28% and 10% greater than those for the high rails (spiral and curve body respectively).

7. The highest overall L/V level, 0.59, measured in the low rail spiral falls below the wheel climb/rail overturning limits.

Statistical Distributions

1. Figure 10 presents distribution of (L/V) ratio in spirals ***for all curves and conditions.*** Note that this figure contains two distributions, one each for the high and low rail.

2. Unlike the high rail distribution, which has a typical and close to symmetrical bell curve, low rail shows asymmetrical distribution with the maximum shifted towards lower L/V ratios. It can be seen from these graphs, that most of the L/V ratios for high rail wheels are between 0.10 and 0.20. At the same time, the picture for the low rail is completely different, with the majority of L/V ratios in the 0 to 0.12 diapason.

3. The right branches of the distribution graphs confirm the analytical data above, and clearly show that all L/V maximums are below the wheel climb/rail overturning thresholds.

4. Figure 11 presents the distribution of L/V ratios in curve bodies ***for all curves and conditions.*** Note that this figure contains two distributions, one each for the high and low rail.

5. Both distributions correlate well, with a relative shift towards lower L/V ratios for the low rail wheels. The majority of L/V ratios are in the range of 0.03 to 0.20, and 0 to 0.12 for high and low rails respectively.

TALGO LOCOMOTIVES

General Statistics

Vertical Forces:

1. Mean vertical forces have roughly the same levels in both curve body and spiral, with the high rail loading averaging from 40% higher than the low rail in spirals to 103% higher than that in curve bodies.

2. The maximum vertical force measured in the curve body high rail was 57,278 lbs. The M+3S value for the same rail reached 62,327 lbs. Note that vertical forces on the low rail have a higher variation about the mean (*standard deviation S*) in the spiral (5,737 lbs.) than that for the high rail (3,632 lbs.). The maximum vertical force of 57,278 lbs. represents the highest vertical force measured (see Chapter 5.1).

Lateral Forces:

1. Mean lateral forces have approximately the same levels in both curve body and spiral, with one exception for the high rail in curve body (7,513 lbs. vs. 5,060 lbs. for spiral). The high rails have typical loading averaging from 83% higher than the low rails in spirals to 164% higher than that in curve bodies (M=7,513 lbs).

2. The maximum lateral force measured in body high rail was 23,735 lbs., with the M+3S value for the same rail reaching 20,562 lbs. Note that this maximum is much higher than those measured on other rails, which are in the range of 12,000 to 15,000 lbs.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have roughly the same tendency as for the lateral forces, although the scatter is much greater.

2. The average (mean) value of the L/V ratios are generally higher for the high rail (in both the spiral and body). However, the actual values for the mean L/V ratios, in the range of 0.10 to 0.16, are very moderate.

3. The standard deviation (S) of L/V ratios measured for the Talgo Locomotives were approximately the same (0.08 to 0.11 range) for all rails under investigation.

4. Higher M + 3S values (reaching 0.43) are determined for the low rail, both in spiral and curve bodies, as compared to those for the high rail.

5. The maximum levels of the M+3S L/V ratio values are in the range of 0.38 to 0.53 for all test data under investigation; these are below the wheel climb/rail overturning limits.

6. The *maximum* measured L/V ratios, developed by the Talgo Locomotives in the low rails, are 34% and 10% greater than those for the high rails (spiral and curve body respectively).

7. The highest overall L/V level, 0.53, measured in the low rail of the curve body falls below the wheel climb/rail overturning limits.

Regression Analyses (Figures 12-15)

One of the most important parameters of the regression investigation performed is the "R Squared" value (coefficient of determination), showing which part of lateral force variation can be "explained" by regression output.

1. Figures 12 and 13 present the regression outputs for the Lateral Forces in high rails ***for all curves*** (spiral and curve body respectively). Note that in both cases, "R Squared" values of 0.904 and 0.832 are well above the assurance threshold of 0.5. This, in communication with the number of measured wheels, provides the necessary level of certainty.

2. It can be seen from both figures that wheel/rail lateral forces are directly proportional to the intended cant deficiency level, as expected. However, the curve body regression line predicts consistently higher lateral forces, specifically in the range of 6,400 to 8,700 lbs., compared to those predicted for spirals of 4,300 to 5,800 lbs.

3. Figures 14 and 15 show the regression outputs for the L/V ratios in high rails ***for all curves*** (spiral and curve body respectively), with adequate "R Squared" values, 0.798 and 0.517.

4. The corresponding values and relationships for L/V ratio have the same tendency as for the lateral forces.

5. Both figures show that L/V ratios are, as expected, directly proportional to the intended cant deficiency level. However, the curve body regression line provides consistently higher levels of L/V, specifically in the range of 0.147 to 0.174, compared to the 0.115 to 0.142 range for spirals.

6. Regressions for the full diapason of the intended cant deficiencies, from 3 to 8 inches represent very moderate *statistical* levels of L/V ratios for both curve bodies and spirals.

TALGO CARS

General Statistics

Vertical Forces:

1. Mean vertical forces have roughly close levels for both rails in spiral, specifically 18,542 and 15,395 lbs., compared with the heavy high rail loading in curve body (21,573 lbs. vs. 12,682 lbs.).

2. The maximum vertical force measured in spiral low rail was 45,294 lbs, comparing to the M+3S value for the same rail reaching only 27,958 lbs. This unusually large difference could reflect the possibility of a "bad" measurement. Note, that this low rail has a higher variation about the mean (*standard deviation S*) in spirals, 4,187 lbs. vs. 1,813 lbs. for the high rail.

Lateral Forces:

1. Mean lateral forces have moderate levels in both curve body and spiral, with measurements from both rails in the range of 1,034 lbs. to 2,926 lbs. The Talgo Car exhibits a slightly higher level of lateral loading in spirals as compared in curves. The high rails have typical loading averaging from 74% higher than the low rail in spirals to 114% higher than that in curve bodies.

2. The maximum lateral force measured in body high rail was 10,770 lbs., with the M+3S value for the same rail reaching 7,324 lbs. Note transfer of the higher M+3S value for the lateral load from the low rail in spiral to the high rail in curve body.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have roughly the same tendency as for the lateral forces, although the scatter is greater.

2. The average (mean) value of the L/V ratios are generally higher for the high rail (in both the spiral and body). However the actual values for the mean L/V ratios, in the range of 0.08 to 0.16, are very moderate.

3. The standard deviation (S) of measurement L/V ratios for the Talgo Cars were the same (0.07) for all rails under investigation, with the exception of the low rail in the spiral (0.16).

4. As a result of the standard deviation values, the Talgo Cars have higher M + 3S values for the low rail in the spiral, reaching a value of 0.59.

5. The maximum levels of the M+3S L/V ratio values are in the range of 0.29 to 0.59 for all test data under investigation; these are below the wheel climb/rail overturning limits.

6. The *maximum* measured L/V ratios were developed by the Talgo Cars on the low rail of the spiral (0.59) and the high rail of the curve body (0.46).

7. The highest overall L/V level (0.59), which was measured on the low rail of the spiral, falls below the wheel climb/rail overturning limits.

Regression Analyses (Figures 16-19)

1. Figures 16 and 17 present the regression outputs for the Lateral Forces in high rails ***for all curves*** (spiral and curve body respectively). Note that in both cases "R Squared" values of 0.746 and 0.571 are above the assurance threshold of 0.5. This, in conjunction with the number of measured wheels, provides the necessary level of certainty.

2. It can be seen from both figures that wheel/rail lateral forces are directly proportional to the intended cant deficiency level. However, unlike locomotives, the ***spiral*** regression lines provide consistently higher levels of lateral force, specifically in the range of 2,550 lbs. to 3,300 lbs., compared to those predicted for curve bodies of 1,630 to 2,650 lbs.

3. Figures 18 and 19 show the regression outputs for the L/V ratios in high rails ***for all curves*** (spiral and curve body respectively), with the "R Squared" values equal to 0.639 and 0.388.

4. The corresponding values and relationships for L/V ratio have the same tendency as those for the lateral forces.

5. Both figures show that L/V ratios are, as expected, directly proportional to the intended cant deficiency level. However, the spiral regression line provides consistently higher levels of L/V, specifically in the range of 0.142 to 0.171, compared to the 0.08 to 0.117 range for curve body.

6. Regressions for the full diapason of the intended cant deficiencies, from 3 to 8 inches, represent very moderate *statistical* levels of L/V ratios for both curve bodies and spirals.

COMPARATIVE CANT DEFICIENCY STATISTICS

General Statistics

Lateral Forces:

1. Comparative Table 5 shows across the observed range of intended cant deficiencies that the Talgo locomotives have, in general, a higher level of lateral dynamics (by factors ranging from 1.6 to 2.4) for all statistical parameters when compared to those corresponding to the Talgo cars. ***Therefore, Talgo locomotives, not tilting cars, will define the level of a rail wear and future maintenance problems.***

2. Maximum mean lateral force reached at an intended cant deficiency of 8 inches are equal 5,917 lbs. and 3,311 lbs. for the locomotives and cars respectively. The corresponding absolute maximum values of lateral force are equal to 15,342 lbs. and 7854 lbs. respectively.

L/V Ratios:

1. Comparative Table 6 shows that L/V ratio distributions for corresponding values and relationships have the opposite tendency as that for the lateral forces.

2. The average (mean) value of the L/V ratios are generally higher for the Talgo cars (for all intended cant deficiencies observed) than for the locomotives. However, the actual values for the mean L/V ratios, in the range of 0.109 to 0.173, are very moderate.

3. Both Talgo cars and locomotives generated roughly the same levels of L/V standard deviation (S) for all intended cant deficiencies under investigation, in the range of 0.06 to 0.096.

4. The maximum L/V ratio measured (within the range of 3 to 8 inches of intended cant deficiency) was 0.46, developed by the Talgo cars at 6 inches of intended cant deficiency. This is compared to a maximum L/V ratio of 0.38 for Talgo locomotives, developed at an intended cant deficiency of 5 inches.

Regression Analyses (Figures 20 and 21)

1. Figure 20 presents the comparative regression outputs for the Lateral Forces L in spiral high rails ***for all curves.*** This part of the statistics confirms the conclusion above, showing that ***Talgo locomotives appear to be a main source of Trainset lateral dynamics.*** Note, again, that in both cases "R Squared" values (0.746 and 0.904) are above the assurance threshold, 0.5. This, in conjunction with the number of measured wheels, provides the necessary level of certainty.

2. Figure 20 shows that wheel/rail lateral forces, which are directly proportional to the intended cant deficiency level, are not only consistently higher for locomotives, but has a higher slope for the locomotive regression.

3. Figure 21 presents the comparative regression outputs for the L/V ratios in spiral high rails ***for all curves***. This part of the analysis shows that L/V ratios are directly proportional to intended cant deficiency.

4. Talgo cars appear to have a consistently higher level of L/V ratios. Both regression lines are almost parallel, with the permanent shift between them approximately equal to 0.028. Note that in both cases "R Squared" values (0.639 and 0.798) are above the assurance threshold of 0.5. Thus, in conjunction with the number of measured wheels, provides the necessary level of certainty.

5. Regressions for the full diapason of the intended cant deficiencies, from 3 to 8 inches, represent very moderate *statistical* levels of L/V ratios for both Talgo cars and locomotives.

COMPARATIVE TRAINS: TALGO VS. REGULAR FREIGHT

General Statistics

Vertical and Lateral Forces:

1. Mean vertical forces have approximately the same levels in curve body and spirals for both the high and low rails, typical for regular traffic traveling at close to balance speed.

2. Mean lateral forces also have approximately the same levels for high and low rails. The higher level of L is exhibited in curve body (3,030 lbs. - 3,211 lbs.) compared to the results exhibited on spirals (2,142 lbs. - 2,298 lbs.).

3. The maximum vertical force measured was exhibited in spiral low rail (56,546 lbs.), with the M+3S value for the same rail reaching 54,783 lbs. Note that the variations about the mean (*standard deviation S*) are close for all locations observed.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio have the same tendency as for the lateral forces.

2. The average (mean) value of the L/V ratios found in curve bodies (0.15), is generally higher than those found in the spiral (0.11-0.12). Note that the actual values for the mean L/V ratios, in the range of 0.11 to 0.15, are moderate.

3. **The Freight Trains generated significantly high *maximum* levels of L/V ratios, reaching 0.83 and 0.87 for low and high rails respectively, which is in the region of track damage, to include gage widening and rail overturning.**

Comparative Statistics

Vertical and Lateral Forces:

1. The relative part of the Table 10 shows that Talgo and Freight train levels of the vertical dynamics are roughly similar, except for the mean vertical forces for all high rails locations, which are 25% to 43% higher (spiral and curve body, respectively) for the Talgo Trainsets.

2. Mean lateral forces are higher for the Talgo Trainsets on the high rail (128% and 161%, curve body and spiral, respectively), but lower for low rail (56% and 97%, curve body and spiral, respectively), compared to the Freight Trains.

L/V Ratios:

1. The relative part of Table 10 shows that Talgo Trainsets generated consistently lower average (mean) L/V ratios in curve bodies (63% and 79%, low rail and high rail, respectively) when compared to corresponding Freight Train data. For L/V ratios in spirals, the Talgo Trainsets generated average L/V ratios equal to or greater than those for Freight Trains (100% and 124%, low rail and high rail, respectively).

2. The average (mean) level of the L/V ratios for the Freight Trains in the curve bodies (0.15 for both high and low rails) is generally higher than those for the Freight Trains in spirals (0.11 and 0.12; low and high rail, respectively). However, all the values of the mean L//V ratios for the Freight Trains are moderate.

3. **The Talgo Trainsets generated significantly lower *maximum* levels of L/V ratios (in the range of 0.46 to 0.59) than those for the Freight Trains.**

4. ***All L/V ratio maximums for Talgo Trainsets are below the wheel climb/rail overturning limits, i.e. less then 0.6, while those for the Freight Trains are approaching the Nadal limit for potential wheel climb 0.8 to 0.85. Freight Train L/V ratio maximums are still below the level of loadings that indicate a real risk of wheel climb.***

COMPARATIVE TRAINS: TALGO VS. REGULAR AMTRAK

General Statistics

Vertical and Lateral Forces:

1. Mean vertical forces have approximately the same levels for both the high and low rails in spirals, with the more evident high rail loading (38% higher than low rail) found in the curve body.

2. Mean lateral forces are significantly higher for the high rails, in both spirals and curve bodies. The higher level of L is exhibited in curve bodies, 2,396 lbs. and 4,630 lbs. for

low and high rail, respectively, as compared to 1,121 lbs. and 3,406 lbs. found in the spiral - low and high rail, respectively.

3. The maximum lateral force measured in the curve body high rail was 16,717 lbs., comparing to the M+3S value for the same rail reaching 17,824 lbs.

L/V Ratios:

1. The corresponding values and relationships for L/V ratio had the same tendency as those for the lateral forces.

2. The average (mean) value of the L/V ratios found in high rails, equal to 0.14 and 0.17 for spirals and bodies, respectively, is generally higher when compared to the 0.05 and 0.12 levels for the low rails in the spirals and bodies, respectively. However, the actual values for the mean L/V ratios, in the range of 0.05 to 0.17, are moderate.

3. The Amtrak Trains generated relatively moderate *maximum* levels of L/V ratios, reaching values of 0.46 and 0.35 for the high rails of curve bodies and low rails of spirals respectively. However, note that this observation was made for the limited number of trains.

Comparative Statistics

Although each of the analyzed data bases contains a significant number of statistical parameters, the discussion presented here focuses exclusively on the leading and most important for the Talgo Test Program parameters.

Vertical and Lateral Forces:

1. The relative part of the Table 12 shows that Talgo and Amtrak train average (mean) levels of the vertical dynamics *are roughly similar.*

2. The maximum vertical forces are higher for the Talgo Trainsets, especially in the low rail of the spiral (up to 59% higher).

3. Mean lateral forces are greater for the Talgo Trainsets in spirals for both rails (8% and 84% higher for high and low rails, respectively) when compared to those of the Amtrak Trains. The mean lateral forces are lower for the Talgo Trainsets in curve bodies for both rails (70% and 89% of values for low and high rail, respectively).

4. The maximum lateral forces are generally higher for the Talgo Trainsets, especially in the low rail of the spiral, where the force associated with the Talgo Trainsets was 92% higher than that of the Amtrak Trains.

L/V Ratios:

1. The relative part of the Table 12 shows that Talgo Trainsets generated consistently lower average (mean) L/V ratios in curve body, (72% and 81% for high and low rails, respectively) when compared to corresponding Amtrak train data values. For the low rail in spiral, the Talgo/Amtrak relative L/V ratio reached 208%. Note that this discussion is referring to the very moderate levels of L/V ratios for both trains, all less than or equal to 0.17.

2. The Talgo Trainsets generated generally higher relative *maximum* levels of L/V ratios, in the range of 104% to 170%, of those for the Amtrak trains. Note again, that this discussion is referring to the moderate maximum levels of L/V ratios for both trains, with a range of 0.27 to 0.59.

It has to be admitted at this point that the comparative statistics above must be used with caution because of the differences in test conditions for both trains. Specifically, the majority of Talgo trains were tested in the speed range close to 70 mph, while the random speed of Amtrak trains varied between 45 and 60 mph. In addition, the Talgo Trainsets were mainly tested in the curves near MP 74 and 76, while the majority of the Amtrak trains was measured in the curve near MP 34. However, this data can be used for a qualitative analysis and a discussion of tendencies.

9. Conclusions

Based on the results of the wayside field test series of dynamic wheel/rail forces applied by Talgo trainset, as well as regular traffic trains, performed on the Pacific Northwest Corridor of the Burlington Northern Santa Fe Railroad (BNSF), and the follow on statistical analysis, the following conclusions are presented:

- According to the regression analysis performed for the Talgo Trainsets, as well as cars and locomotives separately, the general level of the lateral dynamics consistently increases with the cant deficiency rise.

- Comparative data shows that all across the observed range of cant deficiencies (3 to 8 in) ***the Talgo locomotives have, in general, from 1.6 to 2.4 higher level of the lateral dynamics for all statistical parameters, comparing to the Talgo cars. This means that mainly Talgo locomotives, not tilting cars, will define the level of rail wear and future maintenance problems, as well as safety conditions.***

- The maximum lateral Talgo locomotive force measured in body high rail was 23,735 lbs. Note, that this maximum stands out well above maximums measured on all other rails, which are in the moderate range of 12,000 to 15,000 lbs.

- The maximum lateral Talgo car force measured in body high rail was 10,770 lbs.

- **The highest Talgo Trainsets' overall L/V level, 0.59, which was measured in the low rail spiral, falls below the wheel climb/rail overturning limits (Appendix E).**

- Mean lateral forces, which reached the maximums at cant deficiency of 8 inches, were 5,917 lbs and 3,311 lbs for the Talgo locomotives and cars respectively. The corresponding absolute maximum values in "cant deficiency statistics" (MP 74 and 76) were 15,342 lbs. vs. 7,854 lbs., which represents good agreement with M+3S statistics.

- The Talgo Trainsets generated, in general, higher relative *maximum* levels of L/V ratios, in the range of 104% to 170%, of those for regular Amtrak trains. Note, that this comparison is based on moderate levels of L/V ratios for both trains (in the range of 0.27 to 0.59), and to a very limited matrix of Amtrak train measurements.

- The important conclusion, which can be made based on the curvature analysis, is that ***with the increasing curvature, levels of the lateral forces for Talgo cars and locomotives are moving in different directions, specifically increasing for locomotives, but diminishing for cars.*** Note, that this observance was made based on the testing limited by two curves, using the spirals' and curve bodies' data bases.

- **The Freight Trains generated significantly high *maximum* levels of L/V ratios, reaching 0.83 and 0.87 for low and high rails respectively, which is in the regime of track damage, to include gage widening and rail overturning.**

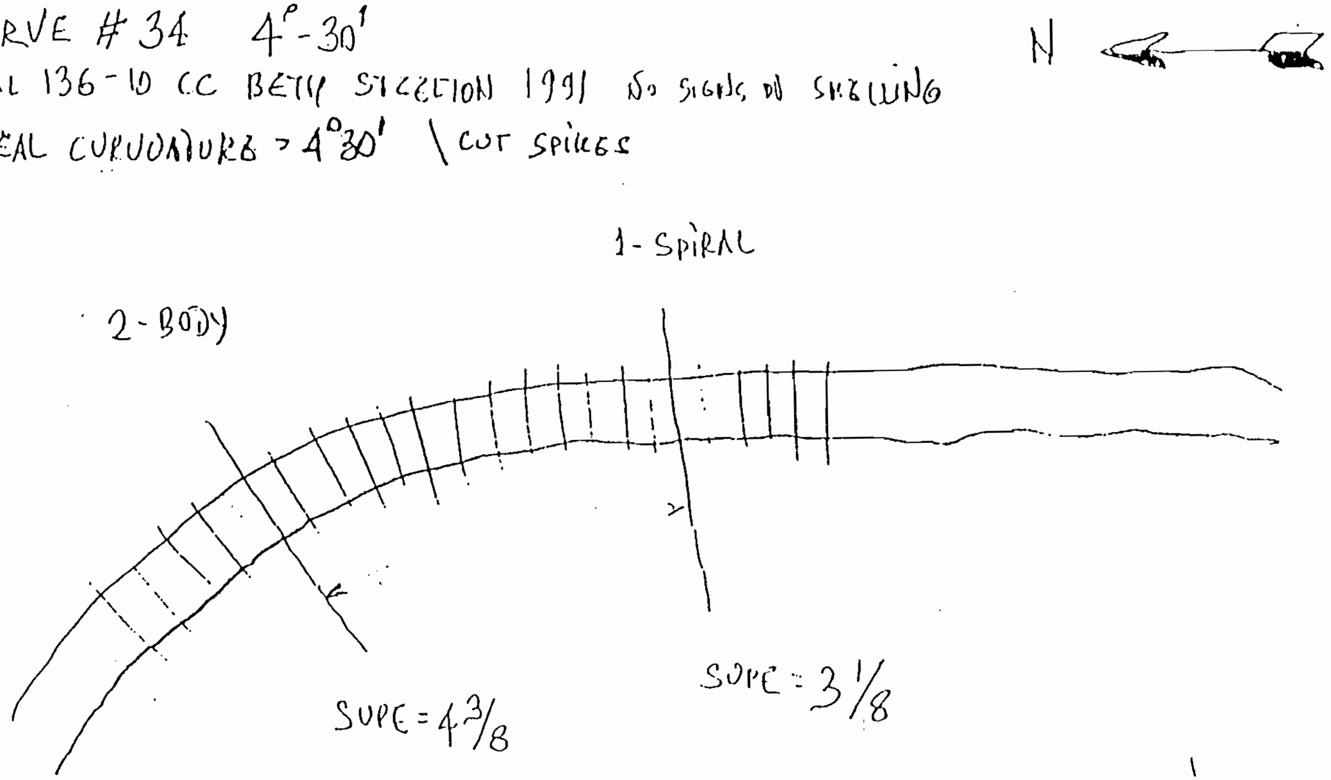
- **The Talgo Trainsets generated significantly lower, relative to Freight trains, *maximum* levels of L/V ratios, located in the range of 0.46 to 0.59.**

- ***All L/V ratio maximums for Talgo Trainsets are below the wheel climb/rail overturning limits, i.e. less then 0.6, while those for the Freight trains are approaching the Nadal limit for potential wheel climb 0.8 to 0.85, though they are still below the level of loadings that indicate a real risk of wheel climb.***

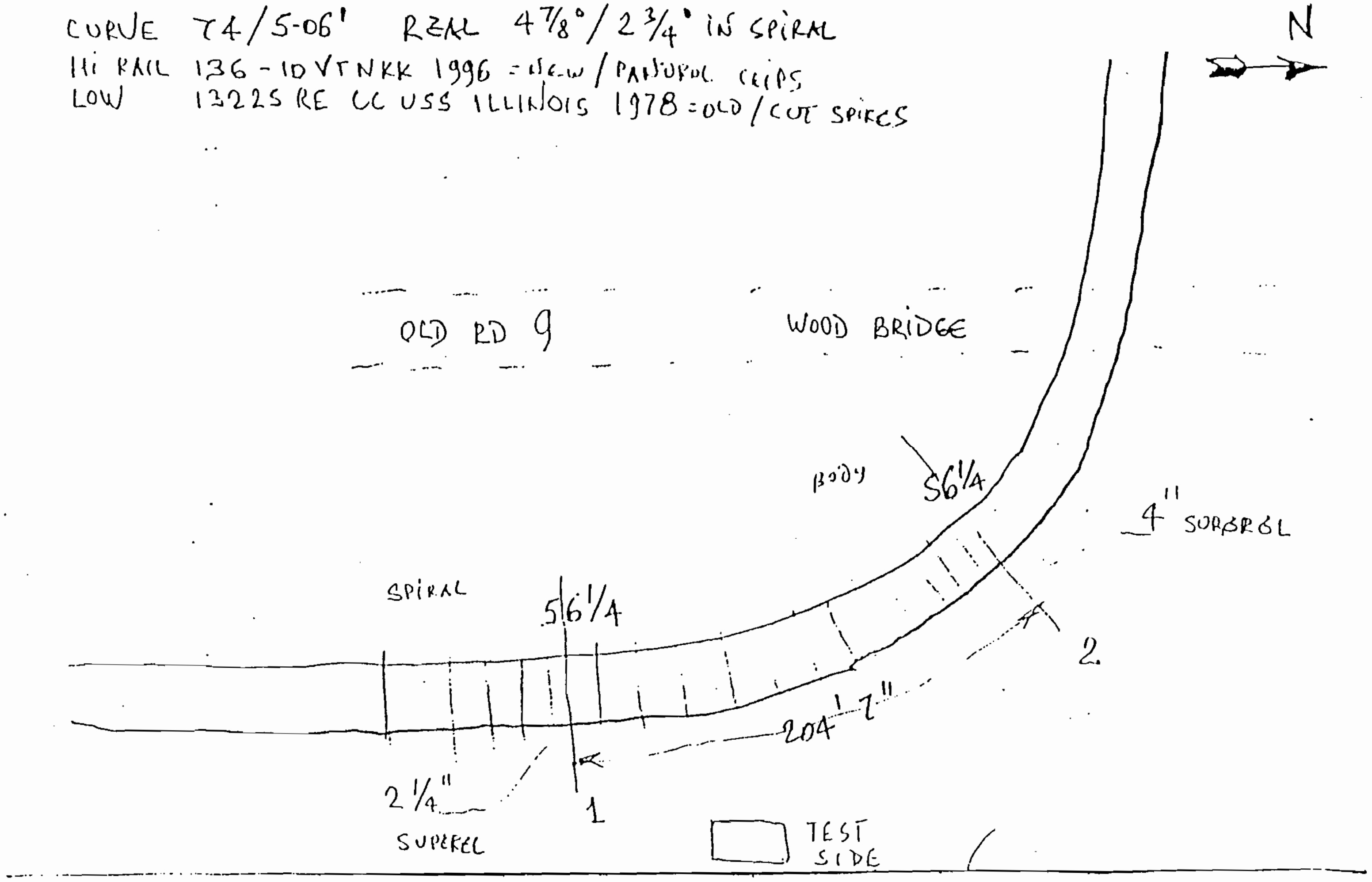
Thus based on the test results presented in this report, it can be concluded that in the range of the tested cant deficiencies, from 3 inches to 8 inches, and within the limits of typical track curvatures between 3 and 5 degrees, *the Talgo Trainset provides and complies with the main safety requirements for the Pacific Northwest Corridor of the Burlington Northern Santa Fe Railroad.*

Appendix A: Track Geometry Measurements and Notes of Test Site

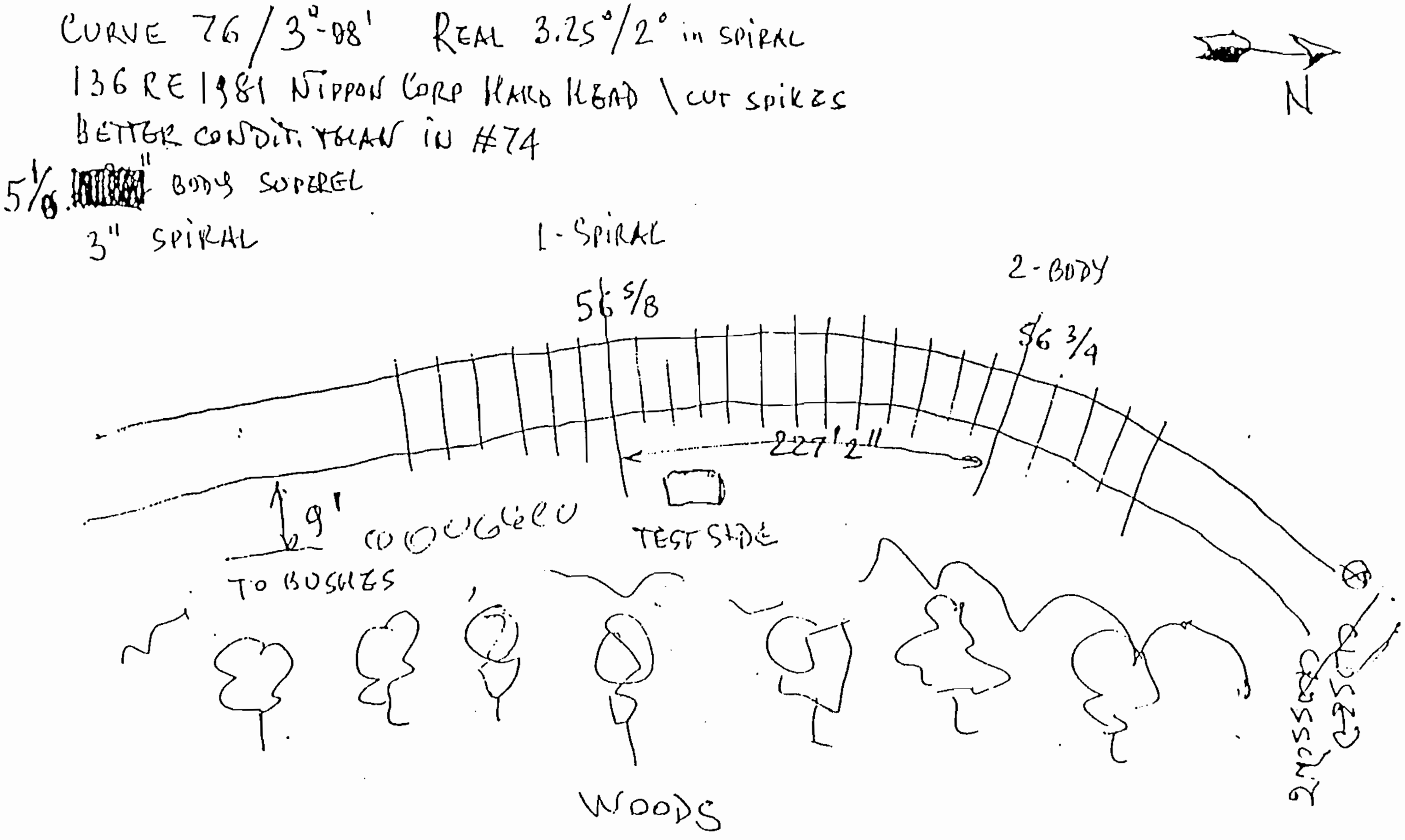
CURVE # 34 4°-30'
RAIL 136-10 CC BETH STEELTON 1991 NO SIGNS OF SHELLING
REAL CURVATURE > 4°30' \ CUT SPIKES

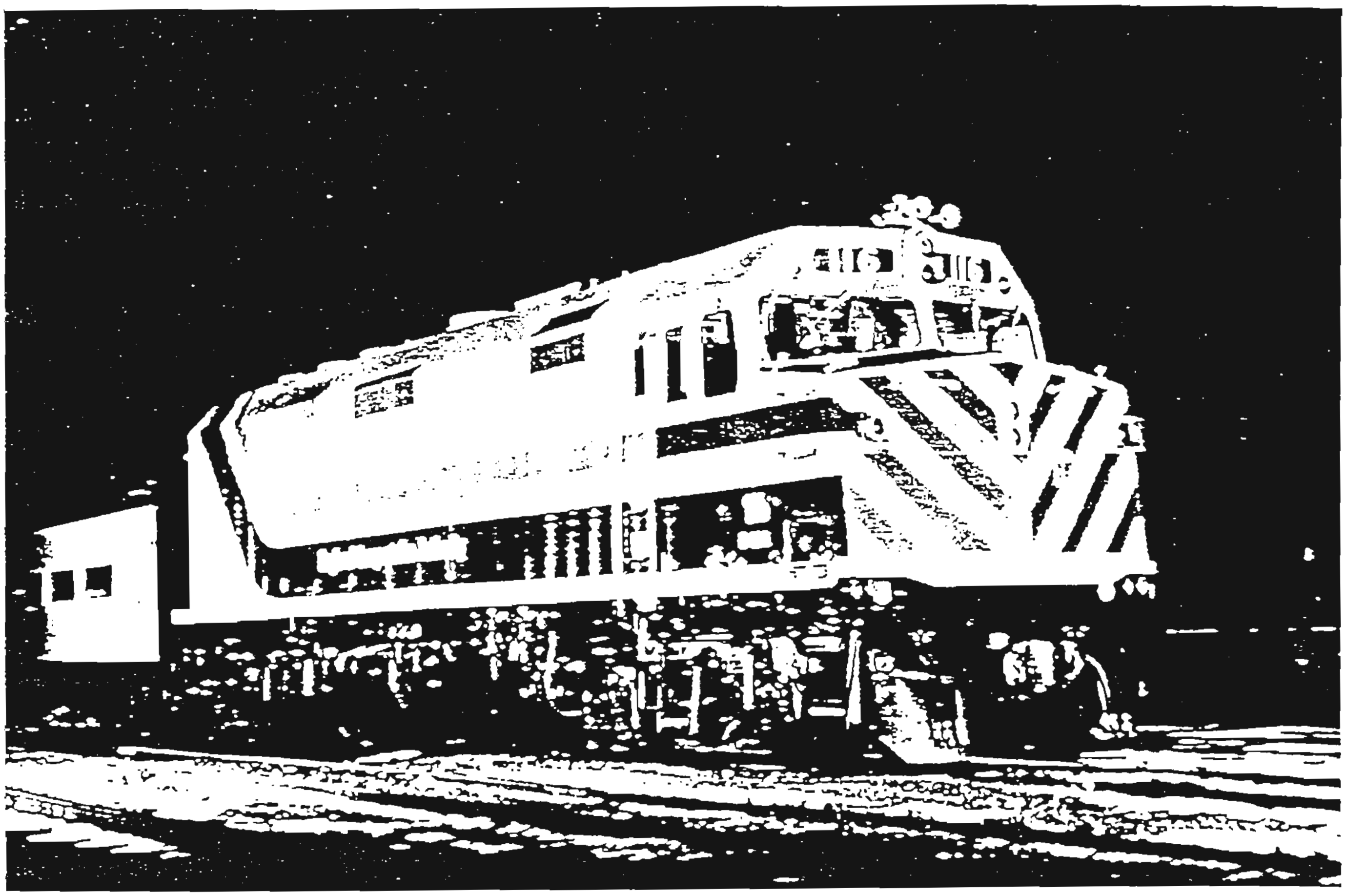


CURVE 74/5-06' REAL $4\frac{7}{8}$°/$2\frac{3}{4}$° IN SPIRAL
HI RAIL 136-10 VTNKK 1996 = NEW / PANDROL CLIPS
LOW 13225 RE CC USS ILLINOIS 1978 = OLD / CUT SPIKES

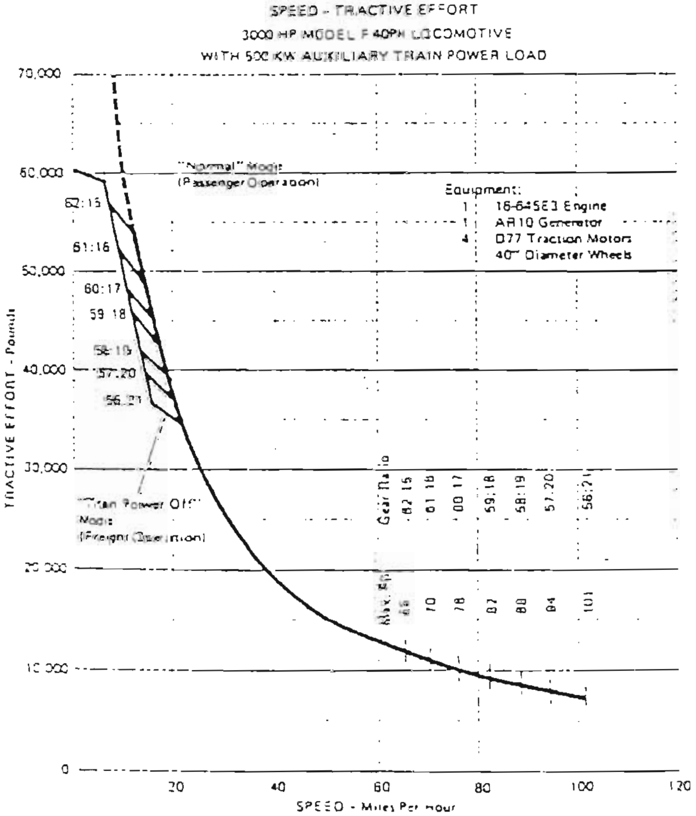


CURVE 76/3°-08' REAL 3.25°/2° in SPIRAL
136 RE 1981 NIPPON CORP HARD HEAD \ CUT SPIKES
BETTER CONDIT. THAN IN #74
5 1/8" BODY SUPEREL
3" SPIRAL





General Motors Model F40PH



General Characteristics, Weights and Dimensions

Model . F40PH 3000 HP Four Motor Diesel-Electric Locomotive	
Type:	
AAR DESIGNATION	B-B
Common Designation	0440
Arrangement .... The Locomotive consists of one unit complete with engine, generator, trucks and all accessories for single unit operation, with a control cab between the long and short hoods.	
Nominal dimensions:	
Distance pulling face of coupler to centerline of truck	11'7"
Distance between bolster centers	33'0"
Truck-rigid wheel base	9'0"
Distance pulling face front coupler to rear coupler	56'2"
Width over cab sheeting	10'0"
Height over cooling fan hatch	15'7"
Drive	
Driving motors	Four
Driving wheels	4 Pair
Diameter wheels	40"
Weights and Supplies:	
Total loaded weight on rails (approximately)	259,000# ±3500
Fuel (basic)	1,500 gal.
Fuel capacity option	1,800 gal.
Sand	26 cu. ft.
Cooling water	254 gal.
Lubricating oil	243 gal.

MO 74 - AUG 5/97.

LOCO - TALGO - LOCO

IN	TIME	DIRECT	SPEED	NOTES.
1	12:20	N	34.5	+ 1"
2	13:12	S	44.1	+ 2.6"
3	13:30	N	44.8	+ 2.9"
4	13:49	S	46.2	+ 3.3
5	14:03	N	47.7	+ 3.8
6	14:19	S	51.2	+ 4.9
7	14:30	N	51.8	+ 5.2
8	14:45	S	51.3	+ 5.0
9	15:09	N	53.0	+ 5.6
10	15:34	S	53.2	+ 5.7
11	15:57	N	51.6	+ 5.1
12	16:15	S	53.7	+ 5.9

FREIGHTS

1	15:20	N	38.5	12 LOCOS 204 WHEELS	+ .00015 V A ~~POINTS~~ } THRESHOLD
2	16:47	S	38.7	220 WHEELS 12 LOCOS	+ .00015 A POINTS

AUG 5/97

MP 76

TALGO TRAIN RECORDS

LOCO - TALGO - LOCO

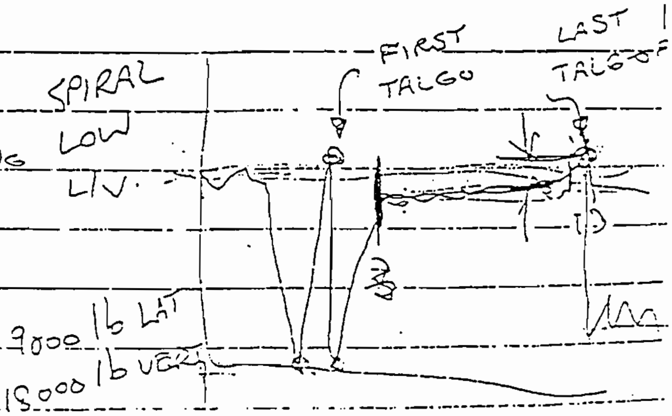
	DIRECTION	SPEEDS	TIME	ACT SPEED	MAX L/V	SHEE
1	N/B	+0.4 BALANCE 34/48	12:25	49.5		✓
2	S/B	+3.0	13:11	59.9	.37	✓
3	N/B	+3.2	13:34	60.3	.28	✓
4	S/B	+4" 47/64	13:49	63.5	.39	✓
5	N/B	+4.2 47/64	14:07	64.0	.29	✓
6	S/B	+~~4~~6 51/67	14:18	65.3	.44	✓
7	N/B	+5.6 51/67	14:34	68.6	.29	✓
8	S/B	+5.2 51/67	14:44	67.2	.43	✓
9	N/B	+5.2 51/67	15:12	67.5	.27	✓
E 10	N/B	-0.7	15:24	44.3	BN 2750 ≈634 30 WHEELS 12/LOCO	✓
11	S/B	+6.5 53/70	15:34	71.4	.57	✓
12	N/B	+6.0 53/70	16:01	69.8	.31	✓
13	S/B	+6.3 53/70	16:15	70.9	.48	✓
E 14	S/B	-1.2	16:46	41.5	.53 BN 2758 220 WHEELS/12 LX5=6	

ALL FILES ANALYZED USING

THRESHOLD 0.00015 V

4 POINTS

L.P. FILTER 2ND ORDER @ 100 Hz.



AUG 6/97

LOCO - TALGO - LOCO

MP 74

	DIRECTION	SPEEDS Nom.	SPEEDS Act.	TIME	OVER BALANCE	MAX 4v	SHE
1.	N/B	45	43.7	10:02	+2.5 AMTRAK REGULAR	.27	18 WHEELS ✓ 4 LOCO EXTRA TRIGGER
2	N/B	53	53.1	11:02	+5.6 "		
3	S/B	53/70	53.0	11:18	+5.6 "	.31	
4	N/B	56/73	56.2	11:33	+ 6.8 "	.31	
5.	S/B	56/73	55.6	12:06	+ 6.6 "	0.32	
:16 SLOW 6.	N/B	56/73	56.1	13:22	+ 6.8	0.46	
: 5 7.	S/B	56/73	56.8	13:43	7.0	0.28	LIGHT RAIN SHOWERS
8.	N/B	56/73	56.2	13:57	6.8	.31	
9.	S/B	56/73	56.3	14:19	6.8	.38	[illegible]
10	N/B	56/73	57.3	14:30	7.2	0.35	
F 11	S/B	45.	40.2	14:42	+1.5	0.65	120 WHEELS 16 LOCO
12	S/B	58/75	58.8	15:13	+7.8	.26	
13	N/B	58/75	56.9	16:06	+7.0	.32	
14	S/B	58/75	59.0	16:22	+7.9	.53	
15.	N/B	—	12.8	12:16	- 3.4	.33	✓ 15F

0.00020 V ; 4 POINTS - TALGO

ANALYZED USING THRESHOLD 0.00015 V ; 4 POINTS. - FREIGHT

.0287

.005.

MP 76 - AUG 6/97

LOCO - TALGO - LOCO

PAIN	TIME	DIRECT	SPEED	O/B	MAX L/V		SHEET
1	11:05	N/B	70.8	+6.3	.30		✓
2	11:18	S/B	70.7	+6.3	.59		✓
3	11:36	N/B	74.2	+7.4	.32		✓
4	12:05	S/B	73.7	+7.2	.55		✓
5	13:25	N/B	73.5	+7.2	.29		✓
6	13:43	S/B	72.2	+6.7	.42	LIGHT RAIN SHOWERS	✓
7	14:00	N/B	72.7	+6.9	.30		✓
8	14:19	S/B	72.7	+6.9	.45		✓
9	14:33	N/B	72.5	+6.8	.30		✓
10	14:41	S/B	45.9	+0.3	.51	120 WHEELS 16 LOCO	✓
11	15:12	S/B	74.6	+7.5	.51		✓
12	16:09	N/B	74.5	+7.5	.28		✓
13	16:22	S/B	73.3	+7.1	.51		✓
14							13 FIL

FILES ALL ANALYZED USING THRESHOLD 0.00015 V & 4 POINTS

MISSED REVENUE TALGO @ 10:00 AM

MP 74.

AUG 7/97.

LOCO - LOCO - TALGOS

TRAINS

TIME	AG. SPEED	OVER BALANCE	MAX L/V	DIREC.		NOTES	SHEE
09:30	45.7	+3.1	0.40	N/B		AMTRAK REGULAR	✓
11:15	57.6	+7.3	0.34	N/B TEST	TRAIN		✓
13:51	58.0	+7.5	.29	S/B			✓
14:09	19.0	-2.8	.28	N/B	PUSH.		✓
14:39	58.5	+7.7	,27	S/B			✓
14:48	37.8	+0.9	.31	S/B	#633	3 UNITS + MIXED	✓

6 FILE

ALL FILES ANALYZED WITH THRESHOLD = 0.00015V & 4 POINTS

MP 76 -AUG 7/97

LOCO - LOCO - TALGOS

PAIN	TIME	DIRECT	SPEED	°/G	MAX W/V NOTES	SHEET
1	09:33	N/B	59.4	2.9	AMTRAK REVENUE 0.35	✓
2	13:51	S/B	75.7	7.9	.40 TEST TRAIN PUSH.	✓
3	14:24	N/B	15.8	-4.6	.31	✓
4	14:39	S/B	74.3	7.4	.48	✓
5	14:46	S/B	43.0	0.9	.39 76 WHEELS 12 LOCO	✓
						5 FILES

ALL FILES ANALYZED WITH THRESHOLD 0.00015 V & 4 POINTS

AUG 11/97

LOCO - LOCO - TALGO

MP 74

RAIN	TIME	DIRECT	SPEED	0/B	MAX UV	NOTES	SHEE
1.	13:24	S/B	51.3	5.0	.38	26 WHEELS	✓
2	16:19	N/B	40.7	1.6	.32	12 LOCOS.	✓
							2 FILE.

MP 76

						2 WHEEL 9 • LT	
1	13:21	S/B	72.8	6.9	.59	360 WHEELS 0,00007V	✓
2.	16:20	N/B	47.4	0.0	.36	12 LOCOS. 4 POINTS	✓
							2 FILES

3/4 FILES ANALYZED USING THRESHOLD 0.00015 V & 4 POINTS.

AUG 12/97 TRAINS - CURVE 34

ET	ID	LOCOS	TIME	SPEED		o/8	MAX L/V	SLEE
N/B	BN 2086	2 x 4	10:29	36	29 wheels	+0.3"		✓
N/B	AMTRAK	1 x 4	12:03	47	24 wheels	+2.5"	.46	✓
N/B	BN 2346	1 x 4	12:27	46	20 wheels	+2.3"	.41	✓
N/B	BN 2086	2	15:50	32	20 wheels	+1.0	.35	✓
N/B	AM 2007	2	16:38	57.4	22 wheels	+6.0"	.44	✓
								5 FILE

AUG 13/97

N/B	FREIGHT - S[illegible]	3 x 4	13:38	37.1	30 wheels	-0.1"	.54	✓
N/B	DOUBLE STACKS	5x6	14:26	39.3	274 wheels	0.6"	EMPTY .83	✓
N/B	3 LOCOS	3 x 6	16:15	44	18 WHEELS	1.6	.53	✓
N/B	TALGO TEST	2 x 4	17:23	62.1	22 WHEELS	+7.8"	.50	✓
N/B	MIXED	1 x 4	18:37	36	56 WHEELS	0.3	.53	✓
N/B	MIXED	2 x 6	19:00	38	258 WHEELS	0.2	EMPTY CAR .87	✓
N/B	MIXED	3 1x4 2x6	19:29	33.4	436 WHEELS	-0.6	.47	✓
						BN-2272		7 FIL

THRESHOLD 0.000135
POINTS = 17
USE CHAN 1 NOT 0 !
FOR SPIRAL

KINGDOME - NE - AMTRAK - General offices

TOTA.
83
FILE

3,953 WHEE

Appendix B: Talgo Trainset Raw Data

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 12-20-51	74	N	34.6	0.1	L	37355	30595	10322	6456	38104	33278	13781	10143	0.28	0.21	0.36	0.3
97-08-05 12-20-51	74	N	34.6	0.1	L	36248	38077	3882	6898	34003	37905	3787	7132	0.11	0.18	0.11	0.19
97-08-05 12-20-51	74	N	34.6	0.1	L	32622	37164	6718	7582	36306	36572	11508	10949	0.21	0.2	0.32	0.3
97-08-05 12-20-51	74	N	34.6	0.1	L	33305	39840	1039	-28	33697	37387	-170	2378	0.03	0	-0.01	0.06
97-08-05 12-20-51	74	N	34.6	0.1	LT	20275	18519	5278	4596	19142	19381	4615	5775	0.26	0.25	0.24	0.3
97-08-05 12-20-51	74	N	34.6	0.1	T	18680	18907	1676	2355	19921	19457	3404	4641	0.09	0.12	0.17	0.24
97-08-05 12-20-51	74	N	34.6	0.1	T	15989	17947	1378	553	16127	18730	52	147	0.09	0.03	0	0.01
97-08-05 12-20-51	74	N	34.6	0.1	T	16269	17017	1851	630	17643	17007	-41	290	0.11	0.04	0	0.02
97-08-05 12-20-51	74	N	34.5	0.1	T	15986	18711	1503	272	16406	18040	66	1254	0.09	0.01	0	0.07
97-08-05 12-20-51	74	N	34.5	0.1	T	15093	17701	2035	836	15813	16571	-72	108	0.13	0.05	0	0.01
97-08-05 12-20-51	74	N	34.5	0.1	T	15463	18948	1676	863	16914	19413	-160	639	0.11	0.05	-0.01	0.03
97-08-05 12-20-51	74	N	34.5	0.1	T	16442	17988	1949	1108	17136	16063	875	2051	0.12	0.06	0.05	0.13
97-08-05 12-20-51	74	N	34.5	0.1	T	15967	18226	776	-247	17033	17353	1489	3082	0.05	-0.01	0.09	0.18
97-08-05 12-20-51	74	N	34.5	0.1	T	16055	18236	1936	703	18181	17248	-88	188	0.12	0.04	0	0.01
97-08-05 12-20-51	74	N	34.4	0	T	15746	17798	1911	612	17632	18211	-126	461	0.12	0.03	-0.01	0.03
97-08-05 12-20-51	74	N	34.4	0	T	15286	18405	1210	5	17604	17356	334	1624	0.08	0	0.02	0.09
97-08-05 12-20-51	74	N	34.4	0	T	18219	20137	3836	2417	17407	19737	1791	1653	0.21	0.12	0.1	0.08
97-08-05 12-20-51	74	N	34.4	0	LT	18781	16852	5322	3047	19248	16570	4994	3412	0.28	0.18	0.26	0.21
97-08-05 12-20-51	74	N	34.4	0	L	36817	31176	1706	2976	39110	33220	7314	9018	0.05	0.1	0.19	0.27
97-08-05 12-20-51	74	N	34.4	0	L	36902	31613	-867	742	37254	32056	-9	2809	-0.02	0.02	0	0.09
97-08-05 12-20-51	74	N	34.4	0	L	33370	35517	-536	2290	38239	35786	5828	9330	-0.02	0.06	0.15	0.26
97-08-05 12-20-51	74	N	34.4	0	L	33822	36194	108	741	36061	35035	-586	1209	0	0.02	-0.02	0.03
97-08-05 12-24-47	76	N	49.3	0.4	L	37148	32926	6385	5800	37459	31420	7157	4571	0.17	0.18	0.19	0.15
97-08-05 12-24-47	76	N	49.3	0.4	L	36321	35695	943	522	36960	34882	1542	769	0.03	0.01	0.04	0.02
97-08-05 12-24-47	76	N	49.3	0.4	L	31885	38072	-320	633	36410	30915	4248	3539	-0.01	0.02	0.12	0.1
97-08-05 12-24-47	76	N	49.3	0.4	L	33660	37649	2289	505	37554	36349	1646	612	0.07	0.01	0.04	0.02
97-08-05 12-24-47	76	N	49.3	0.4	LT	19661	19195	6484	5576	20446	23149	2295	2434	0.33	0.29	0.11	0.11
97-08-05 12-24-47	76	N	49.3	0.4	T	19250	18430	-113	248	20248	18691	1733	1212	-0.01	0.01	0.09	0.06
97-08-05 12-24-47	76	N	49.3	0.4	T	18503	16652	1591	-326	20019	17085	1594	1141	0.09	-0.02	0.08	0.07
97-08-05 12-24-47	76	N	49.3	0.4	T	17856	16276	2161	-210	19051	16372	1835	1259	0.12	-0.01	0.1	0.08
97-08-05 12-24-47	76	N	49.4	0.4	T	17102	16980	2562	-170	17817	17122	530	435	0.15	-0.01	0.03	0.03
97-08-05 12-24-47	76	N	49.4	0.4	T	16872	15827	1388	-217	18203	14771	1780	1168	0.08	-0.01	0.1	0.08
97-08-05 12-24-47	76	N	49.4	0.4	T	17663	15446	1902	-266	20982	15083	2037	1376	0.11	-0.02	0.1	0.09
97-08-05 12-24-47	76	N	49.5	0.4	T	16491	16332	2556	-146	18354	16720	2239	1593	0.16	-0.01	0.12	0.1
97-08-05 12-24-47	76	N	49.5	0.4	T	17538	16953	3263	551	18327	15900	798	-105	0.19	0.03	0.04	-0.01
97-08-05 12-24-47	76	N	49.5	0.5	T	16493	16023	1623	-362	18694	15405	1670	1215	0.1	-0.02	0.09	0.08
97-08-05 12-24-47	76	N	49.5	0.5	T	17277	16353	2407	-304	18516	16852	593	692	0.14	-0.02	0.03	0.04
97-08-05 12-24-47	76	N	49.6	0.5	T	17501	16373	1678	-202	19663	15721	730	704	0.1	-0.01	0.04	0.04
97-08-05 12-24-47	76	N	49.6	0.5	T	17913	21188	2888	-4	19258	19537	633	320	0.16	0	0.03	0.02
97-08-05 12-24-47	76	N	49.6	0.5	LT	16435	19396	2658	-275	17490	18706	1008	-157	0.16	-0.01	0.06	-0.01
97-08-05 12-24-47	76	N	49.7	0.5	L	35069	33647	3909	2332	39214	33993	8032	5622	0.11	0.07	0.2	0.17
97-08-05 12-24-47	76	N	49.7	0.5	L	33436	35720	3986	3234	34644	34563	5562	4603	0.12	0.09	0.16	0.13
97-08-05 12-24-47	76	N	49.7	0.5	L	34807	35953	5538	7248	38926	35497	6641	6060	0.16	0.2	0.17	0.17
97-08-05 12-24-47	76	N	49.7	0.5	L	32698	35253	3962	3829	36201	33450	3807	4673	0.12	0.11	0.11	0.14
97-08-05 13-11-53	76	S	59.9	3	L	37130	33413	7988	10707	42794	27154	8287	5466	0.22	0.32	0.19	0.2
97-08-05 13-11-53	76	S	59.9	3	L	36776	32119	7197	11282	37754	29767	4598	5893	0.2	0.35	0.12	0.2
97-08-05 13-11-53	76	S	59.9	3	L	36788	26779	9455	9245	37859	29474	8279	5526	0.26	0.35	0.22	0.19
97-08-05 13-11-53	76	S	59.9	3	L	33247	30459	3357	542	34407	32421	3459	3261	0.1	0.02	0.1	0.1
97-08-05 13-11-53	76	S	59.9	3	LT	15020	20343	5625	7511	16294	17480	1260	-253	0.37	0.37	0.08	-0.01
97-08-05 13-11-53	76	S	59.9	3	T	18240	17232	931	593	17898	15233	619	220	0.05	0.03	0.03	0.01
97-08-05 13-11-53	76	S	59.9	3	T	17469	16417	1593	3608	18128	14434	1184	86	0.09	0.22	0.07	0.01
97-08-05 13-11-53	76	S	59.9	3	T	16579	14732	3359	4781	17616	14734	885	132	0.2	0.32	0.05	0.01
97-08-05 13-11-53	76	S	59.9	3	T	17378	15527	2318	4756	17563	14167	542	246	0.13	0.31	0.03	0.02
97-08-05 13-11-53	76	S	59.9	3	T	17277	14715	2730	4737	18527	12774	1463	1595	0.16	0.32	0.08	0.12
97-08-05 13-11-53	76	S	59.9	3	T	15210	14722	2529	4318	16976	13925	738	442	0.17	0.29	0.04	0.03
97-08-05 13-11-53	76	S	59.9	3	T	18136	14628	2031	4429	18810	12142	895	111	0.11	0.3	0.05	0.01
97-08-05 13-11-53	76	S	59.9	3	T	16145	14504	2421	4461	17678	13424	849	427	0.15	0.31	0.05	0.03
97-08-05 13-11-53	76	S	59.9	3	T	17494	15209	3065	4935	18019	13016	937	1164	0.18	0.32	0.05	0.09
97-08-05 13-11-53	76	S	59.9	3	T	16491	16481	2635	5335	17691	13764	945	796	0.16	0.32	0.05	0.06
97-08-05 13-11-53	76	S	59.9	3	T	17611	14160	2921	4252	21620	13275	788	569	0.17	0.3	0.04	0.04
97-08-05 13-11-53	76	S	59.9	3	T	19981	15503	3153	5315	20047	14823	924	1061	0.16	0.34	0.05	0.07
97-08-05 13-11-53	76	S	59.9	3	LT	19338	20286	2013	4070	21466	16964	395	551	0.1	0.2	0.02	0.03
97-08-05 13-11-53	76	S	59.9	3	L	33751	32597	1397	1356	43672	28775	8058	4146	0.04	0.04	0.18	0.14
97-08-05 13-11-53	76	S	59.9	3	L	38238	28184	3338	-921	42662	32502	3857	-226	0.09	-0.03	0.09	-0.01
97-08-05 13-11-53	76	S	59.9	3	L	38238	29207	3261	1225	42587	34725	5050	3569	0.09	0.04	0.12	0.1
97-08-05 13-11-53	76	S	59.9	3	L	37581	29278	2859	-555	37378	31205	3071	-238	0.08	-0.02	0.08	-0.01
97-08-05 13-12-57	74	S	44.1	2.7	L	36831	55310	-347	344	42520	28277	3079	1731	-0.01	0.01	0.07	0.06
97-08-05 13-12-57	74	S	44.1	2.7	L	40755	44886	462	2731	43634	28465	868	2251	0.01	0.06	0.02	0.08
97-08-05 13-12-57	74	S	44.1	2.7	L	37821	43903	-684	-278	43947	26230	4287	2628	-0.02	-0.01	0.1	0.1

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-05 13-12-57	74	S	44.1	2.6	L	39492	47470	191	2386	43803	25088	1857	2177	0	0.05	0.04	0.09
97-08-05 13-12-57	74	S	44.1	2.6	LT	18100	34336	758	667	22317	13788	3061	2472	0.04	0.02	0.14	0.18
97-08-05 13-12-57	74	S	44.1	2.7	T	17685	33667	4245	1939	25249	16574	920	549	0.24	0.06	0.04	0.03
97-08-05 13-12-57	74	S	44.1	2.6	T	16640	34556	1236	972	19769	15048	54	341	0.07	0.03	0	0.02
97-08-05 13-12-57	74	S	44.1	2.6	T	16870	45294	2105	1394	19052	14846	-274	397	0.12	0.03	-0.01	0.03
97-08-05 13-12-57	74	S	44.1	2.6	T	16174	32306	2775	1814	20556	14825	159	345	0.17	0.06	0.01	0.02
97-08-05 13-12-57	74	S	44.1	2.6	T	15418	26468	1499	997	19708	16068	-190	475	0.1	0.04	-0.01	0.03
97-08-05 13-12-57	74	S	44.1	2.6	T	17638	36721	937	667	19840	14540	1181	346	0.05	0.02	0.06	0.02
97-08-05 13-12-57	74	S	44.1	2.6	T	15142	35376	1558	1476	18883	16435	-246	755	0.1	0.04	-0.01	0.05
97-08-05 13-12-57	74	S	44.1	2.6	T	15701	25258	2484	1538	19260	14354	-1	461	0.16	0.06	0	0.03
97-08-05 13-12-57	74	S	44.1	2.6	T	17984	34176	2402	1152	20311	15111	109	309	0.13	0.03	0.01	0.02
97-08-05 13-12-57	74	S	44.1	2.6	T	16355	40043	2258	1563	20083	14456	-505	432	0.14	0.04	-0.03	0.03
97-08-05 13-12-57	74	S	44	2.6	T	17041	28834	2819	1874	18674	14456	-166	455	0.17	0.06	-0.01	0.03
97-08-05 13-12-57	74	S	44	2.6	T	19764	38968	2872	1300	22669	16202	1700	316	0.15	0.03	0.07	0.02
97-08-05 13-12-57	74	S	44	2.6	LT	17926	34630	-126	764	23164	16935	5394	2163	-0.01	0.02	0.23	0.13
97-08-05 13-12-57	74	S	44	2.6	L	35644	53036	9048	6563	40941	28422	13573	8158	0.25	0.12	0.33	0.29
97-08-05 13-12-57	74	S	44	2.6	L	36289	46756	2677	1076	40946	30903	1430	1383	0.07	0.02	0.03	0.04
97-08-05 13-12-57	74	S	44	2.6	L	38466	55792	12649	9665	44895	27861	13145	8564	0.33	0.17	0.29	0.31
97-08-05 13-12-57	74	S	44	2.6	L	38940	29614	7626	5885	45364	32975	4506	2763	0.2	0.2	0.1	0.08
97-08-05 13-30-26	74	N	44.8	2.9	L	38089	28092	9892	6186	47632	29287	16427	10986	0.26	0.22	0.34	0.38
97-08-05 13-30-26	74	N	44.8	2.9	L	37795	35012	4598	5160	37915	31665	3973	5394	0.12	0.15	0.1	0.17
97-08-05 13-30-26	74	N	44.8	2.9	L	31847	32881	7206	6864	42512	30819	14528	11289	0.23	0.21	0.34	0.37
97-08-05 13-30-26	74	N	44.8	2.9	L	36671	36797	2426	-357	39418	32606	2182	2792	0.07	-0.01	0.06	0.09
97-08-05 13-30-26	74	N	44.8	2.9	LT	21546	17667	6780	5438	21110	16270	6669	5533	0.31	0.31	0.32	0.34
97-08-05 13-30-26	74	N	44.8	2.9	T	19648	18770	2810	2508	21093	17091	3854	3992	0.14	0.13	0.18	0.23
97-08-05 13-30-26	74	N	44.8	2.9	T	17024	18016	1844	48	18651	16272	310	-76	0.11	0	0.02	0
97-08-05 13-30-26	74	N	44.8	2.9	T	17562	17718	1816	108	21804	15129	208	129	0.1	0.01	0.01	0.01
97-08-05 13-30-26	74	N	44.8	2.9	T	16548	17989	1427	-72	18909	16084	1903	2022	0.09	0	0.1	0.13
97-08-05 13-30-26	74	N	44.8	2.9	T	16825	16402	2129	89	18580	14666	175	644	0.13	0.01	0.01	0.04
97-08-05 13-30-26	74	N	44.8	2.9	T	15809	18985	1911	601	17507	15072	1573	1317	0.12	0.03	0.09	0.09
97-08-05 13-30-26	74	N	44.8	2.9	T	17400	17884	1651	220	19531	14307	1976	2711	0.09	0.01	0.1	0.19
97-08-05 13-30-26	74	N	44.8	2.9	T	16806	18112	617	-312	18473	15823	2029	2634	0.04	-0.02	0.11	0.17
97-08-05 13-30-26	74	N	44.8	2.9	T	17231	17342	1790	64	18215	14467	449	458	0.1	0	0.02	0.03
97-08-05 13-30-26	74	N	44.8	2.9	T	17185	18367	2013	193	18296	15642	17	238	0.12	0.01	0	0.02
97-08-05 13-30-26	74	N	44.8	2.9	T	16780	18144	885	-332	20115	15474	1787	2507	0.05	-0.02	0.09	0.16
97-08-05 13-30-26	74	N	44.8	2.9	T	19311	19755	4241	2022	20157	18767	2129	311	0.22	0.1	0.11	0.02
97-08-05 13-30-26	74	N	44.8	2.9	LT	20264	15962	5994	2475	20837	14738	5444	2900	0.3	0.16	0.26	0.2
97-08-05 13-30-26	74	N	44.8	2.9	L	40175	28425	2649	1905	45274	27376	8803	6445	0.07	0.07	0.19	0.24
97-08-05 13-30-26	74	N	44.8	2.9	L	41553	26782	1001	530	41595	25818	524	692	0.02	0.02	0.01	0.03
97-08-05 13-30-26	74	N	44.8	2.9	L	38032	32846	390	2131	45774	28327	4984	4913	0.01	0.06	0.11	0.17
97-08-05 13-30-26	74	N	44.8	2.9	L	37603	32275	1447	413	42727	28737	452	711	0.04	0.01	0.01	0.02
97-08-05 13-33-54	76	N	60.3	3.2	L	37539	29557	5605	3066	46551	28520	10696	4096	0.15	0.1	0.23	0.14
97-08-05 13-33-54	76	N	60.3	3.2	L	35781	29734	1772	202	44359	29590	4294	906	0.05	0.01	0.1	0.03
97-08-05 13-33-54	76	N	60.3	3.1	L	35124	33575	673	-493	42719	30838	6517	2479	0.02	-0.01	0.15	0.08
97-08-05 13-33-54	76	N	60.3	3.2	L	35752	28470	3716	-472	43222	29797	3809	326	0.1	-0.02	0.09	0.01
97-08-05 13-33-54	76	N	60.3	3.1	LT	20786	19233	5897	4360	24063	15876	3306	1056	0.28	0.23	0.14	0.07
97-08-05 13-33-54	76	N	60.3	3.1	T	19307	16868	39	-319	22179	15640	2116	674	0	-0.02	0.1	0.04
97-08-05 13-33-54	76	N	60.3	3.1	T	18810	13599	2059	-913	21934	12924	2686	664	0.11	-0.07	0.12	0.05
97-08-05 13-33-54	76	N	60.3	3.1	T	17949	15846	2074	-743	19125	11371	2256	1096	0.12	-0.05	0.12	0.1
97-08-05 13-33-54	76	N	60.3	3.1	T	17856	15375	2246	-847	21463	12577	2696	892	0.13	-0.06	0.13	0.07
97-08-05 13-33-54	76	N	60.3	3.1	T	17644	13444	1881	-905	20283	12251	2500	923	0.11	-0.07	0.12	0.08
97-08-05 13-33-54	76	N	60.3	3.2	T	18774	14320	1686	-770	23688	13049	3033	1151	0.09	-0.05	0.13	0.09
97-08-05 13-33-54	76	N	60.3	3.1	T	17415	15457	2759	-569	20210	14544	2984	1279	0.16	-0.04	0.15	0.09
97-08-05 13-33-54	76	N	60.3	3.2	T	18651	14221	3260	-381	21077	13631	1480	550	0.17	-0.03	0.07	0.04
97-08-05 13-33-54	76	N	60.3	3.2	T	17982	15160	1983	-767	19887	13572	2680	1052	0.11	-0.05	0.13	0.08
97-08-05 13-33-54	76	N	60.3	3.2	T	18510	15037	2808	-651	21603	13978	2411	887	0.15	-0.04	0.11	0.06
97-08-05 13-33-54	76	N	60.3	3.2	T	18226	14208	1790	-857	22284	12379	2722	1009	0.1	-0.06	0.12	0.08
97-08-05 13-33-54	76	N	60.3	3.2	T	18804	17992	3051	-405	19903	15450	1016	-82	0.16	-0.02	0.05	-0.01
97-08-05 13-33-54	76	N	60.4	3.2	LT	17173	17306	1768	-862	19024	16561	1315	100	0.1	-0.05	0.07	0.01
97-08-05 13-33-54	76	N	60.4	3.2	L	38074	29332	3854	820	45199	26209	10594	3162	0.1	0.03	0.23	0.12
97-08-05 13-33-54	76	N	60.4	3.2	L	33946	31572	4318	2491	40468	30330	7533	3424	0.13	0.08	0.19	0.11
97-08-05 13-33-54	76	N	60.4	3.2	L	36313	33478	5387	3995	44393	27072	10451	4866	0.15	0.12	0.24	0.18
97-08-05 13-33-54	76	N	60.4	3.2	L	37167	30637	5055	3357	42036	32679	4781	3031	0.14	0.11	0.11	0.09
97-08-05 13-48-49	76	S	63.3	4	L	37781	28308	8189	9507	43830	24028	9525	5551	0.22	0.34	0.22	0.23
97-08-05 13-48-49	76	S	63.3	4	L	37775	28948	6320	7414	40760	27700	6359	5421	0.17	0.26	0.16	0.2
97-08-05 13-48-49	76	S	63.3	4	L	38471	24902	10222	8944	40557	27890	8620	5399	0.27	0.36	0.21	0.19
97-08-05 13-48-49	76	S	63.3	4	L	36109	28949	4167	-596	36058	28438	4057	751	0.12	-0.02	0.11	0.03
97-08-05 13-48-49	76	S	63.3	4	LT	14427	19761	4875	7357	16491	16809	3389	2022	0.34	0.37	0.21	0.12
97-08-05 13-48-49	76	S	63.3	4	T	18280	15785	1113	853	18194	14944	806	-50	0.06	0.05	0.04	0

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ve	Body Low Rail Ve	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 13-48-49	76	S	63.4	4	T	16317	14988	1960	3778	18454	13618	1523	-35	0.12	0.25	0.08	0
97-08-05 13-48-49	76	S	63.4	4	T	17204	14364	3405	5136	17695	13608	863	259	0.2	0.36	0.05	0.02
97-08-05 13-48-49	76	S	63.4	4	T	17375	15466	2977	5227	18218	13500	706	481	0.17	0.34	0.04	0.04
97-08-05 13-48-49	76	S	63.5	4	T	17513	14642	3159	5422	19246	12483	1988	1736	0.18	0.37	0.1	0.14
97-08-05 13-48-49	76	S	63.5	4	T	15796	13531	3150	4646	17495	12685	1331	854	0.2	0.34	0.08	0.07
97-08-05 13-48-49	76	S	63.5	4.1	T	18565	13786	2552	3924	19189	11546	1078	308	0.14	0.28	0.06	0.03
97-08-05 13-48-49	76	S	63.6	4.1	T	16365	14206	3049	4591	18215	12261	1275	897	0.19	0.32	0.07	0.07
97-08-05 13-48-49	76	S	63.6	4.1	T	16737	14326	3829	5078	18727	13105	1739	1307	0.23	0.35	0.09	0.1
97-08-05 13-48-49	76	S	63.7	4.1	T	16899	13905	3185	4725	19501	12027	1125	1166	0.19	0.34	0.06	0.1
97-08-05 13-48-49	76	S	63.7	4.1	T	17707	13827	3311	4564	19269	12387	1188	777	0.19	0.33	0.06	0.06
97-08-05 13-48-49	76	S	63.7	4.1	T	19018	13908	3834	5384	20949	13837	1882	1463	0.2	0.39	0.09	0.11
97-08-05 13-48-49	76	S	63.8	4.1	LT	20570	16195	2452	6311	21549	13917	2185	1854	0.12	0.39	0.1	0.13
97-08-05 13-48-49	76	S	63.8	4.1	L	32066	27917	1662	2137	45091	26676	9257	3991	0.05	0.08	0.21	0.15
97-08-05 13-48-49	76	S	63.8	4.1	L	37570	27143	3861	-1323	40949	25697	4311	-220	0.1	-0.05	0.11	-0.01
97-08-05 13-48-49	76	S	63.8	4.1	L	39690	28072	4308	736	41060	28247	5463	2742	0.11	0.03	0.13	0.1
97-08-05 13-48-49	76	S	63.8	4.1	L	38624	27775	3199	-853	38050	26859	3924	-74	0.08	-0.03	0.1	0
97-08-05 13-49-44	74	S	46.4	3.4	L	37969	29605	-349	134	44698	26669	3341	1081	-0.01	0	0.07	0.04
97-08-05 13-49-44	74	S	46.4	3.4	L	42342	27639	688	2768	44968	25877	1318	1850	0.02	0.1	0.03	0.07
97-08-05 13-49-44	74	S	46.4	3.4	L	38510	25528	-295	-64	46827	24648	4076	1147	-0.01	0	0.09	0.05
97-08-05 13-49-44	74	S	46.4	3.3	L	40285	26209	416	2469	45079	24288	1349	1672	0.01	0.09	0.03	0.07
97-08-05 13-49-44	74	S	46.3	3.3	LT	18466	14693	52	483	23020	13259	3536	2166	0	0.03	0.15	0.16
97-08-05 13-49-44	74	S	46.3	3.3	T	22727	15374	4325	1965	20312	15450	1163	475	0.19	0.13	0.06	0.03
97-08-05 13-49-44	74	S	46.3	3.3	T	16070	14880	1875	1010	19953	14443	287	285	0.12	0.07	0.01	0.02
97-08-05 13-49-44	74	S	46.2	3.3	T	16237	15000	2898	1646	18872	14288	-388	338	0.18	0.11	-0.02	0.02
97-08-05 13-49-44	74	S	46.2	3.3	T	16700	14237	3699	2142	20301	14183	29	291	0.22	0.15	0	0.02
97-08-05 13-49-44	74	S	46.2	3.3	T	16371	15236	2415	1308	19542	14134	106	308	0.15	0.09	0.01	0.02
97-08-05 13-49-44	74	S	46.1	3.3	T	17631	13296	1670	942	20060	13240	-573	365	0.09	0.07	-0.03	0.03
97-08-05 13-49-44	74	S	46.1	3.3	T	15842	17692	2683	1452	20475	15315	-651	452	0.17	0.08	-0.03	0.03
97-08-05 13-49-44	74	S	46.1	3.3	T	15552	13764	3138	1846	19795	13291	-133	413	0.2	0.13	-0.01	0.03
97-08-05 13-49-44	74	S	46.1	3.2	T	18207	15792	2784	1314	20417	14273	172	272	0.15	0.08	0.01	0.02
97-08-05 13-49-44	74	S	46.1	3.2	T	17143	14543	2896	1825	21116	14131	-169	340	0.17	0.13	-0.01	0.02
97-08-05 13-49-44	74	S	46	3.2	T	16788	15442	3605	2252	21179	14194	-27	324	0.21	0.15	0	0.02
97-08-05 13-49-44	74	S	46	3.2	T	20038	15013	3312	1397	21519	15589	72	217	0.17	0.09	0	0.01
97-08-05 13-49-44	74	S	46	3.2	LT	19792	15907	2434	914	24001	15762	-213	464	0.12	0.06	-0.01	0.03
97-08-05 13-49-44	74	S	46	3.2	L	39314	36991	9505	6383	46690	28311	14240	6963	0.24	0.17	0.3	0.25
97-08-05 13-49-44	74	S	46	3.2	L	38481	30726	3250	1131	43141	29783	1337	1138	0.08	0.04	0.03	0.04
97-08-05 13-49-44	74	S	46	3.2	L	41540	44767	13178	9924	45534	26177	14059	7338	0.32	0.22	0.31	0.28
97-08-05 13-49-44	74	S	46	3.2	L	40993	33025	7877	5448	41840	27441	3167	1844	0.19	0.16	0.08	0.07
97-08-05 14-03-45	74	N	48.1	3.9	L	41467	26592	10180	5299	49122	27011	17395	9920	0.25	0.2	0.35	0.37
97-08-05 14-03-45	74	N	48.1	3.9	L	39377	31922	4641	3905	38074	28395	2737	3307	0.12	0.12	0.07	0.12
97-08-05 14-03-45	74	N	48	3.9	L	38091	34247	7626	6830	43958	25676	15773	9357	0.2	0.2	0.36	0.36
97-08-05 14-03-45	74	N	48	3.9	L	39197	34983	3903	-457	38419	28075	2843	2142	0.1	-0.01	0.07	0.08
97-08-05 14-03-45	74	N	48	3.9	LT	22497	16755	6926	4586	25353	15829	6079	5135	0.31	0.27	0.24	0.32
97-08-05 14-03-45	74	N	47.9	3.9	T	21638	18037	2669	2277	21987	17584	3850	3696	0.12	0.13	0.18	0.21
97-08-05 14-03-45	74	N	47.9	3.8	T	17974	17225	2149	-27	17845	15383	632	-134	0.12	0	0.04	-0.01
97-08-05 14-03-45	74	N	47.8	3.8	T	18424	16810	1707	-116	19199	14449	146	257	0.09	-0.01	0.01	0.02
97-08-05 14-03-45	74	N	47.8	3.8	T	17424	18706	1194	-202	18730	14283	2609	2237	0.07	-0.01	0.14	0.16
97-08-05 14-03-45	74	N	47.7	3.8	T	17030	16477	2061	19	18587	13556	1298	1037	0.12	0	0.07	0.08
97-08-05 14-03-45	74	N	47.7	3.8	T	17083	19839	2269	-87	18376	15735	2380	1572	0.13	0	0.13	0.1
97-08-05 14-03-45	74	N	47.6	3.7	T	17484	16689	1647	94	18766	13354	2786	2434	0.09	0.01	0.15	0.18
97-08-05 14-03-45	74	N	47.6	3.7	T	17436	17195	812	-332	19753	14693	2210	2499	0.05	-0.02	0.11	0.17
97-08-05 14-03-45	74	N	47.5	3.7	T	18077	16713	2050	4	21700	14649	1064	1286	0.11	0	0.05	0.09
97-08-05 14-03-45	74	N	47.5	3.7	T	17471	17631	1813	-121	20292	13834	1373	1346	0.1	-0.01	0.07	0.1
97-08-05 14-03-45	74	N	47.4	3.7	T	17389	18423	948	-309	19749	14126	2305	2455	0.05	-0.02	0.12	0.17
97-08-05 14-03-45	74	N	47.3	3.7	T	18348	18536	4143	1505	18885	17792	1629	43	0.23	0.08	0.09	0
97-08-05 14-03-45	74	N	47.3	3.6	LT	20495	15840	6021	2527	21602	14473	5939	2702	0.29	0.16	0.27	0.19
97-08-05 14-03-45	74	N	47.3	3.6	L	40720	27576	2501	1880	46465	26342	9331	5850	0.06	0.07	0.2	0.22
97-08-05 14-03-45	74	N	47.3	3.6	L	41190	24909	1362	473	43175	24058	1124	727	0.03	0.02	0.03	0.03
97-08-05 14-03-45	74	N	47.3	3.6	L	39102	32487	576	2804	47022	26381	4750	4167	0.01	0.09	0.1	0.16
97-08-05 14-03-45	74	N	47.3	3.6	L	36133	30802	1479	484	42632	27233	821	443	0.04	0.02	0.02	0.02
97-08-05 14-07-09	76	N	64.2	4.2	L	37451	26274	8326	3732	45780	24604	10571	2841	0.22	0.14	0.23	0.12
97-08-05 14-07-09	76	N	64.2	4.2	L	38307	28394	2317	-241	50899	33604	6271	999	0.06	-0.01	0.12	0.03
97-08-05 14-07-09	76	N	64.2	4.2	L	32369	28375	973	-428	45462	27661	7369	1796	0.03	-0.02	0.16	0.06
97-08-05 14-07-09	76	N	64.2	4.2	L	37988	31397	4226	-189	45777	27865	4851	681	0.11	-0.01	0.11	0.02
97-08-05 14-07-09	76	N	64.2	4.2	LT	22381	16477	6391	4228	24182	13954	3388	501	0.29	0.26	0.14	0.04
97-08-05 14-07-09	76	N	64.2	4.2	T	20218	15840	86	-350	23492	15790	2150	788	0	-0.02	0.09	0.05
97-08-05 14-07-09	76	N	64.1	4.2	T	18926	13303	2320	-886	22795	11880	2902	572	0.12	-0.07	0.13	0.05
97-08-05 14-07-09	76	N	64.1	4.2	T	18369	15188	2322	-853	22056	12971	2801	1010	0.13	-0.06	0.13	0.08
97-08-05 14-07-09	76	N	64.1	4.2	T	18479	14341	2164	-700	22003	12732	2838	601	0.12	-0.05	0.13	0.05

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 14-07-09	76	N	64.1	4.2	T	18476	13077	2078	-1030	20970	11139	2938	956	0.11	-0.08	0.14	0.09
97-08-05 14-07-09	76	N	64.1	4.2	T	17612	13017	2226	-828	20767	10479	3300	1038	0.13	-0.06	0.16	0.1
97-08-05 14-07-09	76	N	64	4.2	T	17961	14311	2765	-803	21136	12343	3329	1150	0.15	-0.06	0.16	0.09
97-08-05 14-07-09	76	N	64	4.2	T	19185	13800	3090	-659	22310	13368	1850	396	0.16	-0.05	0.08	0.03
97-08-05 14-07-09	76	N	64	4.2	T	18321	14706	2483	-948	22171	12700	3232	994	0.14	-0.06	0.15	0.08
97-08-05 14-07-09	76	N	64	4.2	T	19434	14881	2343	-925	21669	12971	2434	661	0.12	-0.06	0.11	0.05
97-08-05 14-07-09	76	N	64	4.2	T	17916	14289	2105	-1016	22931	12025	2854	1028	0.12	-0.07	0.12	0.09
97-08-05 14-07-09	76	N	63.9	4.2	T	18695	17624	2847	-527	22041	15895	1779	58	0.15	-0.03	0.08	0
97-08-05 14-07-09	76	N	63.9	4.2	LT	16731	17825	1930	-870	20532	15560	1346	197	0.12	-0.05	0.07	0.01
97-08-05 14-07-09	76	N	63.9	4.2	L	37233	28100	3322	288	44227	25780	9539	2380	0.09	0.01	0.22	0.09
97-08-05 14-07-09	76	N	63.9	4.2	L	33690	30633	3568	2079	41859	28373	6986	3183	0.11	0.07	0.17	0.11
97-08-05 14-07-09	76	N	63.9	4.2	L	34966	32386	3668	3168	45118	26013	9938	3909	0.1	0.1	0.22	0.15
97-08-05 14-07-09	76	N	63.9	4.2	L	32142	32125	4304	3204	41882	27993	4291	2225	0.13	0.1	0.1	0.08
97-08-05 14-18-40	76	S	64.8	4.4	L	38857	24834	9461	9633	47407	22380	9837	4998	0.24	0.39	0.21	0.22
97-08-05 14-18-40	76	S	64.8	4.4	L	41355	28450	5550	2525	43140	25739	8168	4028	0.13	0.09	0.19	0.16
97-08-05 14-18-40	76	S	64.8	4.4	L	41056	22420	11655	8619	44680	23963	12146	5297	0.28	0.38	0.27	0.22
97-08-05 14-18-40	76	S	64.8	4.4	L	38661	26949	5661	-1344	39777	26492	6193	168	0.15	-0.05	0.16	0.01
97-08-05 14-18-40	76	S	64.8	4.4	LT	15297	19668	5234	7522	16391	16307	1495	277	0.34	0.38	0.09	0.02
97-08-05 14-18-40	76	S	64.9	4.5	T	18367	14686	1055	983	19367	16628	1119	-6	0.06	0.07	0.06	0
97-08-05 14-18-40	76	S	65	4.5	T	16520	15293	2036	4100	18991	13909	1514	-4	0.12	0.27	0.08	0
97-08-05 14-18-40	76	S	65.1	4.5	T	17213	14437	3547	5244	18025	13359	1009	169	0.21	0.36	0.06	0.01
97-08-05 14-18-40	76	S	65.1	4.5	T	17343	14094	2900	4738	18549	12988	600	480	0.17	0.34	0.03	0.04
97-08-05 14-18-40	76	S	65.2	4.5	T	17373	13413	3108	5575	19267	12138	2201	1538	0.18	0.42	0.11	0.13
97-08-05 14-18-40	76	S	65.3	4.6	T	16415	14129	3130	4727	16823	11863	1162	742	0.19	0.33	0.07	0.06
97-08-05 14-18-40	76	S	65.4	4.6	T	18509	13269	2800	4312	17029	11029	1536	561	0.15	0.32	0.09	0.05
97-08-05 14-18-40	76	S	65.4	4.6	T	16785	14193	2775	5065	18404	12256	1699	986	0.17	0.36	0.09	0.08
97-08-05 14-18-40	76	S	65.5	4.6	T	17741	13497	3792	5299	19603	12346	1812	1256	0.21	0.39	0.09	0.1
97-08-05 14-18-40	76	S	65.6	4.7	T	18001	14510	2343	5179	19731	12325	1386	885	0.13	0.36	0.07	0.07
97-08-05 14-18-40	76	S	65.6	4.7	T	17453	13672	3241	4503	19708	11891	1239	610	0.19	0.33	0.06	0.05
97-08-05 14-18-40	76	S	65.7	4.7	T	20505	14565	4030	5995	21814	13022	2191	1474	0.2	0.41	0.1	0.11
97-08-05 14-18-40	76	S	65.8	4.7	LT	19365	15276	2622	6702	22134	14279	2769	2393	0.14	0.44	0.13	0.17
97-08-05 14-18-40	76	S	65.8	4.7	L	31241	26118	1588	2715	43111	22861	8471	3903	0.05	0.1	0.2	0.17
97-08-05 14-18-40	76	S	65.8	4.7	L	42289	30945	4380	-1188	47281	28743	5061	-189	0.1	-0.04	0.11	-0.01
97-08-05 14-18-40	76	S	65.8	4.7	L	38450	26170	4820	2476	46732	30076	6110	2366	0.13	0.09	0.13	0.08
97-08-05 14-18-40	76	S	65.8	4.7	L	43524	31403	3361	-867	40381	25023	3935	-251	0.08	-0.03	0.1	-0.01
97-08-05 14-19-18	74	S	50.8	4.8	L	37967	27616	-104	34	49712	21851	4409	1214	0	0	0.09	0.06
97-08-05 14-19-18	74	S	50.8	4.8	L	42146	25716	981	3268	48784	21740	2326	2070	0.02	0.13	0.05	0.1
97-08-05 14-19-18	74	S	50.8	4.8	L	40031	25367	614	803	48247	21512	4815	1342	0.02	0.03	0.1	0.06
97-08-05 14-19-18	74	S	50.8	4.8	L	41796	24200	168	3053	46480	20437	2373	1997	0	0.13	0.05	0.1
97-08-05 14-19-18	74	S	50.8	4.8	LT	17911	13585	-16	649	23975	11825	3637	1670	0	0.05	0.15	0.14
97-08-05 14-19-18	74	S	50.9	4.8	T	20650	14297	4463	1344	23336	14878	1197	552	0.22	0.09	0.05	0.04
97-08-05 14-19-18	74	S	50.9	4.8	T	17013	14655	2131	1096	21672	12963	440	411	0.13	0.07	0.02	0.03
97-08-05 14-19-18	74	S	50.9	4.9	T	18378	14041	2873	1614	20505	13209	-252	417	0.16	0.11	-0.01	0.03
97-08-05 14-19-18	74	S	51	4.9	T	17896	13647	4068	2155	25077	13298	575	524	0.23	0.16	0.02	0.04
97-08-05 14-19-18	74	S	51	4.9	T	17207	13985	2573	1278	20458	13449	241	464	0.15	0.09	0.01	0.03
97-08-05 14-19-18	74	S	51.1	4.9	T	17242	12578	1935	849	21167	12078	-312	481	0.11	0.07	-0.01	0.04
97-08-05 14-19-18	74	S	51.1	4.9	T	16628	14287	2891	1770	20184	14126	2	676	0.17	0.12	0	0.05
97-08-05 14-19-18	74	S	51.2	4.9	T	17459	13370	3487	1785	20679	12515	424	516	0.2	0.13	0.02	0.04
97-08-05 14-19-18	74	S	51.2	5	T	17414	13829	2945	1212	20303	13225	281	407	0.17	0.09	0.01	0.03
97-08-05 14-19-18	74	S	51.3	5	T	18531	12977	2711	1822	23011	12598	223	512	0.15	0.14	0.01	0.04
97-08-05 14-19-18	74	S	51.4	5	T	18988	13370	3476	2246	21932	12238	571	507	0.18	0.17	0.03	0.04
97-08-05 14-19-18	74	S	51.5	5	T	21481	14124	4342	1846	22643	14327	479	354	0.2	0.13	0.02	0.02
97-08-05 14-19-18	74	S	51.5	5.1	LT	20237	15521	3956	1916	26621	13911	272	773	0.2	0.12	0.01	0.06
97-08-05 14-19-18	74	S	51.6	5.1	L	40154	31395	10058	5601	50224	22539	14884	5797	0.25	0.18	0.3	0.26
97-08-05 14-19-18	74	S	51.6	5.1	L	40452	27975	2938	1292	45305	24870	1732	1127	0.07	0.05	0.04	0.05
97-08-05 14-19-18	74	S	51.7	5.1	L	37557	24546	12955	7628	48590	23651	14012	6084	0.34	0.31	0.29	0.26
97-08-05 14-19-18	74	S	51.7	5.1	L	41967	29721	7818	4733	47185	26491	4161	1513	0.19	0.16	0.09	0.06
97-08-05 14-30-43	74	N	52.1	5.3	L	43599	27910	10959	5599	52140	28739	17678	9487	0.25	0.2	0.34	0.33
97-08-05 14-30-43	74	N	52.1	5.3	L	41040	30811	5003	3744	44404	26254	3170	2724	0.12	0.12	0.07	0.1
97-08-05 14-30-43	74	N	52.1	5.3	L	37760	32793	7681	6782	49003	25399	16061	9001	0.2	0.21	0.33	0.35
97-08-05 14-30-43	74	N	52.1	5.3	L	39050	32547	4813	27	49230	28719	4587	2160	0.12	0	0.09	0.08
97-08-05 14-30-43	74	N	52.1	5.3	LT	24203	16250	6805	4523	24759	13511	6452	4514	0.28	0.28	0.26	0.33
97-08-05 14-30-43	74	N	52	5.3	T	19944	17616	3158	2244	21951	15752	4254	3314	0.16	0.13	0.19	0.21
97-08-05 14-30-43	74	N	52	5.2	T	18154	16292	1891	-125	19195	14486	946	-228	0.1	-0.01	0.05	-0.02
97-08-05 14-30-43	74	N	52	5.2	T	18916	15540	1415	-129	22685	12284	2123	1479	0.07	-0.01	0.09	0.12
97-08-05 14-30-43	74	N	51.9	5.2	T	17255	17357	1375	-230	21082	13561	3108	2219	0.08	-0.01	0.15	0.16
97-08-05 14-30-43	74	N	51.9	5.2	T	17256	16264	1976	-126	19245	12966	1767	1214	0.11	-0.01	0.09	0.09
97-08-05 14-30-43	74	N	51.8	5.2	T	17064	17785	1893	-252	19860	15030	2671	1700	0.11	-0.01	0.13	0.11
97-08-05 14-30-43	74	N	51.8	5.2	T	18356	15641	1613	83	20887	12160	2961	2404	0.09	0.01	0.14	0.2

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 14-30-43	74	N	51.7	5.1	T	18661	16717	1065	-295	21105	13483	2854	2310	0.06	-0.02	0.14	0.17
97-08-05 14-30-43	74	N	51.7	5.1	T	18904	16798	2048	-202	23379	13293	1739	1425	0.11	-0.01	0.07	0.11
97-08-05 14-30-43	74	N	51.7	5.1	T	18140	16334	1711	-181	20640	13516	1791	1349	0.09	-0.01	0.09	0.1
97-08-05 14-30-43	74	N	51.6	5.1	T	17663	16953	1175	-278	21063	13521	3036	2611	0.07	-0.02	0.14	0.19
97-08-05 14-30-43	74	N	51.6	5.1	T	19746	10050	4237	1923	18289	16044	1712	-358	0.21	0.1	0.09	-0.02
97-08-05 14-30-43	74	N	51.6	5.1	LT	21242	15394	6600	2655	22185	12854	5857	2072	0.31	0.17	0.26	0.16
97-08-05 14-30-43	74	N	51.6	5.1	L	41702	27961	3283	3004	48573	23488	8526	4227	0.08	0.11	0.18	0.18
97-08-05 14-30-43	74	N	51.6	5.1	L	41237	24314	2411	507	47422	23452	1928	487	0.06	0.02	0.04	0.02
97-08-05 14-30-43	74	N	51.6	5.1	L	40928	31454	802	2488	49360	23738	3748	3351	0.02	0.08	0.08	0.14
97-08-05 14-30-43	74	N	51.6	5.1	L	37693	30554	2793	166	47537	22344	2526	-106	0.07	0.01	0.05	0
97-08-05 14-33-53	76	N	68.5	5.5	L	39824	24838	7301	2242	51506	21929	12910	1762	0.18	0.09	0.25	0.08
97-08-05 14-33-53	76	N	68.5	5.5	L	39005	25125	3553	-368	49664	24719	6478	583	0.09	-0.01	0.13	0.02
97-08-05 14-33-53	76	N	68.5	5.5	L	34520	27923	1060	-480	49892	20548	11188	1468	0.03	-0.02	0.22	0.07
97-08-05 14-33-53	76	N	68.5	5.6	L	38610	28565	4570	-210	50278	23961	6685	527	0.12	-0.01	0.13	0.02
97-08-05 14-33-53	76	N	68.5	5.5	LT	23200	13947	6387	4110	25821	17126	4003	338	0.28	0.29	0.16	0.02
97-08-05 14-33-53	76	N	68.5	5.6	T	19790	15086	626	-585	23975	15093	2247	556	0.03	-0.04	0.09	0.04
97-08-05 14-33-53	76	N	68.5	5.6	T	19793	12680	2761	-974	23782	10794	2991	602	0.14	-0.08	0.13	0.06
97-08-05 14-33-53	76	N	68.5	5.6	T	19023	14723	2650	-957	23134	11481	3328	783	0.14	-0.06	0.14	0.07
97-08-05 14-33-53	76	N	68.6	5.6	T	18672	13501	2407	-951	22939	11353	3305	736	0.13	-0.07	0.14	0.06
97-08-05 14-33-53	76	N	68.6	5.6	T	18819	12199	2528	-1072	22276	10666	3210	770	0.13	-0.09	0.14	0.07
97-08-05 14-33-53	76	N	68.6	5.6	T	19916	12993	2531	-896	25719	11161	4122	858	0.13	-0.07	0.16	0.08
97-08-05 14-33-53	76	N	68.7	5.6	T	18004	13688	3183	-885	22134	12108	3887	1190	0.18	-0.06	0.18	0.1
97-08-05 14-33-53	76	N	68.7	5.6	T	18960	13338	3335	-792	22768	11647	2686	573	0.18	-0.06	0.12	0.05
97-08-05 14-33-53	76	N	68.7	5.6	T	18568	13941	2647	-853	22022	11692	3280	955	0.14	-0.06	0.15	0.08
97-08-05 14-33-53	76	N	68.7	5.6	T	19585	14381	2723	-1112	23652	10583	3330	727	0.14	-0.08	0.14	0.07
97-08-05 14-33-53	76	N	68.7	5.6	T	19177	13137	2483	-1021	23862	10612	3624	854	0.13	-0.08	0.15	0.08
97-08-05 14-33-53	76	N	68.8	5.6	T	19022	15722	2763	-803	23169	13380	3310	270	0.15	-0.05	0.14	0.02
97-08-05 14-33-53	76	N	68.8	5.6	LT	17253	15257	1842	-941	20590	14025	2330	320	0.11	-0.06	0.11	0.02
97-08-05 14-33-53	76	N	68.8	5.6	L	39045	27636	4983	1534	47209	23087	10311	1902	0.13	0.06	0.22	0.08
97-08-05 14-33-53	76	N	68.8	5.6	L	33895	28065	5224	1980	42708	25115	7389	2551	0.15	0.07	0.17	0.1
97-08-05 14-33-53	76	N	68.8	5.7	L	37423	32796	3168	2843	48199	23053	11761	3551	0.08	0.09	0.24	0.15
97-08-05 14-33-53	76	N	68.8	5.7	L	35247	29617	3519	1953	44527	24586	5603	2185	0.1	0.07	0.13	0.09
97-08-05 14-44-13	76	S	67.4	5.2	L	34177	27282	5698	9632	45008	23342	8879	5216	0.17	0.35	0.2	0.22
97-08-05 14-44-13	76	S	67.4	5.2	L	37113	32188	6158	10688	42025	26134	6729	5549	0.17	0.33	0.16	0.21
97-08-05 14-44-13	76	S	67.4	5.2	L	37006	26442	9346	8255	39949	25746	7790	4599	0.25	0.31	0.2	0.18
97-08-05 14-44-13	76	S	67.4	5.2	L	33914	28358	3712	316	36158	27182	4173	1308	0.11	0.01	0.12	0.05
97-08-05 14-44-13	76	S	67.4	5.2	LT	15275	19542	5674	8370	17004	15491	1959	211	0.37	0.43	0.12	0.01
97-08-05 14-44-13	76	S	67.3	5.2	T	18951	15415	1127	-158	19567	15208	1319	-30	0.06	-0.01	0.07	0
97-08-05 14-44-13	76	S	67.3	5.2	T	17018	14845	2304	3978	19292	12822	1770	-18	0.14	0.27	0.09	0
97-08-05 14-44-13	76	S	67.3	5.2	T	18758	14090	3901	5220	19082	11954	841	58	0.21	0.37	0.04	0
97-08-05 14-44-13	76	S	67.3	5.2	T	18028	14497	3281	4915	19735	12783	1815	1153	0.18	0.34	0.09	0.09
97-08-05 14-44-13	76	S	67.3	5.2	T	17485	14097	3174	5415	20328	11904	2606	1719	0.18	0.38	0.13	0.14
97-08-05 14-44-13	76	S	67.3	5.2	T	17283	13362	3065	4762	18929	11262	1834	855	0.18	0.36	0.1	0.08
97-08-05 14-44-13	76	S	67.3	5.2	T	18814	12689	2840	4345	19905	10666	1781	670	0.15	0.34	0.09	0.06
97-08-05 14-44-13	76	S	67.2	5.2	T	17341	12961	2990	4760	19072	11333	2185	1188	0.17	0.37	0.11	0.1
97-08-05 14-44-13	76	S	67.2	5.2	T	18279	13872	3616	4847	21167	11315	2284	1344	0.2	0.35	0.11	0.12
97-08-05 14-44-13	76	S	67.2	5.1	T	17999	13246	3059	4496	18444	11171	1433	1135	0.17	0.34	0.08	0.1
97-08-05 14-44-13	76	S	67.2	5.1	T	19733	12953	3291	4485	19827	11117	1526	943	0.17	0.35	0.08	0.08
97-08-05 14-44-13	76	S	67.1	5.1	T	19229	14268	3743	5766	21640	12951	2316	1688	0.19	0.4	0.11	0.13
97-08-05 14-44-13	76	S	67.1	5.1	LT	19422	15504	3266	6742	22756	14369	2663	2708	0.17	0.43	0.12	0.19
97-08-05 14-44-13	76	S	67.1	5.1	L	38061	34317	1577	2161	50400	26488	10105	3648	0.04	0.06	0.2	0.14
97-08-05 14-44-13	76	S	67.1	5.1	L	41976	30524	4282	-1242	44983	24128	5207	-347	0.1	-0.04	0.12	-0.01
97-08-05 14-44-13	76	S	67.1	5.1	L	39604	26504	4927	3030	42282	23595	5593	2007	0.12	0.11	0.13	0.09
97-08-05 14-44-13	76	S	67.1	5.1	L	37923	25689	3258	-939	40172	22350	5010	-348	0.09	-0.04	0.12	-0.02
97-08-05 14-45-05	74	S	51.1	4.9	L	37245	27269	-135	-17	50180	22333	3773	611	0	0	0.08	0.03
97-08-05 14-45-05	74	S	51.1	4.9	L	42825	27065	571	3200	50111	22131	2678	1876	0.01	0.12	0.05	0.08
97-08-05 14-45-05	74	S	51.1	4.9	L	39183	25567	491	863	49070	21299	5062	1150	0.01	0.03	0.1	0.05
97-08-05 14-45-05	74	S	51.1	4.9	L	41705	23718	544	2924	46679	21218	2639	1748	0.01	0.12	0.06	0.08
97-08-05 14-45-05	74	S	51.1	4.9	LT	17970	13966	2	565	23313	11865	3713	1599	0	0.04	0.16	0.13
97-08-05 14-45-05	74	S	51.1	4.9	T	21796	14141	4014	1626	23031	14334	1379	450	0.18	0.11	0.06	0.03
97-08-05 14-45-05	74	S	51.2	4.9	T	17683	13916	1660	866	21282	13206	438	319	0.09	0.06	0.02	0.02
97-08-05 14-45-05	74	S	51.2	4.9	T	17286	14138	2743	1528	22142	13306	-177	470	0.16	0.11	-0.01	0.04
97-08-05 14-45-05	74	S	51.2	5	T	17007	13757	3877	2212	21631	12675	489	396	0.23	0.16	0.02	0.03
97-08-05 14-45-05	74	S	51.2	5	T	17459	14463	2918	1224	20366	13155	248	419	0.17	0.08	0.01	0.03
97-08-05 14-45-05	74	S	51.3	5	T	17728	13077	2293	859	20895	12101	-109	421	0.13	0.07	-0.01	0.03
97-08-05 14-45-05	74	S	51.3	5	T	16656	14120	3363	1535	19906	14111	184	469	0.2	0.11	0.01	0.03
97-08-05 14-45-05	74	S	51.4	5	T	16246	13615	3386	1801	19373	12315	542	481	0.21	0.13	0.03	0.04
97-08-05 14-45-05	74	S	51.4	5	T	18562	14062	3238	1208	20902	12589	384	356	0.17	0.09	0.02	0.03
97-08-05 14-45-05	74	S	51.5	5	T	19576	13447	3108	1587	23248	12317	109	530	0.16	0.12	0	0.04

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 14-45-05	74	S	51.5	5.1	T	18082	13931	3366	1957	22511	11895	624	480	0.19	0.14	0.03	0.04
97-08-05 14-45-05	74	S	51.6	5.1	T	22035	13450	4130	1787	23819	14388	282	329	0.19	0.13	0.01	0.02
97-08-05 14-45-05	74	S	51.6	5.1	LT	20632	14639	4382	2070	25224	13485	269	670	0.21	0.14	0.01	0.05
97-08-05 14-45-05	74	S	51.6	5.1	L	38634	29350	8794	3984	49805	21036	14493	5796	0.23	0.14	0.29	0.28
97-08-05 14-45-05	74	S	51.6	5.1	L	41345	29127	2422	1091	41039	22750	1643	901	0.06	0.04	0.04	0.04
97-08-05 14-45-05	74	S	51.7	5.1	L	42543	28523	13235	8268	50372	23216	14371	5732	0.31	0.29	0.29	0.25
97-08-05 14-45-05	74	S	51.7	5.1	L	42573	29655	7722	4709	45008	25249	3498	1253	0.18	0.16	0.08	0.05
97-08-05 15-09-05	74	N	52.7	5.5	L	37906	27218	10321	5849	49717	23667	17994	9156	0.27	0.21	0.36	0.39
97-08-05 15-09-05	74	N	52.7	5.5	L	39327	34611	4691	4282	45208	27235	2746	2871	0.12	0.12	0.06	0.11
97-08-05 15-09-05	74	N	52.7	5.5	L	35389	33763	7066	7467	47461	25947	15531	10144	0.2	0.22	0.33	0.39
97-08-05 15-09-05	74	N	52.7	5.5	L	39351	35496	4430	630	44977	28423	3299	2870	0.11	0.02	0.07	0.1
97-08-05 15-09-05	74	N	52.8	5.5	LT	25021	15530	7559	4932	25056	13067	6636	4563	0.3	0.32	0.26	0.35
97-08-05 15-09-05	74	N	52.8	5.5	T	21046	17673	3260	2837	20838	15152	4443	3539	0.15	0.16	0.21	0.23
97-08-05 15-09-05	74	N	52.8	5.5	T	17981	15967	1899	206	20221	15244	868	-153	0.11	0.01	0.04	-0.01
97-08-05 15-09-05	74	N	52.9	5.5	T	19020	16514	1639	-96	20833	12060	2249	1460	0.09	-0.01	0.11	0.12
97-08-05 15-09-05	74	N	52.9	5.6	T	17604	17772	1440	-163	20284	13814	3230	2188	0.08	-0.01	0.16	0.16
97-08-05 15-09-05	74	N	53	5.6	T	17463	16210	2052	126	22414	13208	1632	1476	0.12	0.01	0.07	0.11
97-08-05 15-09-05	74	N	53	5.6	T	17204	19461	2078	30	20537	14497	2855	1536	0.12	0	0.14	0.11
97-08-05 15-09-05	74	N	53.1	5.6	T	18580	15948	1635	114	21247	11667	3050	2522	0.09	0.01	0.14	0.22
97-08-05 15-09-05	74	N	53.1	5.6	T	18353	17309	1160	-251	20332	13376	2855	2467	0.06	-0.01	0.14	0.18
97-08-05 15-09-05	74	N	53.1	5.6	T	18025	16011	1898	-28	23420	12775	2123	1510	0.11	0	0.09	0.12
97-08-05 15-09-05	74	N	53.2	5.7	T	17639	16783	1925	131	21437	13440	2182	1472	0.11	0.01	0.1	0.11
97-08-05 15-09-05	74	N	53.2	5.7	T	18169	17450	1282	-213	20704	12527	3362	2511	0.07	-0.01	0.16	0.2
97-08-05 15-09-05	74	N	53.3	5.7	T	18882	19224	4049	1890	22199	16261	1471	-321	0.21	0.1	0.07	-0.02
97-08-05 15-09-05	74	N	53.3	5.7	LT	21712	15658	6157	2587	22711	12197	5528	1317	0.28	0.17	0.24	0.11
97-08-05 15-09-05	74	N	53.3	5.7	L	40855	27399	2371	2423	50211	21057	9979	4829	0.06	0.09	0.2	0.23
97-08-05 15-09-05	74	N	53.3	5.7	L	39801	25018	1550	826	49434	21223	2381	821	0.04	0.03	0.05	0.04
97-08-05 15-09-05	74	N	53.3	5.7	L	41765	31025	5754	6273	51708	21070	4125	2507	0.14	0.2	0.08	0.12
97-08-05 15-09-05	74	N	53.3	5.7	L	38354	29374	2705	555	48213	22413	2437	152	0.07	0.02	0.05	0.01
97-08-05 15-12-18	76	N	67.4	5.2	L	38797	23839	7274	2066	48854	22543	11405	1545	0.19	0.09	0.23	0.07
97-08-05 15-12-18	76	N	67.4	5.2	L	39799	26937	3144	-836	46755	22636	5426	542	0.08	-0.03	0.12	0.02
97-08-05 15-12-18	76	N	67.4	5.2	L	32820	28427	1230	-574	43363	19089	8903	1099	0.04	-0.02	0.21	0.06
97-08-05 15-12-18	76	N	67.4	5.2	L	38765	30082	4211	-502	48612	24646	6415	581	0.11	-0.02	0.13	0.02
97-08-05 15-12-18	76	N	67.4	5.2	LT	21457	14921	5797	3861	26279	13031	3607	486	0.27	0.26	0.14	0.04
97-08-05 15-12-18	76	N	67.4	5.2	T	19968	15156	417	-370	23812	14363	2477	504	0.02	-0.02	0.1	0.04
97-08-05 15-12-18	76	N	67.5	5.2	T	20058	12667	2651	-859	23117	11088	2975	622	0.13	-0.07	0.13	0.06
97-08-05 15-12-18	76	N	67.5	5.2	T	18304	13930	2369	-862	22631	12151	3331	896	0.13	-0.06	0.15	0.07
97-08-05 15-12-18	76	N	67.5	5.2	T	18442	14040	2373	-978	21889	10540	3144	674	0.13	-0.07	0.14	0.06
97-08-05 15-12-18	76	N	67.5	5.2	T	18161	12000	2531	-1032	21680	10555	2906	873	0.14	-0.09	0.13	0.08
97-08-05 15-12-18	76	N	67.5	5.2	T	20253	12781	2341	-811	22013	10569	3411	868	0.12	-0.06	0.15	0.08
97-08-05 15-12-18	76	N	67.5	5.2	T	17924	14168	2946	-812	21440	12570	3778	1041	0.16	-0.06	0.18	0.08
97-08-05 15-12-18	76	N	67.5	5.3	T	19135	13047	2713	-940	22431	10773	2820	642	0.14	-0.07	0.13	0.06
97-08-05 15-12-18	76	N	67.5	5.3	T	19086	13984	2238	-915	23005	12194	3503	797	0.12	-0.07	0.15	0.07
97-08-05 15-12-18	76	N	67.5	5.3	T	18258	13189	2339	-1023	22165	12232	3399	660	0.13	-0.08	0.15	0.05
97-08-05 15-12-18	76	N	67.6	5.3	T	18445	14337	2185	-854	22822	10956	3456	925	0.12	-0.06	0.15	0.08
97-08-05 15-12-18	76	N	67.6	5.3	T	18683	15605	2327	-707	22883	15536	3179	86	0.12	-0.05	0.14	0.01
97-08-05 15-12-18	76	N	67.6	5.3	LT	17838	15785	1710	-821	20710	13891	2229	333	0.1	-0.05	0.11	0.02
97-08-05 15-12-18	76	N	67.6	5.3	L	38922	27419	2885	589	46896	23263	9486	1791	0.07	0.02	0.2	0.08
97-08-05 15-12-18	76	N	67.6	5.3	L	35341	27191	5399	2211	43377	25180	7244	2502	0.15	0.08	0.17	0.1
97-08-05 15-12-18	76	N	67.6	5.3	L	37242	32522	3430	2965	46920	23976	10080	3700	0.09	0.09	0.21	0.15
97-08-05 15-12-18	76	N	67.6	5.3	L	34401	28584	3404	2980	44463	26862	5255	2248	0.1	0.1	0.12	0.08
97-08-05 15-24-26	76	N	44.2	-0.7	L	33990	33653	2231	1688	29882	31550	2594	1203	0.07	0.05	0.09	0.04
97-08-05 15-24-26	76	N	44.2	-0.7	L	35004	39345	515	16	27431	32965	310	142	0.01	0	0.01	0
97-08-05 15-24-26	76	N	44.2	-0.7	L	32959	36053	2926	2039	37157	35066	4446	3078	0.09	0.06	0.12	0.09
97-08-05 15-24-26	76	N	44.2	-0.7	L	29804	38243	9	-272	30901	34446	322	470	0	-0.01	0.01	0.01
97-08-05 15-24-26	76	N	44.2	-0.7	LT	34676	32923	4797	2802	34795	43445	6665	5456	0.14	0.09	0.19	0.13
97-08-05 15-24-26	76	N	44.2	-0.7	T	30811	30699	641	652	36450	34405	740	262	0.02	0.02	0.02	0.01
97-08-05 15-24-26	76	N	44.2	-0.7	T	32959	34565	6483	6125	33163	30505	7499	5478	0.2	0.18	0.23	0.18
97-08-05 15-24-26	76	N	44.2	-0.7	T	32583	38566	1183	-555	34807	38556	709	-14	0.04	-0.01	0.02	0
97-08-05 15-24-26	76	N	44.2	-0.7	T	33967	30778	5832	7233	35929	36498	7150	6708	0.17	0.24	0.2	0.18
97-08-05 15-24-26	76	N	44.2	-0.7	T	35726	31593	-414	2418	35187	38245	1136	879	-0.01	0.08	0.03	0.02
97-08-05 15-24-26	76	N	44.3	-0.7	T	37340	28759	897	1968	39645	30283	5703	4656	0.02	0.07	0.14	0.15
97-08-05 15-24-26	76	N	44.3	-0.7	T	31545	39640	791	-280	32281	36664	965	318	0.03	-0.01	0.03	0.01
97-08-05 15-24-26	76	N	44.3	-0.7	T	8808	7694	1356	1317	8557	8442	1318	1254	0.15	0.17	0.15	0.15
97-08-05 15-24-26	76	N	44.3	-0.7	T	8814	7404	1144	115	9122	9322	709	16	0.13	0.02	0.08	0
97-08-05 15-24-26	76	N	44.3	-0.7	T	9149	7922	187	1288	9126	7973	357	1280	0.02	0.16	0.04	0.16
97-08-05 15-24-26	76	N	44.3	-0.7	T	9268	7881	1675	158	10442	8866	991	412	0.18	0.02	0.09	0.05
97-08-05 15-24-26	76	N	44.3	-0.7	T	10543	7153	960	1467	9204	8526	684	1278	0.09	0.21	0.07	0.15
97-08-05 15-24-26	76	N	44.3	-0.7	LT	11071	7440	1131	737	9819	7394	761	530	0.1	0.1	0.08	0.07

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 15-24-26	76	N	44.3	-0.7	L	8242	10840	821	1283	13548	11101	950	1553	0.1	0.12	0.07	0.14
97-08-05 15-24-26	76	N	44.3	-0.7	L	6979	7751	1241	118	11265	7681	900	633	0.18	0.02	0.08	0.08
97-08-05 15-24-26	76	N	44.3	-0.7	L	10023	6642	1651	1751	10455	7275	1213	1491	0.16	0.26	0.12	0.2
97-08-05 15-24-26	76	N	44.3	-0.7	L	9100	6806	1130	960	9317	8296	534	739	0.12	0.14	0.06	0.09
97-08-05 15-24-26	76	N	44.4	-0.6	Aver	7359	10062	1402	1805	9993	7307	1955	1687	0.19	0.18	0.2	0.23
97-08-05 15-24-26	76	N	44.4	-0.6	Max	8010	10555	615	1253	9172	8691	476	1088	0.08	0.12	0.05	0.13
97-08-05 15-24-26	76	N	44.4	-0.6	Std.	9615	9031	1939	1200	11176	8136	2087	1429	0.2	0.13	0.19	0.18
97-08-05 15-24-26	76	N	44.4	-0.6	3 x S	9757	7299	1484	502	10453	8046	930	642	0.15	0.07	0.09	0.08
97-08-05 15-24-26	76	N	44.4	-0.6	C. of	8449	8819	2077	1710	7872	7747	1502	1778	0.25	0.19	0.19	0.23
97-08-05 15-24-26	76	N	44.4	-0.6		8935	9739	1030	655	10045	9453	734	759	0.12	0.07	0.07	0.08
97-08-05 15-24-26	76	N	44.4	-0.6		10012	8456	932	1519	9951	8234	1361	1567	0.09	0.18	0.14	0.19
97-08-05 15-24-26	76	N	44.4	-0.6		9543	9273	854	964	10378	10952	659	581	0.09	0.1	0.06	0.05
97-08-05 15-34-27	76	S	71	6.4	L	40563	23127	12096	11728	50420	16787	13312	5115	0.3	0.51	0.26	0.3
97-08-05 15-34-27	76	S	71.1	6.4	L	40958	26452	6345	3582	45952	22180	8403	3443	0.15	0.14	0.18	0.16
97-08-05 15-34-27	76	S	71.1	6.4	L	41381	19386	14965	9178	46998	19089	14610	5848	0.36	0.47	0.31	0.31
97-08-05 15-34-27	78	S	71.1	6.4	L	39104	24148	6115	110	42189	22371	7187	-507	0.16	0	0.17	-0.02
97-08-05 15-34-27	76	S	71.1	6.4	LT	14996	19533	6882	9582	18105	14199	2283	-526	0.46	0.49	0.13	-0.04
97-08-05 15-34-27	76	S	71.2	6.4	T	18562	16150	988	-471	20191	14627	1691	-66	0.05	-0.03	0.08	0
97-08-05 15-34-27	76	S	71.2	6.4	T	17272	14423	2540	4364	19423	11767	1900	-273	0.15	0.3	0.1	-0.02
97-08-05 15-34-27	76	S	71.3	6.4	T	19466	13278	4204	6376	19618	11492	1526	564	0.22	0.48	0.08	0.05
97-08-05 15-34-27	76	S	71.3	6.4	T	17957	14232	3495	6034	20562	11185	2039	1053	0.19	0.42	0.1	0.09
97-08-05 15-34-27	76	S	71.4	6.5	T	17884	13512	3284	6613	20629	10170	2578	1851	0.18	0.49	0.12	0.18
97-08-05 15-34-27	76	S	71.4	6.5	T	17104	12940	3388	5180	19390	11099	1989	920	0.2	0.4	0.1	0.08
97-08-05 15-34-27	76	S	71.5	6.5	T	18107	11686	2759	4205	19321	9660	1981	652	0.15	0.36	0.1	0.07
97-08-05 15-34-27	76	S	71.5	6.5	T	16689	12362	3155	4704	19409	10475	2154	1199	0.19	0.38	0.11	0.11
97-08-05 15-34-27	76	S	71.6	6.5	T	17958	13153	3596	5131	20594	10765	2498	1447	0.2	0.39	0.12	0.13
97-08-05 15-34-27	76	S	71.6	6.5	T	18313	13079	2443	5024	21675	10809	1999	744	0.13	0.38	0.09	0.07
97-08-05 15-34-27	76	S	71.7	6.6	T	18586	12812	3260	4487	21345	10293	1921	1125	0.18	0.35	0.09	0.11
97-08-05 15-34-27	76	S	71.7	6.6	T	19690	14091	3925	6264	24109	12395	3235	2079	0.2	0.44	0.13	0.17
97-08-05 15-34-27	76	S	71.7	6.6	LT	20847	13289	4411	7620	24885	16240	4685	3453	0.21	0.57	0.19	0.21
97-08-05 15-34-27	76	S	71.7	6.6	L	35957	25160	2256	2738	50803	19198	11940	3190	0.06	0.11	0.24	0.17
97-08-05 15-34-27	76	S	71.7	6.6	L	44772	30037	4757	-1108	49870	22285	6654	-304	0.11	-0.04	0.13	-0.01
97-08-05 15-34-27	76	S	71.7	6.6	L	37778	23237	6978	3777	45344	18642	7142	1270	0.18	0.16	0.16	0.07
97-08-05 15-34-27	76	S	71.7	6.6	L	37889	24134	3744	-895	48448	20727	7510	-358	0.1	-0.04	0.16	-0.02
97-08-05 15-35-08	74	S	53.5	5.8	L	38986	25170	-2	-54	52689	19735	7334	2222	0	0	0.14	0.11
97-08-05 15-35-08	74	S	53.5	5.8	L	45855	23472	2238	2954	49869	20630	3360	2513	0.05	0.13	0.07	0.12
97-08-05 15-35-08	74	S	53.5	5.8	L	41001	22672	325	-214	50431	18510	9889	4268	0.01	-0.01	0.2	0.23
97-08-05 15-35-08	74	S	53.5	5.8	L	43339	22034	3038	2696	49691	18246	4474	1820	0.07	0.12	0.09	0.1
97-08-05 15-35-08	74	S	53.5	5.8	LT	18139	13453	894	696	24164	11309	3714	1161	0.05	0.05	0.15	0.1
97-08-05 15-35-08	74	S	53.4	5.8	T	24006	14183	2640	878	27613	14023	1958	539	0.11	0.06	0.07	0.04
97-08-05 15-35-08	74	S	53.4	5.7	T	18523	14067	2219	1003	21721	12249	873	535	0.12	0.07	0.04	0.04
97-08-05 15-35-08	74	S	53.3	5.7	T	18276	13553	3273	1617	21871	12016	448	509	0.18	0.12	0.02	0.04
97-08-05 15-35-08	74	S	53.3	5.7	T	18169	13859	4339	2340	21740	12213	1304	543	0.24	0.17	0.06	0.04
97-08-05 15-35-08	74	S	53.3	5.7	T	17499	13709	2868	1203	21536	12390	632	488	0.16	0.09	0.03	0.04
97-08-05 15-35-08	74	S	53.2	5.7	T	17856	12042	2456	1104	21379	10977	98	539	0.14	0.09	0	0.05
97-08-05 15-35-08	74	S	53.2	5.7	T	17177	15608	3305	1456	20826	12616	676	684	0.19	0.09	0.03	0.05
97-08-05 15-35-08	74	S	53.1	5.6	T	17033	12951	3647	1664	19964	11321	1122	555	0.21	0.13	0.06	0.05
97-08-05 15-35-08	74	S	53.1	5.6	T	18260	13619	3265	1271	20923	11891	758	445	0.18	0.09	0.04	0.04
97-08-05 15-35-08	74	S	53	5.6	T	17801	13580	3539	1509	22108	11580	755	619	0.2	0.11	0.03	0.05
97-08-05 15-35-08	74	S	53	5.6	T	18117	13346	3683	2021	22352	11525	1231	561	0.2	0.15	0.06	0.05
97-08-05 15-35-08	74	S	53	5.6	T	21639	13704	5028	2183	26113	13602	848	469	0.23	0.16	0.03	0.03
97-08-05 15-35-08	74	S	53	5.6	LT	20508	14935	5677	3298	26259	13221	2668	996	0.28	0.22	0.1	0.08
97-08-05 15-35-08	74	S	53	5.6	L	42681	31302	11740	7069	51228	20034	16036	6683	0.28	0.23	0.31	0.33
97-08-05 15-35-08	74	S	53	5.6	L	41648	26305	3690	1212	46913	25260	2386	1299	0.09	0.05	0.05	0.05
97-08-05 15-35-08	74	S	53.1	5.6	L	39924	25732	13535	8853	52106	20911	15603	7217	0.34	0.34	0.3	0.35
97-08-05 15-35-08	74	S	53	5.6	L	40575	27915	8508	5567	46164	24861	4453	1446	0.21	0.2	0.1	0.06
97-08-05 15-57-38	74	N	52.1	5.3	L	42097	27429	12269	6359	51513	26121	18860	9867	0.29	0.23	0.37	0.38
97-08-05 15-57-38	74	N	52.1	5.3	L	44269	36529	5408	4919	43958	27148	3760	3279	0.12	0.13	0.09	0.12
97-08-05 15-57-38	74	N	52.1	5.3	L	38076	31878	8352	7200	49582	24963	17022	9406	0.22	0.23	0.34	0.38
97-08-05 15-57-38	74	N	52.1	5.3	L	39674	33255	5062	739	43250	26069	4350	2503	0.13	0.02	0.1	0.1
97-08-05 15-57-38	74	N	52	5.3	LT	23855	16023	7540	4943	24430	13470	6988	4739	0.32	0.31	0.29	0.35
97-08-05 15-57-38	74	N	52	5.2	T	22765	17786	3671	2822	23104	15597	4293	3455	0.16	0.16	0.19	0.22
97-08-05 15-57-38	74	N	51.9	5.2	T	18004	16845	1770	-131	19362	14519	914	-253	0.1	-0.01	0.05	-0.02
97-08-05 15-57-38	74	N	51.9	5.2	T	18718	15633	1473	-158	20364	12152	2175	1224	0.08	-0.01	0.11	0.1
97-08-05 15-57-38	74	N	51.8	5.2	T	17661	17411	1390	-248	20761	13702	3358	2124	0.08	-0.01	0.16	0.15
97-08-05 15-57-38	74	N	51.7	5.1	T	17583	15665	1885	88	19966	12948	2046	1342	0.11	0.01	0.1	0.1
97-08-05 15-57-38	74	N	51.7	5.1	T	16881	16839	1997	-187	19306	13669	2495	1753	0.12	-0.01	0.13	0.13
97-08-05 15-57-38	74	N	51.6	5.1	T	18116	15794	1685	-186	20946	12202	3009	2481	0.09	-0.01	0.14	0.2
97-08-05 15-57-38	74	N	51.5	5.1	T	17672	16866	1093	-309	20635	13359	2982	2201	0.06	-0.02	0.14	0.16

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-05 15-57-38	74	N	51.5	5	T	18594	15771	1824	-235	21036	12739	2370	1378	0.1	-0.01	0.11	0.11
97-08-05 15-57-38	74	N	51.4	5	T	17867	17252	1702	-87	20932	13462	1632	1122	0.1	-0.01	0.08	0.08
97-08-05 15-57-38	74	N	51.3	5	T	17718	17457	1040	-297	22544	13562	2932	2839	0.06	-0.02	0.13	0.21
97-08-05 15-57-38	74	N	51.2	5	T	19811	18455	3832	1610	18798	17557	1651	-344	0.19	0.09	0.09	-0.02
97-08-05 15-57-38	74	N	51.2	5	LT	20957	15473	6506	2872	22359	12656	6043	2302	0.31	0.19	0.27	0.18
97-08-05 15-57-38	74	N	51.2	5	L	42743	25114	5037	2386	48689	22457	10118	5612	0.12	0.1	0.21	0.25
97-08-05 15-57-38	74	N	51.2	4.9	L	42633	24446	2224	442	46844	24167	1667	730	0.05	0.02	0.04	0.03
97-08-05 15-57-38	74	N	51.2	4.9	L	40475	31134	3002	3469	50550	23106	5751	3888	0.07	0.11	0.11	0.17
97-08-05 15-57-38	74	N	51.1	4.9	L	41258	27058	3406	333	48118	24883	2293	486	0.08	0.01	0.05	0.02
97-08-05 16-00-51	76	N	69.9	6	L	40221	26125	4357	840	47944	21199	10138	1394	0.11	0.03	0.21	0.07
97-08-05 16-00-51	76	N	69.9	6	L	37844	27067	3118	-311	48293	25358	5825	874	0.08	-0.01	0.12	0.03
97-08-05 16-00-51	76	N	69.9	6	L	34640	27735	1248	-139	45399	21979	8657	1257	0.04	-0.01	0.19	0.06
97-08-05 16-00-51	76	N	69.9	6	L	37073	28045	4353	-265	47710	20231	6132	478	0.12	-0.01	0.13	0.02
97-08-05 16-00-51	76	N	69.9	6	LT	21711	14253	6638	3635	26557	17282	4189	418	0.31	0.26	0.16	0.02
97-08-05 16-00-51	76	N	69.9	6	T	19991	15310	870	-254	24942	14339	2384	526	0.04	-0.02	0.1	0.04
97-08-05 16-00-51	76	N	69.8	6	T	19914	12589	2959	-1046	24793	11095	2887	606	0.15	-0.08	0.12	0.05
97-08-05 16-00-51	76	N	69.8	6	T	18880	14457	2777	-966	22872	10813	3610	951	0.15	-0.07	0.16	0.09
97-08-05 16-00-51	76	N	69.8	6	T	19070	13410	2466	-979	23409	11778	3143	458	0.13	-0.07	0.13	0.04
97-08-05 16-00-51	76	N	69.8	6	T	18358	12317	2520	-1073	21775	10411	3217	809	0.14	-0.09	0.15	0.08
97-08-05 16-00-51	76	N	69.8	5.9	T	19595	12337	2788	-910	25858	10222	3868	806	0.14	-0.07	0.15	0.08
97-08-05 16-00-51	76	N	69.8	5.9	T	17951	13500	2937	-879	22414	11542	3827	1088	0.16	-0.07	0.17	0.09
97-08-05 16-00-51	76	N	69.7	5.9	T	19220	12473	2978	-811	23577	11015	2617	700	0.15	-0.06	0.11	0.06
97-08-05 16-00-51	76	N	69.7	5.9	T	18020	13735	2181	-1030	23003	10884	3424	821	0.12	-0.07	0.15	0.08
97-08-05 16-00-51	76	N	69.7	5.9	T	18691	13866	2594	-920	24472	11644	2948	648	0.14	-0.07	0.12	0.06
97-08-05 16-00-51	76	N	69.7	5.9	T	18538	12860	2352	-1064	24279	10578	3438	878	0.13	-0.08	0.14	0.08
97-08-05 16-00-51	76	N	69.7	5.9	T	19195	16010	2717	-898	24333	13601	3311	252	0.14	-0.06	0.14	0.02
97-08-05 16-00-51	76	N	69.7	5.9	LT	17543	15987	2287	-789	21224	13809	2748	354	0.13	-0.05	0.13	0.03
97-08-05 16-00-51	76	N	69.6	5.9	L	38024	26620	3659	398	46414	22914	11041	2375	0.1	0.01	0.24	0.1
97-08-05 16-00-51	76	N	69.6	5.9	L	34401	27952	6286	2652	42554	25309	7399	3048	0.18	0.09	0.17	0.12
97-08-05 16-00-51	76	N	69.6	5.9	L	35242	29759	2873	3425	48105	22511	11934	4044	0.08	0.12	0.25	0.18
97-08-05 16-00-51	76	N	69.6	5.9	L	34372	29725	4103	3168	43736	22778	5180	2690	0.12	0.11	0.12	0.12
97-08-05 16-15-07	76	S	71	6.3	L	38666	26003	7929	9852	48799	18030	12076	4516	0.21	0.38	0.25	0.25
97-08-05 16-15-07	76	S	71	6.3	L	36828	29139	7683	9971	45094	24154	8696	4752	0.21	0.34	0.19	0.2
97-08-05 16-15-07	76	S	71	6.3	L	39888	24256	11477	9068	46335	21948	12035	4938	0.29	0.37	0.26	0.22
97-08-05 16-15-07	76	S	71	6.3	L	36380	27090	4276	592	40850	23630	5909	-560	0.12	0.02	0.14	-0.02
97-08-05 16-15-07	76	S	71	6.3	LT	14881	18669	5695	8668	17991	14888	1865	-261	0.38	0.46	0.1	-0.02
97-08-05 16-15-07	76	S	71	6.3	T	18653	15194	1080	-483	19720	13101	1300	-18	0.06	-0.03	0.07	0
97-08-05 16-15-07	76	S	71	6.3	T	17588	14055	2696	3971	19384	11688	2146	-105	0.15	0.28	0.11	-0.01
97-08-05 16-15-07	76	S	71	6.3	T	18350	12614	3269	5347	19279	11179	1573	543	0.18	0.42	0.08	0.05
97-08-05 16-15-07	76	S	71	6.3	T	18221	13880	3292	4763	19171	11360	2204	1161	0.18	0.34	0.11	0.1
97-08-05 16-15-07	76	S	71	6.3	T	17780	14684	2623	6006	21048	10886	2900	2011	0.15	0.41	0.14	0.18
97-08-05 16-15-07	76	S	70.9	6.3	T	17212	13443	2943	5111	19897	10338	2112	1125	0.17	0.38	0.11	0.11
97-08-05 16-15-07	76	S	70.9	6.3	T	19255	12646	2945	4390	17723	9907	2061	591	0.15	0.35	0.12	0.06
97-08-05 16-15-07	76	S	70.9	6.3	T	16759	13000	2912	4980	19343	10095	2094	1344	0.17	0.38	0.11	0.13
97-08-05 16-15-07	76	S	70.8	6.3	T	17519	12938	3319	5087	20378	10254	2261	1378	0.19	0.39	0.11	0.13
97-08-05 16-15-07	76	S	70.8	6.3	T	18526	14054	2614	4545	20505	9872	1755	1011	0.14	0.32	0.09	0.1
97-08-05 16-15-07	76	S	70.7	6.3	T	19001	12459	3058	4448	20468	9927	2130	1237	0.16	0.36	0.1	0.12
97-08-05 16-15-07	76	S	70.7	6.2	T	20873	13831	4036	6108	23025	11985	3288	2057	0.19	0.44	0.14	0.17
97-08-05 16-15-07	76	S	70.7	6.2	LT	21140	17892	4457	8570	24250	12364	3383	2889	0.21	0.48	0.14	0.23
97-08-05 16-15-07	76	S	70.6	6.2	L	36030	26595	1882	1996	48426	20133	10575	3237	0.05	0.08	0.22	0.16
97-08-05 16-15-07	76	S	70.6	6.2	L	39356	25945	4392	-1150	44821	20001	5940	-300	0.11	-0.04	0.13	-0.01
97-08-05 16-15-07	76	S	70.6	6.2	L	42829	27940	6155	3692	46710	20902	7014	1590	0.14	0.13	0.15	0.08
97-08-05 16-15-07	76	S	70.6	6.2	L	37647	24060	3552	-985	44949	19053	7421	-265	0.09	-0.04	0.17	-0.01
97-08-05 16-15-39	74	S	53.5	5.8	L	38707	25668	90	-287	48014	18847	5712	2433	0	-0.01	0.12	0.13
97-08-05 16-15-39	74	S	53.5	5.8	L	43969	24932	2126	3583	50236	20509	2604	2217	0.05	0.14	0.05	0.11
97-08-05 16-15-39	74	S	53.5	5.8	L	40595	23709	2595	1141	48746	19110	8152	4468	0.06	0.05	0.17	0.23
97-08-05 16-15-39	74	S	53.5	5.8	L	43311	21806	872	3322	49894	18737	3749	2095	0.02	0.15	0.08	0.11
97-08-05 16-15-39	74	S	53.5	5.8	LT	18531	13111	193	763	24658	11184	3868	1327	0.01	0.06	0.16	0.12
97-08-05 16-15-39	74	S	53.6	5.8	T	20384	13814	4061	909	23237	14196	1518	474	0.2	0.07	0.07	0.03
97-08-05 16-15-39	74	S	53.6	5.8	T	16854	14365	2268	1049	21122	11958	666	379	0.13	0.07	0.03	0.03
97-08-05 16-15-39	74	S	53.7	5.9	T	17869	13495	3222	1526	22839	12481	135	461	0.18	0.11	0.01	0.04
97-08-05 16-15-39	74	S	53.7	5.9	T	17687	13364	3942	2083	22425	12174	1325	556	0.22	0.16	0.06	0.05
97-08-05 16-15-39	74	S	53.8	5.9	T	17242	13713	3014	1109	23451	12602	605	381	0.17	0.08	0.03	0.03
97-08-05 16-15-39	74	S	53.8	5.9	T	17359	12775	2444	969	20149	10063	37	513	0.14	0.08	0	0.05
97-08-05 16-15-39	74	S	53.8	5.9	T	16105	13345	3201	1511	20671	13733	829	786	0.2	0.11	0.04	0.06
97-08-05 16-15-39	74	S	53.8	5.9	T	16155	13019	3308	1389	20222	11376	474	525	0.2	0.11	0.02	0.05
97-08-05 16-15-39	74	S	53.8	5.9	T	18332	13808	3236	910	20952	12071	890	352	0.18	0.07	0.04	0.03
97-08-05 16-15-39	74	S	53.8	5.9	T	18237	13754	3291	1321	21537	11168	724	521	0.18	0.1	0.03	0.05
97-08-05 16-15-39	74	S	53.8	5.9	T	18718	12678	3741	1858	23759	11403	1250	582	0.2	0.15	0.05	0.05

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-15-39	74	S	53.8	5.9	T	21149	13410	5486	2021	25503	13544	985	383	0.26	0.15	0.04	0.03
97-08-05 16-15-39	74	S	53.8	5.9	LT	21513	14768	5749	3466	27088	12325	2227	904	0.27	0.23	0.08	0.07
97-08-05 16-15-39	74	S	53.8	5.9	L	40771	28911	9596	5035	50958	18862	15395	4996	0.24	0.17	0.3	0.26
97-08-05 16-15-39	74	S	53.8	5.9	L	42481	27799	3632	1258	45520	23526	2436	1137	0.09	0.05	0.05	0.05
97-08-05 16-15-39	74	S	53.8	5.9	L	42138	25713	13150	7238	52023	20449	15117	5544	0.31	0.28	0.29	0.27
97-08-05 16-15-39	74	S	53.8	5.9	L	45979	32120	7650	5106	46097	23422	3439	1191	0.17	0.16	0.07	0.05
97-08-05 16-46-12	76	S	41.3	-1.2	L	28579	35040	7772	14295	33258	35404	7277	8634	0.27	0.41	0.22	0.24
97-08-05 16-46-12	76	S	41.3	-1.2	L	29832	37620	4154	7272	30761	35253	2669	4710	0.14	0.19	0.09	0.13
97-08-05 16-46-12	76	S	41.3	-1.2	L	33152	31900	7967	10283	29710	31271	7307	6386	0.24	0.32	0.25	0.2
97-08-05 16-46-12	76	S	41.3	-1.2	L	32379	35391	1595	1645	30526	38006	1802	700	0.05	0.05	0.06	0.02
97-08-05 16-46-12	76	S	41.3	-1.2	LT	27835	35592	4664	10017	33755	37075	6734	7928	0.17	0.28	0.2	0.21
97-08-05 16-46-12	76	S	41.3	-1.2	T	31494	36353	1189	3180	30446	36725	576	3367	0.04	0.09	0.02	0.09
97-08-05 16-46-12	76	S	41.3	-1.2	T	31520	32402	2803	7134	35484	38339	4931	7094	0.09	0.22	0.14	0.19
97-08-05 16-46-12	76	S	41.3	-1.2	T	33320	36770	1272	-119	28984	39003	853	1333	0.04	0	0.03	0.03
97-08-05 16-46-12	76	S	41.3	-1.2	T	28993	38950	6156	11923	31922	37292	6425	7637	0.21	0.31	0.2	0.2
97-08-05 16-46-12	76	S	41.3	-1.2	T	31165	35674	2161	1654	32873	37017	1559	1610	0.07	0.05	0.05	0.04
97-08-05 16-46-12	76	S	41.3	-1.2	T	33524	31297	7353	10878	34295	34560	7165	6608	0.22	0.35	0.21	0.19
97-08-05 16-46-12	76	S	41.3	-1.2	T	35238	34231	3076	5092	31370	37552	2373	2794	0.09	0.15	0.08	0.07
97-08-05 16-46-12	76	S	41.3	-1.2	T	25588	44800	1145	3703	26957	39428	3556	5492	0.04	0.08	0.13	0.14
97-08-05 16-46-12	76	S	41.3	-1.2	T	27985	41694	1076	-965	29364	41840	576	90	0.04	-0.02	0.02	0
97-08-05 16-46-12	76	S	41.3	-1.2	T	32186	38895	3098	9026	25954	42396	4021	7491	0.1	0.23	0.15	0.18
97-08-05 16-46-12	76	S	41.4	-1.2	T	29561	35484	591	-418	26610	44562	166	2585	0.02	-0.01	0.01	0.06
97-08-05 16-46-12	76	S	41.3	-1.2	T	26825	33564	-605	5750	23177	34677	200	4585	-0.02	0.17	0.01	0.13
97-08-05 16-46-12	76	S	41.3	-1.2	LT	27197	37647	1722	-964	21024	40269	1059	1863	0.06	-0.03	0.05	0.05
97-08-05 16-46-12	76	S	41.4	-1.2	L	28688	33117	130	6404	23924	34210	352	3896	0	0.19	0.01	0.11
97-08-05 16-46-12	76	S	41.4	-1.2	L	24995	33507	508	2271	25102	36710	682	1515	0.02	0.07	0.03	0.04
97-08-05 16-46-12	76	S	41.4	-1.2	L	17922	33006	-410	4840	17120	32264	60	3654	-0.02	0.15	0	0.11
97-08-05 16-46-12	76	S	41.4	-1.2	L	20009	29995	1747	-1059	19330	34106	402	1512	0.09	-0.04	0.02	0.04
97-08-05 16-46-12	76	S	41.4	-1.2	Aver	31262	21470	4830	4229	22691	27168	974	3105	0.15	0.2	0.04	0.11
97-08-05 16-46-12	76	S	41.4	-1.2	Max	23572	25357	33	4788	22425	30346	377	1608	0	0.19	0.02	0.05
97-08-05 16-46-12	76	S	41.4	-1.2	Std.	25915	37509	-403	5279	29622	30477	931	3974	-0.02	0.14	0.03	0.13
97-08-05 16-46-12	76	S	41.4	-1.2	3 x S	28362	34267	2459	537	28743	39106	277	3656	0.09	0.02	0.01	0.09
97-08-05 16-46-12	76	S	41.4	-1.2	C. of	33102	31729	2404	6580	30559	29423	1797	3110	0.07	0.21	0.06	0.11
97-08-06 10-02-22	74	N	44	2.6	L	38160	38940	6368	5860	45327	30650	11874	7576	0.17	0.15	0.26	0.25
97-08-06 10-02-22	74	N	44	2.6	L	38370	52347	1230	1601	40887	30958	1795	4211	0.03	0.03	0.04	0.14
97-08-06 10-02-22	74	N	43.9	2.6	L	35441	43268	6180	6685	40707	29118	10466	7502	0.17	0.15	0.26	0.26
97-08-06 10-02-22	74	N	43.9	2.6	L	36775	45131	806	517	40331	28458	-527	898	0.02	0.01	-0.01	0.03
97-08-06 10-02-22	74	N	43.9	2.6	LT	21942	24769	3784	2844	21981	16140	3103	3022	0.17	0.11	0.14	0.19
97-08-06 10-02-22	74	N	43.8	2.6	T	19812	24866	67	404	22105	18231	1418	2744	0	0.02	0.06	0.15
97-08-06 10-02-22	74	N	43.7	2.5	T	19752	38499	1694	-172	21571	15919	1224	1645	0.09	0	0.06	0.1
97-08-06 10-02-22	74	N	43.7	2.5	T	18834	23129	2114	466	21271	16700	2096	2486	0.11	0.02	0.1	0.15
97-08-06 10-02-22	74	N	43.7	2.5	T	19527	38107	886	-28	19831	15339	3417	2859	0.05	0	0.17	0.19
97-08-06 10-02-22	74	N	43.6	2.5	T	19628	27154	2974	727	21696	17023	82	281	0.15	0.03	0	0.02
97-08-06 10-02-22	74	N	43.6	2.5	T	17490	23462	3402	927	18072	17915	350	146	0.19	0.04	0.02	0.01
97-08-06 10-02-22	74	N	43.6	2.5	T	17893	14340	730	-47	20187	16200	2990	2293	0.04	0	0.15	0.14
97-08-06 10-02-22	74	N	43.6	2.5	T	18107	14085	3488	1494	19026	16317	851	710	0.19	0.11	0.04	0.04
97-08-06 10-02-22	74	N	43.6	2.5	T	18038	14654	1345	-169	20844	16406	565	780	0.07	-0.01	0.03	0.05
97-08-06 10-02-22	74	N	43.6	2.5	T	18932	15164	3612	1766	20364	17411	520	82	0.19	0.12	0.03	0
97-08-06 10-02-22	74	N	43.6	2.5	T	19632	14597	2555	427	21942	15861	2026	2246	0.13	0.03	0.09	0.14
97-08-06 10-02-22	74	N	43.5	2.5	T	19746	15773	2490	1172	20792	18305	146	992	0.13	0.07	0.01	0.05
97-08-06 10-02-22	74	N	43.5	2.5	T	19367	12537	5199	2555	21192	13963	2481	550	0.27	0.2	0.12	0.04
97-08-06 11-02-18	74	N	53	5.6	L	40195	26710	10778	5015	50134	22932	14249	5005	0.27	0.19	0.28	0.22
97-08-06 11-02-18	74	N	53	5.6	L	37947	33574	4625	4644	40018	24657	1203	2013	0.12	0.14	0.03	0.08
97-08-06 11-02-18	74	N	53	5.6	L	34669	31924	5981	5737	46868	23829	10843	5348	0.17	0.18	0.23	0.22
97-08-06 11-02-18	74	N	53	5.6	L	39155	35551	4529	827	50213	30393	2541	961	0.12	0.02	0.05	0.03
97-08-06 11-02-18	74	N	53	5.6	LT	22515	15570	4236	2873	25512	12457	4404	2533	0.19	0.18	0.17	0.2
97-08-06 11-02-18	74	N	53	5.6	T	22472	17620	2680	2137	21039	15432	3358	2808	0.12	0.12	0.16	0.18
97-08-06 11-02-18	74	N	53.1	5.6	T	17937	15893	1963	88	19543	14184	915	-151	0.11	0.01	0.05	-0.01
97-08-06 11-02-18	74	N	53.1	5.6	T	18846	15453	1389	-12	23277	12387	2283	1597	0.07	0	0.1	0.13
97-08-06 11-02-18	74	N	53.2	5.7	T	17349	16607	1314	-48	20677	13272	3023	1979	0.08	0	0.15	0.15
97-08-06 11-02-18	74	N	53.2	5.7	T	17419	15862	2089	83	20359	12571	1923	1348	0.12	0.01	0.09	0.11
97-08-06 11-02-18	74	N	53.2	5.7	T	19101	17568	2054	-9	21636	14992	2484	1444	0.11	0	0.11	0.1
97-08-06 11-02-18	74	N	53.2	5.7	T	18424	15122	1744	165	20905	11651	2477	1979	0.09	0.01	0.12	0.17
97-08-06 11-02-18	74	N	53.2	5.7	T	17866	16285	1016	-69	20840	12772	2678	2181	0.06	0	0.13	0.17
97-08-06 11-02-18	74	N	53.2	5.7	T	18893	16940	1756	-12	23118	12967	2247	1630	0.09	0	0.1	0.13
97-08-06 11-02-18	74	N	53.2	5.7	T	18436	16319	1740	-46	22230	12973	1715	1265	0.09	0	0.08	0.1
97-08-06 11-02-18	74	N	53.2	5.7	T	17971	16634	1401	-83	21620	12511	2763	2276	0.08	0	0.13	0.18
97-08-06 11-02-18	74	N	53.2	5.7	T	20564	19287	4182	1640	19211	16463	1012	-428	0.2	0.09	0.05	-0.03
97-08-06 11-02-18	74	N	53.2	5.7	LT	21600	15535	6518	2681	22288	12528	5419	1650	0.3	0.17	0.24	0.13

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 11-02-18	74	N	53.2	5.7	L	42621	25983	3200	2370	49903	22107	10458	5181	0.08	0.09	0.21	0.23
97-08-06 11-02-18	74	N	53.1	5.6	L	43693	23780	2576	210	47532	22072	2386	561	0.06	0.01	0.05	0.03
97-08-06 11-02-18	74	N	53.2	5.7	L	40142	28952	1227	2073	51629	20850	5907	3269	0.03	0.07	0.11	0.16
97-08-06 11-02-18	74	N	53.1	5.6	L	41862	27154	3349	39	49445	23311	2444	100	0.08	0	0.05	0
97-08-06 11-05-29	76	N	70.9	6.3	L	39884	26490	6163	1107	50745	22166	10796	1645	0.15	0.04	0.21	0.07
97-08-06 11-05-29	76	N	70.9	6.3	L	37247	26893	3847	-193	48161	23765	5725	551	0.1	-0.01	0.12	0.02
97-08-06 11-05-29	76	N	70.9	6.3	L	33130	26367	2247	314	44271	19083	7107	1227	0.07	0.01	0.16	0.06
97-08-06 11-05-29	76	N	70.9	6.3	L	36565	28806	4862	-119	51662	21110	8193	874	0.13	0	0.16	0.04
97-08-06 11-05-29	76	N	70.8	6.3	LT	23096	12966	6780	3880	26261	16918	3833	406	0.29	0.3	0.15	0.02
97-08-06 11-05-29	76	N	70.8	6.3	T	20353	14800	1843	-13	24470	15047	2434	595	0.09	0	0.1	0.04
97-08-06 11-05-29	76	N	70.8	6.3	T	20407	12613	3207	-946	24463	10749	2761	541	0.16	-0.08	0.11	0.05
97-08-06 11-05-29	76	N	70.8	6.3	T	18937	13119	2962	-985	23114	10479	2596	606	0.16	-0.08	0.11	0.06
97-08-06 11-05-29	76	N	70.8	6.3	T	19124	13834	3121	-845	22980	10646	2709	373	0.16	-0.06	0.12	0.04
97-08-06 11-05-29	76	N	70.8	6.3	T	18296	12425	2815	-967	22343	10686	2739	660	0.15	-0.08	0.12	0.06
97-08-06 11-05-29	76	N	70.8	6.3	T	21694	12746	3078	-901	27738	10077	3327	779	0.14	-0.07	0.12	0.08
97-08-06 11-05-29	76	N	70.8	6.3	T	17681	13609	3352	-917	20988	11445	3460	780	0.19	-0.07	0.16	0.07
97-08-06 11-05-29	76	N	70.8	6.3	T	18832	12186	3722	-817	22908	11333	2652	504	0.2	-0.07	0.12	0.04
97-08-06 11-05-29	76	N	70.8	6.3	T	18910	12846	2856	-698	23569	10415	2824	737	0.15	-0.05	0.12	0.07
97-08-06 11-05-29	76	N	70.8	6.3	T	18564	14149	3437	-907	23270	10879	2921	524	0.19	-0.06	0.13	0.05
97-08-06 11-05-29	76	N	70.8	6.3	T	19084	13817	2761	-877	24638	10947	3210	593	0.14	-0.06	0.13	0.05
97-08-06 11-05-29	76	N	70.8	6.3	T	18842	15355	2776	-1083	23883	13787	2903	262	0.15	-0.07	0.12	0.02
97-08-06 11-05-29	76	N	70.8	6.3	LT	17495	15760	2866	-874	21549	14210	1973	233	0.16	-0.06	0.09	0.02
97-08-06 11-05-29	76	N	70.8	6.3	L	38202	26948	3980	192	47163	22115	10601	2596	0.1	0.01	0.22	0.12
97-08-06 11-05-29	76	N	70.8	6.3	L	35965	27893	4924	1679	45247	25704	8096	3398	0.14	0.06	0.18	0.13
97-08-06 11-05-29	76	N	70.8	6.3	L	37648	31489	4452	2748	48731	23521	9993	2528	0.12	0.09	0.21	0.11
97-08-06 11-05-29	76	N	70.8	6.3	L	35283	32078	5305	4377	46501	24376	4937	1982	0.15	0.14	0.11	0.08
97-08-06 11-18-08	76	S	70.7	6.3	L	38475	26851	10487	9882	49384	18314	12353	3930	0.27	0.37	0.25	0.21
97-08-06 11-18-08	76	S	70.7	6.2	L	37966	29359	7151	8139	43064	21456	5582	2506	0.19	0.28	0.13	0.12
97-08-06 11-18-08	76	S	70.7	6.3	L	37913	22592	12460	8192	43487	19908	12657	4148	0.33	0.36	0.29	0.21
97-08-06 11-18-08	76	S	70.7	6.3	L	36001	26435	4468	293	38242	23961	5009	-24	0.12	0.01	0.13	0
97-08-06 11-18-08	76	S	70.8	6.3	LT	14041	18961	3574	5882	17765	14474	1536	-204	0.25	0.31	0.09	-0.01
97-08-06 11-18-08	76	S	70.8	6.3	T	17287	13277	1144	264	20446	14895	1187	-35	0.07	0.02	0.06	0
97-08-06 11-18-08	76	S	70.8	6.3	T	16967	13452	2592	3758	19174	11567	1963	-121	0.15	0.28	0.1	-0.01
97-08-06 11-18-08	76	S	70.8	6.3	T	17595	13128	3668	5366	19882	10922	2106	608	0.21	0.41	0.11	0.06
97-08-06 11-18-08	76	S	70.8	6.3	T	18882	13915	3754	5116	19649	10778	2556	1280	0.2	0.37	0.13	0.12
97-08-06 11-18-08	76	S	70.8	6.3	T	17829	12835	3606	5390	20271	9885	2806	1884	0.2	0.42	0.14	0.19
97-08-06 11-18-08	76	S	70.8	6.3	T	16796	13141	3454	4826	18451	11038	2096	971	0.21	0.37	0.11	0.09
97-08-06 11-18-08	76	S	70.8	6.3	T	18004	12077	3087	4296	20377	9906	2031	858	0.17	0.36	0.1	0.09
97-08-06 11-18-08	76	S	70.8	6.3	T	16698	13093	3751	5072	18121	10155	2504	1583	0.22	0.39	0.14	0.16
97-08-06 11-18-08	76	S	70.7	6.3	T	18371	12405	3745	5606	20255	10163	2675	1492	0.2	0.45	0.13	0.15
97-08-06 11-18-08	76	S	70.7	6.3	T	18115	13792	3917	5304	20341	10235	2435	1458	0.22	0.38	0.12	0.14
97-08-06 11-18-08	76	S	70.7	6.2	T	18013	12318	3548	4569	19868	10625	2406	1394	0.2	0.37	0.12	0.13
97-08-06 11-18-08	76	S	70.7	6.2	T	20590	13357	5361	6631	22702	12272	3179	2363	0.26	0.5	0.14	0.19
97-08-06 11-18-08	76	S	70.7	6.2	LT	21092	13044	5335	7705	23493	13546	4615	3199	0.25	0.59	0.2	0.24
97-08-06 11-18-08	76	S	70.7	6.2	L	40889	31095	2782	3385	47968	19060	11747	4080	0.07	0.11	0.24	0.21
97-08-06 11-18-08	76	S	70.7	6.2	L	38615	24413	4001	-515	46851	21504	5070	-280	0.1	-0.02	0.11	-0.01
97-08-06 11-18-08	76	S	70.7	6.2	L	39025	23886	8541	5394	45711	19231	7597	1993	0.22	0.23	0.17	0.1
97-08-06 11-18-08	76	S	70.7	6.2	L	36465	23178	3987	-166	46202	19139	6570	-133	0.11	-0.01	0.14	-0.01
97-08-06 11-18-51	74	S	53.3	5.7	L	40284	23968	22	190	49237	21319	6102	1833	0	0.01	0.12	0.09
97-08-06 11-18-51	74	S	53.3	5.7	L	44940	23382	1464	2834	49669	20263	3861	2538	0.03	0.12	0.08	0.13
97-08-06 11-18-51	74	S	53.2	5.7	L	39812	21851	531	-181	49830	18994	8594	3410	0.01	-0.01	0.17	0.18
97-08-06 11-18-51	74	S	53.2	5.7	L	43147	23042	1864	2509	48547	19940	3215	1979	0.04	0.11	0.07	0.1
97-08-06 11-18-51	74	S	53.2	5.7	LT	18474	13256	319	920	23937	11013	2726	788	0.02	0.07	0.11	0.07
97-08-06 11-18-51	74	S	53.2	5.7	T	21085	13805	2088	864	26137	13929	1993	707	0.1	0.06	0.08	0.05
97-08-06 11-18-51	74	S	53.2	5.7	T	16316	14323	1722	951	20984	12003	484	738	0.11	0.07	0.02	0.06
97-08-06 11-18-51	74	S	53.1	5.6	T	18023	13096	2112	952	20553	12482	258	722	0.12	0.07	0.01	0.06
97-08-06 11-18-51	74	S	53.1	5.6	T	17434	12186	2744	1048	21487	11614	1230	722	0.16	0.09	0.06	0.06
97-08-06 11-18-51	74	S	53	5.6	T	17520	13183	2395	1010	21507	12129	610	669	0.14	0.08	0.03	0.06
97-08-06 11-18-51	74	S	53	5.6	T	17869	11891	1743	843	21621	10769	-85	684	0.1	0.07	0	0.06
97-08-06 11-18-51	74	S	52.9	5.6	T	17119	14339	2164	844	20909	11725	227	781	0.13	0.06	0.01	0.07
97-08-06 11-18-51	74	S	52.9	5.6	T	17308	12980	2329	904	21378	11108	936	817	0.13	0.07	0.04	0.07
97-08-06 11-18-51	74	S	52.9	5.5	T	18245	13230	2414	620	21242	12127	360	632	0.13	0.05	0.02	0.05
97-08-06 11-18-51	74	S	52.8	5.5	T	17068	13035	2440	1103	20744	11141	619	856	0.14	0.08	0.03	0.08
97-08-06 11-18-51	74	S	52.8	5.5	T	18301	12656	2492	1168	22322	11139	1124	769	0.14	0.09	0.05	0.07
97-08-06 11-18-51	74	S	52.7	5.5	T	20494	13404	3688	1121	24109	12537	690	689	0.18	0.08	0.03	0.05
97-08-06 11-18-51	74	S	52.7	5.5	LT	20672	15668	3451	1850	25755	13254	1818	1005	0.17	0.12	0.07	0.08
97-08-06 11-18-51	74	S	52.7	5.5	L	43302	33029	9787	5439	51521	20427	11761	3402	0.23	0.16	0.23	0.17
97-08-06 11-18-51	74	S	52.7	5.5	L	41968	26046	3244	1297	45006	22086	1496	547	0.08	0.05	0.03	0.02
97-08-06 11-18-51	74	S	52.7	5.5	L	36777	23219	11575	4972	50127	21608	11451	4345	0.31	0.21	0.23	0.2

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 11-18-51	74	S	52.6	5.5	L	38942	28543	6665	4647	41944	20096	2951	912	0.17	0.16	0.07	0.05
97-08-06 11-33-31	74	N	56.2	6.8	L	42541	25634	11741	4870	50364	16946	14839	4747	0.28	0.19	0.29	0.28
97-08-06 11-33-31	74	N	56.2	6.8	L	39401	30130	4777	3649	44112	25791	3061	1808	0.12	0.12	0.07	0.07
97-08-06 11-33-31	74	N	56.2	6.8	L	35352	28002	7144	5692	50101	20736	13800	6214	0.2	0.2	0.28	0.3
97-08-06 11-33-31	74	N	56.2	6.8	L	40569	29098	5205	-222	47925	23954	4628	2258	0.13	-0.01	0.1	0.09
97-08-06 11-33-31	74	N	56.2	6.8	LT	23937	14666	6441	3242	26613	11518	5237	2907	0.27	0.22	0.2	0.25
97-08-06 11-33-31	74	N	56.2	6.8	T	20660	16678	3251	2288	23401	14300	3631	2739	0.16	0.14	0.16	0.19
97-08-06 11-33-31	74	N	56.2	6.8	T	19113	16416	2161	139	20327	13691	1296	-118	0.11	0.01	0.06	-0.01
97-08-06 11-33-31	74	N	56.2	6.8	T	19361	14636	1766	-21	23943	10990	2487	1537	0.09	0	0.1	0.14
97-08-06 11-33-31	74	N	56.2	6.8	T	18161	16814	1524	-26	21649	12423	3191	1740	0.08	0	0.15	0.14
97-08-06 11-33-31	74	N	56.2	6.8	T	19079	15611	2240	280	21911	10943	1814	1108	0.12	0.02	0.08	0.1
97-08-06 11-33-31	74	N	56.2	6.8	T	17453	16966	2100	98	22018	13686	2735	1177	0.12	0.01	0.12	0.09
97-08-06 11-33-31	74	N	56.2	6.8	T	18474	14858	1764	92	21876	10704	2633	1879	0.1	0.01	0.12	0.18
97-08-06 11-33-31	74	N	56.2	6.8	T	18354	16198	1453	-72	22196	12068	2446	1804	0.08	0	0.11	0.15
97-08-06 11-33-31	74	N	56.2	6.8	T	19453	14660	1821	-9	22553	10880	2603	1130	0.09	0	0.12	0.1
97-08-06 11-33-31	74	N	56.2	6.8	T	18514	16352	2069	-83	23560	12349	1967	1455	0.11	-0.01	0.08	0.12
97-08-06 11-33-31	74	N	56.2	6.8	T	18379	16491	1510	-42	23844	11872	2954	2215	0.08	0	0.12	0.19
97-08-06 11-33-31	74	N	56.2	6.8	T	19668	17777	4110	2033	20510	15617	1211	-337	0.21	0.11	0.06	-0.02
97-08-06 11-33-31	74	N	56.2	6.8	LT	21686	14227	6679	2704	23626	11369	5526	1345	0.31	0.19	0.23	0.12
97-08-06 11-33-31	74	N	56.2	6.8	L	43190	25170	2852	1295	52394	18811	9948	4618	0.07	0.05	0.19	0.25
97-08-06 11-33-31	74	N	56.2	6.8	L	42845	22821	3163	493	51180	19780	3007	737	0.07	0.02	0.06	0.04
97-08-06 11-33-31	74	N	56.2	6.8	L	42441	27986	3718	3594	52320	19597	5044	2872	0.09	0.13	0.1	0.15
97-08-06 11-33-31	74	N	56.2	6.8	L	42377	25945	3885	245	50287	20327	3757	308	0.09	0.01	0.07	0.02
97-08-06 11-36-37	76	N	74.1	7.4	L	39618	22550	7932	1453	49654	16722	10797	990	0.2	0.06	0.22	0.06
97-08-06 11-36-37	76	N	74.1	7.4	L	39301	24007	4965	-260	56377	24819	9331	666	0.13	-0.01	0.17	0.03
97-08-06 11-36-37	76	N	74.1	7.4	L	36610	28015	2775	-39	48896	18554	8597	509	0.08	0	0.18	0.03
97-08-06 11-36-37	76	N	74.1	7.4	L	37930	25999	5493	-100	51476	17100	8697	617	0.14	0	0.17	0.04
97-08-06 11-36-37	76	N	74.1	7.4	LT	22279	15125	7204	3372	27296	9464	3802	-18	0.32	0.22	0.14	0
97-08-06 11-36-37	76	N	74.1	7.4	T	21377	13653	1872	88	23955	12319	2591	351	0.09	0.01	0.11	0.03
97-08-06 11-36-37	76	N	74.1	7.4	T	20101	12470	3352	-678	23215	10062	2926	393	0.17	-0.05	0.13	0.04
97-08-06 11-36-37	76	N	74.1	7.4	T	18954	12366	2968	-767	23594	9043	2870	489	0.16	-0.06	0.12	0.05
97-08-06 11-36-37	76	N	74.1	7.4	T	19231	13059	3099	-635	24809	10666	3163	302	0.16	-0.05	0.13	0.03
97-08-06 11-36-37	76	N	74.2	7.4	T	18385	12229	2829	-726	22295	10072	3029	493	0.15	-0.06	0.14	0.05
97-08-06 11-36-37	76	N	74.2	7.4	T	20110	11866	3085	-552	24810	9448	3494	521	0.15	-0.05	0.14	0.06
97-08-06 11-36-37	76	N	74.2	7.4	T	18137	12789	3597	-615	22632	9704	3551	595	0.2	-0.05	0.16	0.06
97-08-06 11-36-37	76	N	74.2	7.4	T	19465	12789	3754	-719	24576	10022	3103	419	0.19	-0.06	0.13	0.04
97-08-06 11-36-37	76	N	74.3	7.4	T	19303	13973	3524	-446	23630	10339	3098	479	0.18	-0.03	0.13	0.05
97-08-06 11-36-37	76	N	74.3	7.4	T	19956	13324	3378	-673	24481	10147	2969	449	0.17	-0.05	0.12	0.04
97-08-06 11-36-37	76	N	74.3	7.4	T	19054	13379	3144	-553	25426	9124	3187	529	0.17	-0.04	0.13	0.06
97-08-06 11-36-37	76	N	74.4	7.5	T	19417	15400	3528	-34	24670	12636	3134	130	0.18	0	0.13	0.01
97-08-06 11-36-37	76	N	74.4	7.5	LT	17681	16207	3292	-514	22297	13458	3187	362	0.19	-0.03	0.14	0.03
97-08-06 11-36-37	76	N	74.4	7.5	L	39223	26199	4623	761	50124	19311	11456	2136	0.12	0.03	0.23	0.11
97-08-06 11-36-37	76	N	74.4	7.5	L	35603	27163	5945	1983	46359	23536	9052	2935	0.17	0.07	0.2	0.12
97-08-06 11-36-37	76	N	74.4	7.5	L	36869	27325	3867	2058	49389	19705	9042	2483	0.1	0.08	0.18	0.13
97-08-06 11-36-37	76	N	74.4	7.5	L	35802	26858	4585	2710	46301	23649	4682	2179	0.13	0.1	0.1	0.09
97-08-06 12-05-50	76	S	73.8	7.3	L	37881	25568	10524	10225	51692	15634	12704	3293	0.28	0.4	0.25	0.21
97-08-06 12-05-50	76	S	73.8	7.3	L	38343	30582	6321	9661	43822	21317	6025	2701	0.16	0.32	0.14	0.13
97-08-06 12-05-50	76	S	73.8	7.3	L	40125	22610	12949	9803	45297	19645	10277	3872	0.32	0.43	0.23	0.2
97-08-06 12-05-50	76	S	73.8	7.3	L	35807	25711	4528	1286	41007	20648	5649	-18	0.13	0.05	0.14	0
97-08-06 12-05-50	76	S	73.8	7.3	LT	15087	17522	3114	5385	18028	13441	1458	-201	0.21	0.31	0.08	-0.01
97-08-06 12-05-50	76	S	73.8	7.3	T	18762	15145	1243	-15	20512	14379	1845	-31	0.07	0	0.09	0
97-08-06 12-05-50	76	S	73.8	7.3	T	17669	13932	2883	3695	19641	11061	1840	59	0.16	0.27	0.09	0.01
97-08-06 12-05-50	76	S	73.8	7.3	T	18340	13022	3885	5667	21201	10629	2897	1091	0.21	0.44	0.14	0.1
97-08-06 12-05-50	76	S	73.8	7.3	T	17867	13061	3714	5218	20419	11018	3033	1621	0.21	0.4	0.15	0.15
97-08-06 12-05-50	76	S	73.8	7.3	T	18236	12411	3612	5703	20228	9629	2824	2025	0.2	0.46	0.14	0.21
97-08-06 12-05-50	76	S	73.7	7.2	T	16985	12458	3353	5207	18420	9675	2402	1294	0.2	0.42	0.13	0.13
97-08-06 12-05-50	76	S	73.7	7.2	T	17097	12072	3703	4136	22178	9675	2706	1175	0.22	0.34	0.12	0.12
97-08-06 12-05-50	76	S	73.7	7.2	T	16987	12227	3177	5429	19249	9886	2901	1529	0.19	0.44	0.15	0.15
97-08-06 12-05-50	76	S	73.6	7.2	T	18156	12736	3553	6158	21844	9522	2985	1550	0.2	0.48	0.14	0.16
97-08-06 12-05-50	76	S	73.6	7.2	T	17999	11945	3202	5206	20143	10348	2948	1404	0.18	0.44	0.15	0.14
97-08-06 12-05-50	76	S	73.6	7.2	T	18714	11802	3299	4507	19926	9394	3131	1336	0.18	0.38	0.16	0.14
97-08-06 12-05-50	76	S	73.5	7.2	T	20727	12561	4967	6517	23408	11330	3707	2381	0.24	0.52	0.16	0.21
97-08-06 12-05-50	76	S	73.5	7.2	LT	20770	13020	4620	7106	24723	10469	4725	3169	0.22	0.55	0.19	0.3
97-08-06 12-05-50	76	S	73.5	7.2	L	38358	26845	2957	3693	49995	15006	14319	2954	0.08	0.14	0.29	0.2
97-08-06 12-05-50	76	S	73.5	7.2	L	39091	24527	4824	-958	46184	18307	5801	-293	0.12	-0.04	0.13	-0.02
97-08-06 12-05-50	76	S	73.5	7.2	L	39762	23436	8156	5377	46955	18623	8463	1735	0.21	0.23	0.18	0.09
97-08-06 12-05-50	76	S	73.5	7.2	L	40788	24421	4489	-647	47774	19444	5853	-261	0.11	-0.03	0.12	-0.01
97-08-06 12-06-29	74	S	56	6.7	L	42078	21929	-80	-41	49752	20726	6929	1782	0	0	0.14	0.09
97-08-06 12-06-29	74	S	56	6.7	L	45130	20853	2159	3039	51138	19782	3883	2223	0.05	0.15	0.08	0.11

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 12-06-29	74	S	55.9	6.7	L	41085	22394	810	-348	51299	19094	7578	2406	0.02	-0.02	0.15	0.13
97-08-06 12-06-29	74	S	55.9	6.7	L	42905	20788	879	2657	50715	17266	4711	1989	0.02	0.13	0.09	0.12
97-08-06 12-06-29	74	S	55.9	6.7	LT	18110	13402	3208	601	25176	10677	2869	970	0.18	0.04	0.11	0.09
97-08-06 12-06-29	74	S	55.9	6.7	T	21312	13045	1700	823	23229	12524	1801	846	0.08	0.06	0.08	0.07
97-08-06 12-06-29	74	S	55.8	6.6	T	18249	12912	1980	1023	22749	11494	713	787	0.11	0.08	0.03	0.07
97-08-06 12-06-29	74	S	55.8	6.6	T	17804	13072	3081	1198	21329	11736	1010	767	0.17	0.09	0.05	0.07
97-08-06 12-06-29	74	S	55.7	6.6	T	17109	12866	3395	1368	24227	11677	1714	772	0.2	0.11	0.07	0.07
97-08-06 12-06-29	74	S	55.7	6.6	T	18189	12146	2834	1120	21511	11277	671	740	0.16	0.09	0.03	0.07
97-08-06 12-06-29	74	S	55.6	6.6	T	17563	11930	2092	922	22563	10115	425	765	0.12	0.08	0.02	0.08
97-08-06 12-06-29	74	S	55.6	6.6	T	17492	13603	2794	911	20863	11761	1398	839	0.16	0.07	0.07	0.07
97-08-06 12-06-29	74	S	55.5	6.5	T	16764	12300	2908	1160	21657	10559	1476	845	0.17	0.09	0.07	0.08
97-08-06 12-06-29	74	S	55.5	6.5	T	18179	12978	2845	628	23017	11248	834	641	0.16	0.05	0.04	0.06
97-08-06 12-06-29	74	S	55.4	6.5	T	18117	13512	2940	1221	21639	10610	1071	898	0.16	0.09	0.05	0.08
97-08-06 12-06-29	74	S	55.4	6.5	T	18732	13152	2784	1319	23408	10702	1329	903	0.15	0.1	0.06	0.08
97-08-06 12-06-29	74	S	55.4	6.5	T	21077	12853	4143	1396	25716	11848	1714	754	0.2	0.11	0.07	0.06
97-08-06 12-06-29	74	S	55.3	6.5	LT	20724	14873	4458	2133	27337	11700	2818	1177	0.22	0.14	0.1	0.1
97-08-06 12-06-29	74	S	55.3	6.5	L	40081	26131	9352	4809	53329	18449	12513	3284	0.23	0.18	0.23	0.18
97-08-06 12-06-29	74	S	55.3	6.5	L	42567	24273	3446	1208	52064	25998	2616	980	0.08	0.05	0.05	0.04
97-08-06 12-06-29	74	S	55.3	6.5	L	36429	22166	11585	5037	52221	19495	13879	4809	0.32	0.23	0.27	0.25
97-08-06 12-06-29	74	S	55.3	6.5	L	35765	21520	7050	3886	47442	22269	3665	1299	0.2	0.18	0.08	0.06
97-08-06 12-16-39	74	N	13.5	-3.4	L	36031	34179	9491	8293	32025	40491	10589	11995	0.26	0.24	0.33	0.3
97-08-06 12-16-39	74	N	13.4	-3.4	L	30399	37964	-633	2435	26507	44470	-44	7429	-0.02	0.06	0	0.17
97-08-06 12-16-39	74	N	13.3	-3.4	L	31955	38195	7585	8991	31052	40649	10367	12770	0.24	0.24	0.33	0.31
97-08-06 12-16-39	74	N	13.3	-3.4	L	27690	41253	6	1080	28809	44258	-369	4973	0	0.03	-0.01	0.11
97-08-06 12-16-39	74	N	13.2	-3.4	LT	17850	19737	4010	4680	16183	22766	3749	6673	0.22	0.24	0.23	0.29
97-08-06 12-16-39	74	N	13	-3.4	T	17129	19712	1217	2716	17990	22777	3241	5726	0.07	0.14	0.18	0.25
97-08-06 12-16-39	74	N	12.8	-3.4	T	13732	20646	1445	1380	13078	22420	110	933	0.11	0.07	0.01	0.04
97-08-06 12-16-39	74	N	12.2	-3.5	T	14191	19493	2344	2065	14785	19641	299	1683	0.17	0.11	0.02	0.09
97-08-06 12-16-39	74	N	10.5	-3.6	T	14204	20586	1858	1514	13356	20895	666	1810	0.13	0.07	0.05	0.09
97-08-06 13-22-22	74	N	56.2	6.8	L	42677	27368	11764	5995	50173	19120	17213	6435	0.28	0.22	0.34	0.34
97-08-06 13-22-22	74	N	56.2	6.8	L	40292	30658	5208	4523	49563	27137	3909	2822	0.13	0.15	0.08	0.1
97-08-06 13-22-22	74	N	56.2	6.8	L	37358	31119	7705	6234	50620	19072	15030	7626	0.21	0.2	0.3	0.4
97-08-06 13-22-22	74	N	56.2	6.8	L	41158	32443	5584	182	45921	23832	4960	2303	0.14	0.01	0.11	0.1
97-08-06 13-22-22	74	N	56.2	6.8	LT	25409	15602	6312	3318	24813	10970	5951	3449	0.25	0.21	0.24	0.31
97-08-06 13-22-22	74	N	56.2	6.8	T	20589	16706	3242	2255	24328	14184	3950	3005	0.16	0.13	0.16	0.21
97-08-06 13-22-22	74	N	56.2	6.8	T	19482	16151	2241	215	21257	13132	1570	-143	0.12	0.01	0.07	-0.01
97-08-06 13-22-22	74	N	56.2	6.8	T	19803	15772	1936	-6	23343	10157	2840	1513	0.1	0	0.12	0.15
97-08-06 13-22-22	74	N	56.2	6.8	T	17779	16488	1746	-131	21062	12687	3918	1908	0.1	-0.01	0.19	0.15
97-08-06 13-22-22	74	N	56.2	6.8	T	17107	16393	2281	218	21816	12892	1870	993	0.13	0.01	0.09	0.08
97-08-06 13-22-22	74	N	56.2	6.8	T	17605	18153	2475	53	21792	15130	2879	702	0.14	0	0.13	0.05
97-08-06 13-22-22	74	N	56.1	6.8	T	19082	14916	2121	127	21278	10465	5829	3336	0.11	0.01	0.27	0.32
97-08-06 13-22-22	74	N	56.1	6.8	T	19286	15301	1686	427	22458	12074	10268	4729	0.09	0.03	0.46	0.39
97-08-06 13-22-22	74	N	56.1	6.8	T	19994	15720	1718	332	22951	11079	8928	4251	0.09	0.02	0.39	0.38
97-08-06 13-22-22	74	N	56.1	6.7	T	19093	16170	1873	287	22811	12485	1903	916	0.1	0.02	0.08	0.07
97-08-06 13-22-22	74	N	56.1	6.7	T	18849	16450	1337	632	21769	12195	3092	1892	0.07	0.04	0.14	0.16
97-08-06 13-22-22	74	N	56	6.7	T	21987	18249	4403	5910	21778	16520	992	-820	0.2	0.32	0.05	-0.05
97-08-06 13-22-22	74	N	56	6.7	LT	23665	14558	7854	4032	23371	11767	4782	338	0.33	0.28	0.2	0.03
97-08-06 13-22-22	74	N	56	6.7	L	45003	24594	7180	3013	52518	18990	10385	4017	0.16	0.12	0.2	0.21
97-08-06 13-22-22	74	N	56	6.7	L	46196	21474	5060	1402	49983	20483	3486	330	0.11	0.07	0.07	0.02
97-08-06 13-22-22	74	N	56	6.7	L	43640	27728	3286	2566	53002	20383	4736	1897	0.08	0.09	0.09	0.09
97-08-06 13-22-22	74	N	55.9	6.7	L	42217	25544	3701	420	49115	21507	3156	25	0.09	0.02	0.06	0
97-08-06 13-25-29	76	N	73.5	7.2	L	39016	22054	6106	1420	50351	17836	10852	650	0.16	0.06	0.22	0.04
97-08-06 13-25-29	76	N	73.5	7.2	L	39651	24464	4451	-625	51720	20183	8246	584	0.11	-0.03	0.16	0.03
97-08-06 13-25-29	76	N	73.5	7.2	L	37701	27016	2253	-239	52102	23773	9005	933	0.06	-0.01	0.17	0.04
97-08-06 13-25-29	76	N	73.5	7.2	L	38774	26157	5521	-669	53279	19879	9173	635	0.14	-0.03	0.17	0.03
97-08-06 13-25-29	76	N	73.5	7.2	LT	21539	10884	6343	3105	28018	11426	4295	-77	0.29	0.29	0.15	-0.01
97-08-06 13-25-29	76	N	73.5	7.2	T	20322	13877	1553	193	24607	12302	2718	459	0.08	0.01	0.11	0.04
97-08-06 13-25-29	76	N	73.5	7.2	T	19921	11536	3333	-916	24648	10456	2884	269	0.17	-0.08	0.12	0.03
97-08-06 13-25-29	76	N	73.5	7.2	T	19109	13606	2949	-605	23591	10367	3295	485	0.15	-0.04	0.14	0.05
97-08-06 13-25-29	76	N	73.5	7.2	T	19265	12966	2597	-777	25036	10130	2959	323	0.13	-0.06	0.12	0.03
97-08-06 13-25-29	76	N	73.5	7.2	T	18869	11855	2784	-943	23850	9300	2794	532	0.15	-0.08	0.12	0.06
97-08-06 13-25-29	76	N	73.5	7.2	T	18533	11684	2462	-817	24581	10017	3377	296	0.13	-0.07	0.14	0.03
97-08-06 13-25-29	76	N	73.5	7.2	T	18184	13133	3364	-627	22232	10327	3495	657	0.18	-0.05	0.16	0.06
97-08-06 13-25-29	76	N	73.5	7.2	T	19143	12209	3382	-718	24415	10411	2950	438	0.18	-0.06	0.12	0.04
97-08-06 13-25-29	76	N	73.5	7.2	T	18845	13010	2987	-739	23769	10760	3061	472	0.16	-0.06	0.13	0.04
97-08-06 13-25-29	76	N	73.5	7.2	T	18997	13495	3021	-923	24706	10280	2883	400	0.16	-0.07	0.12	0.04
97-08-06 13-25-29	76	N	73.6	7.2	T	18801	13046	2413	-729	25724	9931	3130	486	0.13	-0.06	0.12	0.05
97-08-06 13-25-29	76	N	73.6	7.2	T	18679	15795	2584	-611	25294	16628	3905	131	0.14	-0.04	0.15	0.01
97-08-06 13-25-29	76	N	73.6	7.2	LT	17706	14688	2266	-703	22426	12863	3104	144	0.13	-0.05	0.14	0.01

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 13-25-29	76	N	73.6	7.2	L	38625	25510	3577	1035	49472	19892	11272	2290	0.09	0.04	0.23	0.12
97-08-06 13-25-29	76	N	73.6	7.2	L	35223	28407	2566	1352	46153	23741	8237	2764	0.07	0.05	0.18	0.12
97-08-06 13-25-29	76	N	73.6	7.2	L	37835	31203	4008	2851	49859	19985	9379	2381	0.11	0.09	0.19	0.12
97-08-06 13-25-29	76	N	73.6	7.2	L	35569	30327	4681	4377	47249	23289	5219	2043	0.13	0.14	0.11	0.09
97-08-06 13-43-03	76	S	72.2	6.7	L	39527	25597	10191	10117	48998	16568	11199	2699	0.26	0.4	0.23	0.16
97-08-06 13-43-03	76	S	72.2	6.7	L	40467	26850	7488	8017	47185	22064	6695	1950	0.19	0.3	0.14	0.09
97-08-06 13-43-03	76	S	72.2	6.7	L	40817	20087	12859	8533	47214	17867	12729	3088	0.32	0.42	0.27	0.17
97-08-06 13-43-03	76	S	72.2	6.7	L	37156	24869	4605	1082	42623	21967	6640	-644	0.12	0.04	0.16	-0.03
97-08-06 13-43-03	76	S	72.2	6.7	LT	14469	18623	3081	5671	18041	14574	1506	-318	0.21	0.3	0.08	-0.02
97-08-06 13-43-03	76	S	72.2	6.7	T	18234	14766	1068	-148	20374	13758	1540	18	0.06	-0.01	0.08	0
97-08-06 13-43-03	76	S	72.2	6.7	T	17433	12877	2649	3715	19790	11582	1706	-18	0.15	0.29	0.09	0
97-08-06 13-43-03	76	S	72.2	6.7	T	17991	13241	3518	5175	19247	11469	2149	894	0.2	0.39	0.11	0.08
97-08-06 13-43-03	76	S	72.2	6.7	T	18099	12895	3275	5215	20353	11175	2456	1183	0.18	0.4	0.12	0.11
97-08-06 13-43-03	76	S	72.2	6.7	T	18016	12839	2782	5352	20201	9612	2793	1834	0.15	0.42	0.14	0.19
97-08-06 13-43-03	76	S	72.3	6.8	T	17878	13354	3280	4918	19164	9818	2117	960	0.18	0.37	0.11	0.1
97-08-06 13-43-03	76	S	72.3	6.8	T	14911	12073	3136	3907	23905	10719	2063	833	0.21	0.32	0.09	0.08
97-08-06 13-43-03	76	S	72.2	6.7	T	17336	11999	3034	4676	20027	9862	2432	1278	0.18	0.39	0.12	0.13
97-08-06 13-43-03	76	S	72.2	6.7	T	18149	13041	3509	5041	21410	10312	2399	1358	0.19	0.39	0.11	0.13
97-08-06 13-43-03	76	S	72.2	6.7	T	18471	13344	2931	5049	21577	10149	2086	1293	0.16	0.38	0.1	0.13
97-08-06 13-43-03	76	S	72.2	6.7	T	19360	12061	3016	4436	20779	10035	2624	1288	0.16	0.37	0.13	0.13
97-08-06 13-43-03	76	S	72.2	6.7	T	20854	13859	4415	5772	23720	11760	2733	1973	0.21	0.42	0.12	0.17
97-08-06 13-43-03	76	S	72.2	6.7	LT	21323	17928	5070	7400	25820	10909	4160	2642	0.24	0.41	0.16	0.24
97-08-06 13-43-03	76	S	72.2	6.7	L	43417	33306	2473	2897	53510	20174	13708	3169	0.06	0.09	0.26	0.16
97-08-06 13-43-03	76	S	72.2	6.7	L	38142	24587	4633	-1104	44915	17444	5816	-398	0.12	-0.04	0.13	-0.02
97-08-06 13-43-03	76	S	72.2	6.7	L	42783	27379	8130	5000	48634	19402	8833	1125	0.19	0.18	0.18	0.06
97-08-06 13-43-03	76	S	72.2	6.7	L	40290	24464	3814	-868	46337	18689	6852	-356	0.09	-0.04	0.15	-0.02
97-08-06 13-43-42	74	S	56.6	7	L	38425	24634	-220	-248	51615	17930	6757	2283	-0.01	-0.01	0.13	0.13
97-08-06 13-43-42	74	S	56.6	7	L	44853	24528	2205	3441	53268	18233	3336	2412	0.05	0.14	0.06	0.13
97-08-06 13-43-42	74	S	56.7	7	L	41341	22066	2169	1141	48982	17970	7265	3189	0.05	0.05	0.15	0.18
97-08-06 13-43-42	74	S	56.7	7	L	42537	20926	1018	3153	50505	17528	4268	2410	0.02	0.15	0.08	0.14
97-08-06 13-43-42	74	S	56.7	7	LT	19069	12918	1412	870	24516	10221	2972	774	0.07	0.07	0.12	0.08
97-08-06 13-43-42	74	S	56.7	7	T	18963	12162	2371	946	22798	12883	2069	693	0.13	0.08	0.09	0.05
97-08-06 13-43-42	74	S	56.7	7	T	17426	13255	2224	1042	22296	11082	1113	641	0.13	0.08	0.05	0.06
97-08-06 13-43-42	74	S	56.8	7	T	17269	13175	3093	1119	21581	11271	893	697	0.18	0.08	0.04	0.06
97-08-06 13-43-42	74	S	56.8	7	T	18894	12062	3521	1589	22665	10882	1722	812	0.19	0.13	0.08	0.07
97-08-06 13-43-42	74	S	56.8	7	T	18156	12401	2501	952	21530	10793	1131	701	0.14	0.08	0.05	0.06
97-08-06 13-43-42	74	S	56.8	7	T	17760	11314	2114	826	22257	10051	489	749	0.12	0.07	0.02	0.07
97-08-06 13-43-42	74	S	56.9	7	T	16980	13611	2971	872	21828	11246	1698	757	0.17	0.06	0.08	0.07
97-08-06 13-43-42	74	S	56.9	7	T	16596	12735	3060	1062	21190	10669	1798	815	0.18	0.08	0.08	0.08
97-08-06 13-43-42	74	S	56.9	7	T	17991	12408	2959	638	23569	10874	1194	562	0.16	0.05	0.05	0.05
97-08-06 13-43-42	74	S	56.9	7	T	16996	11457	2770	1095	24825	10188	1597	865	0.16	0.1	0.06	0.08
97-08-06 13-43-42	74	S	56.8	7	T	19179	12131	3142	1176	24596	10267	1618	831	0.16	0.1	0.07	0.08
97-08-06 13-43-42	74	S	56.8	7	T	21214	12005	3832	1282	25348	11752	2118	872	0.18	0.11	0.08	0.07
97-08-06 13-43-42	74	S	56.8	7	LT	19196	13928	4431	2018	26481	11050	3399	1208	0.23	0.14	0.13	0.11
97-08-06 13-43-42	74	S	56.8	7	L	42519	25782	9547	4146	55563	18634	13344	3394	0.22	0.16	0.24	0.18
97-08-06 13-43-42	74	S	56.8	7	L	43049	23586	3423	1319	47492	21412	3212	968	0.08	0.06	0.07	0.05
97-08-06 13-43-42	74	S	56.8	7	L	41374	22641	11516	4820	48314	18098	13093	4388	0.28	0.21	0.27	0.24
97-08-06 13-43-42	74	S	56.8	7	L	40861	26307	7225	3569	48304	19432	3256	1168	0.18	0.14	0.07	0.06
97-08-06 13-57-01	74	N	56.2	6.8	L	39291	27448	11026	5882	52696	18521	15206	5741	0.28	0.21	0.29	0.31
97-08-06 13-57-01	74	N	56.2	6.8	L	38154	34402	4542	3980	43785	27221	3022	1741	0.12	0.12	0.07	0.06
97-08-06 13-57-01	74	N	56.2	6.8	L	35783	31533	6673	6224	50638	22425	13212	6811	0.19	0.2	0.26	0.3
97-08-06 13-57-01	74	N	56.2	6.8	L	42456	32317	5092	437	45407	22344	4741	1729	0.12	0.01	0.1	0.08
97-08-06 13-57-01	74	N	56.2	6.8	LT	23615	14983	5860	3351	25369	11851	5835	3174	0.25	0.22	0.23	0.27
97-08-06 13-57-01	74	N	56.2	6.8	T	21643	17167	3434	2520	22012	13247	3877	2752	0.16	0.15	0.18	0.21
97-08-06 13-57-01	74	N	56.2	6.8	T	19451	16524	2442	267	19661	13306	1581	-213	0.13	0.02	0.08	-0.02
97-08-06 13-57-01	74	N	56.2	6.8	T	19641	14668	1847	124	23013	10758	2430	1344	0.09	0.01	0.11	0.12
97-08-06 13-57-01	74	N	56.2	6.8	T	17626	16414	1632	-26	21392	12100	3241	1914	0.09	0	0.15	0.16
97-08-06 13-57-01	74	N	56.2	6.8	T	18197	15209	2148	179	20675	11629	2092	1065	0.12	0.01	0.1	0.09
97-08-06 13-57-01	74	N	56.2	6.8	T	17291	16139	2068	355	21237	12990	2837	1028	0.12	0.02	0.13	0.08
97-08-06 13-57-01	74	N	56.2	6.8	T	18659	14023	1895	157	22026	10368	2662	1940	0.1	0.01	0.12	0.19
97-08-06 13-57-01	74	N	56.1	6.8	T	18268	15791	1386	-58	21922	12564	2733	1785	0.08	0	0.12	0.14
97-08-06 13-57-01	74	N	56.1	6.8	T	18901	14734	1924	-41	21920	11089	2448	1583	0.1	0	0.11	0.14
97-08-06 13-57-01	74	N	56.1	6.8	T	18879	15462	2140	-27	22404	12253	2239	1527	0.11	0	0.1	0.12
97-08-06 13-57-01	74	N	56.1	6.8	T	18391	15801	1814	19	22349	11063	3249	2242	0.1	0	0.15	0.2
97-08-06 13-57-01	74	N	56.1	6.7	T	19387	17674	3941	1915	21850	15537	1383	-335	0.2	0.11	0.06	-0.02
97-08-06 13-57-01	74	N	56.1	6.7	LT	21845	14318	6496	2456	23407	11222	5565	1087	0.3	0.17	0.24	0.1
97-08-06 13-57-01	74	N	56.1	6.8	L	43969	23147	5128	1573	52231	18525	9537	3697	0.12	0.07	0.18	0.2
97-08-06 13-57-01	74	N	56.1	6.7	L	44689	21746	3854	494	49013	19363	2637	674	0.09	0.02	0.05	0.03
97-08-06 13-57-01	74	N	56.1	6.8	L	43061	27278	3947	3937	52525	18921	3606	2088	0.09	0.14	0.07	0.11

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 13-57-01	74	N	56.1	6.7	L	42189	26067	4198	413	49714	20986	4056	496	0.1	0.02	0.08	0.02
97-08-06 14-00-06	76	N	72.6	6.9	L	38049	22088	6456	1598	53106	18853	11962	806	0.17	0.07	0.23	0.04
97-08-06 14-00-06	76	N	72.6	6.9	L	39762	25907	4176	-227	50397	20400	7477	578	0.11	-0.01	0.15	0.03
97-08-06 14-00-06	76	N	72.6	6.9	L	36454	28040	1747	-557	49981	20296	8790	592	0.05	-0.02	0.18	0.03
97-08-06 14-00-06	76	N	72.6	6.9	L	40106	25949	5891	-721	52833	19972	8795	886	0.15	-0.03	0.17	0.04
97-08-06 14-00-06	76	N	72.6	6.9	LT	21746	13764	6440	2659	27584	15126	3878	402	0.3	0.19	0.14	0.03
97-08-06 14-00-06	76	N	72.6	6.9	T	21267	14247	1666	-73	25235	13444	2642	423	0.08	-0.01	0.1	0.03
97-08-06 14-00-06	76	N	72.6	6.9	T	19935	11459	3000	-913	22706	10394	2944	372	0.15	-0.08	0.13	0.04
97-08-06 14-00-06	76	N	72.6	6.9	T	18571	11972	2797	-1075	24415	9063	3074	348	0.15	-0.09	0.13	0.04
97-08-06 14-00-06	76	N	72.6	6.9	T	18928	12894	2662	-964	24218	10650	2896	270	0.14	-0.07	0.12	0.03
97-08-06 14-00-06	76	N	72.7	6.9	T	18690	12347	2815	-1167	23600	10136	2969	450	0.15	-0.09	0.13	0.04
97-08-06 14-00-06	76	N	72.7	6.9	T	19367	11318	3167	-879	24028	9010	3189	429	0.16	-0.08	0.13	0.05
97-08-06 14-00-06	76	N	72.7	6.9	T	17874	13054	3084	-688	21328	10359	3325	564	0.17	-0.05	0.16	0.05
97-08-06 14-00-06	76	N	72.7	6.9	T	19405	12124	3443	-769	24371	10566	3027	513	0.18	-0.06	0.12	0.05
97-08-06 14-00-06	76	N	72.7	6.9	T	19439	11959	2839	-859	23767	10580	3158	483	0.15	-0.07	0.13	0.05
97-08-06 14-00-06	76	N	72.7	6.9	T	20028	14128	2960	-916	24738	10565	3040	309	0.15	-0.06	0.12	0.03
97-08-06 14-00-06	76	N	72.7	6.9	T	18675	12621	2655	-808	24373	10240	3074	532	0.14	-0.06	0.13	0.05
97-08-06 14-00-06	76	N	72.8	6.9	T	18960	14737	2521	-535	24827	15649	3189	203	0.13	-0.04	0.13	0.01
97-08-06 14-00-06	76	N	72.8	6.9	LT	17846	15012	2588	-756	21726	13975	2519	171	0.15	-0.05	0.12	0.01
97-08-06 14-00-06	76	N	72.7	6.9	L	41380	23998	5520	546	48395	21036	10369	1920	0.13	0.02	0.21	0.09
97-08-06 14-00-06	76	N	72.8	6.9	L	35381	24223	3133	743	44457	22711	7944	2682	0.09	0.03	0.18	0.12
97-08-06 14-00-06	76	N	72.8	6.9	L	37202	27786	3458	1754	49237	20176	10311	2282	0.09	0.06	0.21	0.11
97-08-06 14-00-06	76	N	72.8	6.9	L	35300	27809	4481	2771	43916	23310	4628	2033	0.13	0.1	0.11	0.09
97-08-06 14-19-05	76	S	72.3	6.8	L	40812	22122	7933	2905	49685	16434	9438	817	0.19	0.13	0.19	0.05
97-08-06 14-19-05	76	S	72.3	6.8	L	40823	21235	6267	-249	47760	18492	8133	-10	0.15	-0.01	0.17	0
97-08-06 14-19-05	76	S	72.4	6.8	L	42639	18430	10339	1792	45720	19792	7965	1157	0.24	0.1	0.17	0.06
97-08-06 14-19-05	76	S	72.3	6.8	L	40069	21182	6835	-897	43763	19840	9105	-288	0.17	-0.04	0.21	-0.01
97-08-06 14-19-05	76	S	72.4	6.8	LT	16374	16273	3078	1228	18477	14271	2660	206	0.19	0.08	0.14	0.01
97-08-06 14-19-05	76	S	72.4	6.8	T	18343	15215	1346	1085	20380	13925	1901	233	0.07	0.07	0.09	0.02
97-08-06 14-19-05	76	S	72.5	6.8	T	17258	13481	942	1847	20283	11088	1786	294	0.05	0.14	0.09	0.03
97-08-06 14-19-05	76	S	72.5	6.8	T	17830	12710	1285	1883	18959	10879	2090	951	0.07	0.15	0.11	0.09
97-08-06 14-19-05	76	S	72.6	6.9	T	17757	13426	1316	2626	19909	11335	2285	1153	0.07	0.2	0.11	0.1
97-08-06 14-19-05	76	S	72.6	6.9	T	18106	12944	1895	3904	21009	10141	2365	1375	0.1	0.3	0.11	0.14
97-08-06 14-19-05	76	S	72.7	6.9	T	17343	12872	2645	4495	19067	10345	2103	1075	0.15	0.35	0.11	0.1
97-08-06 14-19-05	76	S	72.8	6.9	T	15536	12481	2547	4253	21380	9311	2262	994	0.16	0.34	0.11	0.11
97-08-06 14-19-05	76	S	72.8	6.9	T	17166	12240	2698	4655	19092	9674	2316	1171	0.16	0.38	0.12	0.12
97-08-06 14-19-05	76	S	72.9	7	T	18271	12888	2691	3626	20733	10477	2669	1241	0.15	0.28	0.13	0.12
97-08-06 14-19-05	76	S	72.9	7	T	18504	12828	2525	4775	21538	10434	2172	1432	0.14	0.37	0.1	0.14
97-08-06 14-19-05	76	S	73	7	T	18924	11823	3313	4455	20966	9140	2649	1212	0.18	0.38	0.13	0.13
97-08-06 14-19-05	76	S	73	7	T	19750	13491	3979	6122	24008	11023	3241	2093	0.2	0.45	0.13	0.19
97-08-06 14-19-05	76	S	73.1	7	LT	20549	14661	2123	3109	24273	11346	3004	1606	0.1	0.21	0.12	0.14
97-08-06 14-19-05	76	S	73.1	7	L	32572	21682	2593	2451	48023	15801	11297	2764	0.08	0.11	0.24	0.17
97-08-06 14-19-05	76	S	73.1	7	L	33780	21253	4588	-1026	46321	18296	6186	-347	0.14	-0.05	0.13	-0.02
97-08-06 14-19-05	76	S	73.1	7	L	38705	23122	7769	4509	46857	18977	8259	1629	0.2	0.2	0.18	0.09
97-08-06 14-19-05	76	S	73.1	7	L	31806	17975	3844	-814	43140	18215	5847	-323	0.12	-0.05	0.14	-0.02
97-08-06 14-19-40	74	S	56.4	6.9	L	39138	23530	-239	-340	49877	16939	5818	2119	-0.01	-0.01	0.12	0.13
97-08-06 14-19-40	74	S	56.4	6.9	L	46233	23101	2923	3411	51743	17646	3313	2335	0.06	0.15	0.06	0.13
97-08-06 14-19-40	74	S	56.4	6.9	L	40628	22121	2054	1060	51773	17609	5704	2521	0.05	0.05	0.11	0.14
97-08-06 14-19-40	74	S	56.4	6.9	L	43856	21279	1720	3015	51521	16515	4444	2356	0.04	0.14	0.09	0.14
97-08-06 14-19-40	74	S	56.4	6.9	LT	18567	12920	1462	904	25178	10595	2644	804	0.08	0.07	0.11	0.08
97-08-06 14-19-40	74	S	56.4	6.9	T	19903	13610	2149	935	26627	13016	1700	719	0.11	0.07	0.06	0.06
97-08-06 14-19-40	74	S	56.5	6.9	T	17389	12603	1759	1079	23183	11322	933	689	0.1	0.09	0.04	0.06
97-08-06 14-19-40	74	S	56.4	6.9	T	17732	12890	3058	1223	21998	11126	920	882	0.17	0.09	0.04	0.08
97-08-06 14-19-40	74	S	56.4	6.9	T	17645	12745	3418	1232	23846	10552	1690	851	0.19	0.1	0.07	0.08
97-08-06 14-19-40	74	S	56.4	6.9	T	16223	10491	6243	1131	22523	11376	906	838	0.38	0.11	0.04	0.07
97-08-06 14-19-40	74	S	56.4	6.9	T	18216	11691	2129	963	22809	9797	512	817	0.12	0.08	0.02	0.08
97-08-06 14-19-40	74	S	56.4	6.9	T	17350	12566	2833	738	21505	10730	1442	975	0.16	0.06	0.07	0.09
97-08-06 14-19-40	74	S	56.4	6.9	T	16801	12451	2956	1065	20362	10612	1594	843	0.18	0.09	0.08	0.08
97-08-06 14-19-40	74	S	56.3	6.8	T	17417	12972	2729	778	22653	11167	1423	585	0.16	0.06	0.06	0.05
97-08-06 14-19-40	74	S	56.3	6.8	T	19843	13179	2895	1142	23000	10530	1298	773	0.15	0.09	0.06	0.07
97-08-06 14-19-40	74	S	56.3	6.8	T	18368	12636	3242	1288	24869	10518	2180	803	0.18	0.1	0.09	0.08
97-08-06 14-19-40	74	S	56.2	6.8	T	21245	13015	4213	1274	26141	11813	1907	751	0.2	0.1	0.07	0.06
97-08-06 14-19-40	74	S	56.2	6.8	LT	19612	14590	4058	2067	26910	11178	3152	1119	0.21	0.14	0.12	0.1
97-08-06 14-19-40	74	S	56.2	6.8	L	40860	26893	8756	3986	53692	16371	12702	3247	0.21	0.15	0.24	0.2
97-08-06 14-19-40	74	S	56.2	6.8	L	41667	21793	3267	1383	46437	21300	3191	1169	0.08	0.06	0.07	0.05
97-08-06 14-19-40	74	S	56.2	6.8	L	41027	22629	11207	4905	49625	18995	13461	4818	0.27	0.22	0.27	0.25
97-08-06 14-19-40	74	S	56.2	6.8	L	42532	26399	6577	3147	50440	20956	3178	1273	0.15	0.12	0.06	0.06
97-08-06 14-30-20	74	N	57.2	7.2	L	40949	25285	10180	4631	48455	16606	15323	5091	0.25	0.18	0.32	0.31
97-08-06 14-30-20	74	N	57.2	7.2	L	40599	29493	4792	2835	48922	25064	3028	1978	0.12	0.1	0.06	0.08

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ve	Body Low Rail Ve	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-06 14-30-2	74	N	57.3	7.2	L	38722	30841	7492	5942	51801	19372	14410	6762	0.19	0.19	0.28	0.35
97-08-06 14-30-2	74	N	57.2	7.2	L	37016	25288	5467	-56	47953	22093	5294	2225	0.15	0	0.11	0.1
97-08-06 14-30-2	74	N	57.3	7.2	LT	24183	14947	5850	3167	26890	10895	5759	3154	0.24	0.21	0.21	0.29
97-08-06 14-30-2	74	N	57.3	7.2	T	23491	16495	3596	2611	24389	13254	3622	2755	0.15	0.16	0.15	0.21
97-08-06 14-30-2	74	N	57.3	7.2	T	18667	15595	2284	174	20627	13227	1302	-146	0.12	0.01	0.06	-0.01
97-08-06 14-30-2	74	N	57.3	7.2	T	20480	14966	2072	44	22773	10542	2698	1304	0.1	0	0.12	0.12
97-08-06 14-30-2	74	N	57.3	7.2	T	18433	16648	1797	-54	21822	11871	2941	1734	0.1	0	0.13	0.15
97-08-06 14-30-2	74	N	57.3	7.2	T	18453	16064	2106	238	21004	11866	1954	1243	0.11	0.01	0.09	0.1
97-08-06 14-30-2	74	N	57.4	7.2	T	18337	16510	2124	291	22046	12096	2427	1065	0.12	0.02	0.11	0.09
97-08-06 14-30-2	74	N	57.4	7.2	T	19552	14560	2012	117	21629	10162	2779	1850	0.1	0.01	0.13	0.18
97-08-06 14-30-2	74	N	57.4	7.2	T	19127	15714	1485	-57	21800	11663	2654	1880	0.08	0	0.12	0.16
97-08-06 14-30-2	74	N	57.4	7.2	T	20001	15312	2114	225	24657	11204	2360	1568	0.11	0.01	0.1	0.14
97-08-06 14-30-2	74	N	57.4	7.2	T	18540	15283	1976	-65	22260	11852	1986	1521	0.11	0	0.09	0.13
97-08-06 14-30-2	74	N	57.3	7.2	T	18402	16118	1377	-59	23274	11163	3275	2262	0.07	0	0.14	0.2
97-08-06 14-30-2	74	N	57.3	7.2	T	20447	18976	4181	1475	22170	14914	1656	-223	0.2	0.08	0.07	-0.01
97-08-06 14-30-2	74	N	57.3	7.2	LT	21698	14582	6661	2749	23527	10877	4942	744	0.31	0.19	0.21	0.07
97-08-06 14-30-2	74	N	57.3	7.2	L	43187	24267	4801	1521	52624	17239	8599	3333	0.11	0.06	0.16	0.19
97-08-06 14-30-2	74	N	57.3	7.2	L	42916	21161	3354	750	49954	18391	2802	953	0.08	0.04	0.06	0.05
97-08-06 14-30-2	74	N	57.3	7.2	L	42698	27313	1601	1938	52110	18429	3675	1787	0.04	0.07	0.07	0.1
97-08-06 14-30-2	74	N	57.3	7.2	L	43898	25576	4082	481	51307	19855	3807	712	0.09	0.02	0.07	0.04
97-08-06 14-33-2	76	N	72.5	6.8	L	39146	22816	6532	966	45950	14455	10573	721	0.17	0.04	0.23	0.05
97-08-06 14-33-2	76	N	72.5	6.8	L	38386	22974	4583	-584	52195	24178	7400	812	0.12	-0.03	0.14	0.03
97-08-06 14-33-2	76	N	72.5	6.8	L	36160	27671	2115	-494	48039	19047	8428	733	0.06	-0.02	0.18	0.04
97-08-06 14-33-2	76	N	72.5	6.8	L	38204	25514	5535	-690	52580	20975	8626	830	0.14	-0.03	0.16	0.04
97-08-06 14-33-2	76	N	72.5	6.8	LT	22600	11099	6711	2642	25612	12914	3276	5	0.3	0.24	0.13	0
97-08-06 14-33-2	76	N	72.5	6.8	T	20729	13929	1371	-92	25611	12897	2664	414	0.07	-0.01	0.1	0.03
97-08-06 14-33-2	76	N	72.5	6.8	T	19928	12772	2888	-941	25159	10574	2736	390	0.14	-0.07	0.11	0.04
97-08-06 14-33-2	76	N	72.5	6.8	T	18503	14255	2856	-1086	24104	11688	2936	370	0.15	-0.08	0.12	0.03
97-08-06 14-33-2	76	N	72.5	6.8	T	19524	12691	2547	-923	23722	10785	2841	305	0.13	-0.07	0.12	0.03
97-08-06 14-33-2	76	N	72.5	6.8	T	18608	11331	2812	-1058	23443	9861	2650	439	0.15	-0.09	0.11	0.04
97-08-06 14-33-2	76	N	72.5	6.8	T	18984	12200	2372	-660	24494	9826	3304	178	0.12	-0.05	0.13	0.02
97-08-06 14-33-2	76	N	72.5	6.8	T	17622	12941	3204	-587	22642	11529	3184	593	0.18	-0.05	0.14	0.05
97-08-06 14-33-2	76	N	72.5	6.8	T	19068	11737	3605	-848	23818	9935	2955	285	0.19	-0.07	0.12	0.03
97-08-06 14-33-2	76	N	72.5	6.8	T	18499	12931	2739	-768	24239	10192	3000	358	0.15	-0.06	0.12	0.04
97-08-06 14-33-2	76	N	72.6	6.9	T	18723	13889	2963	-943	24428	10771	2626	500	0.16	-0.07	0.11	0.05
97-08-06 14-33-2	76	N	72.6	6.9	T	19011	13636	2624	-757	24994	10649	2938	523	0.14	-0.06	0.12	0.05
97-08-06 14-33-2	76	N	72.6	6.9	T	19512	17313	3007	-834	24138	13239	2947	128	0.15	-0.05	0.12	0.01
97-08-06 14-33-2	76	N	72.6	6.9	LT	17199	15429	2347	-666	21304	14262	2857	182	0.14	-0.04	0.13	0.01
97-08-06 14-33-2	76	N	72.6	6.9	L	40608	25146	4831	737	48382	21114	10300	2098	0.12	0.03	0.21	0.1
97-08-06 14-33-2	76	N	72.6	6.9	L	34367	27939	3148	1214	44359	23581	7874	2568	0.09	0.04	0.18	0.11
97-08-06 14-33-2	76	N	72.6	6.9	L	37551	29397	2785	2103	48606	21752	10727	2473	0.07	0.07	0.22	0.11
97-08-06 14-33-2	76	N	72.6	6.9	L	34284	28754	3120	3076	46529	24703	4840	2292	0.09	0.11	0.1	0.09
97-08-06 15-12-5	76	S	74.6	7.5	L	39551	24441	7997	7648	49731	16166	11017	2785	0.2	0.31	0.22	0.17
97-08-06 15-12-5	76	S	74.6	7.5	L	38917	26538	5508	4142	46125	20728	6680	1640	0.14	0.16	0.14	0.08
97-08-06 15-12-5	76	S	74.6	7.5	L	41636	22256	8646	5380	44912	20759	7882	2722	0.21	0.24	0.18	0.13
97-08-06 15-12-5	76	S	74.6	7.5	L	39400	23162	5206	-233	44172	19285	7341	217	0.13	-0.01	0.17	0.01
97-08-06 15-12-5	76	S	74.6	7.5	LT	15435	17986	4850	7495	19176	13375	2709	73	0.31	0.42	0.14	0.01
97-08-06 15-12-5	76	S	74.6	7.5	T	18800	13972	1213	-577	20616	13143	2512	98	0.06	-0.04	0.12	0.01
97-08-06 15-12-5	76	S	74.6	7.5	T	16970	13334	1378	2993	20933	10411	1918	243	0.08	0.22	0.09	0.02
97-08-06 15-12-5	76	S	74.6	7.5	T	17969	12295	2797	4101	20839	10517	2617	1361	0.16	0.33	0.13	0.13
97-08-06 15-12-5	76	S	74.6	7.5	T	18700	12394	3405	5296	20600	11277	2884	1360	0.18	0.43	0.14	0.12
97-08-06 15-12-5	76	S	74.6	7.6	T	18041	12358	3166	5909	21337	9498	3342	1882	0.18	0.48	0.16	0.2
97-08-06 15-12-5	76	S	74.6	7.6	T	18180	13238	3154	5403	19238	9145	2559	1087	0.17	0.41	0.13	0.12
97-08-06 15-12-5	76	S	74.6	7.6	T	18893	11991	2657	4570	21474	9346	2973	965	0.14	0.38	0.14	0.1
97-08-06 15-12-5	76	S	74.7	7.6	T	17536	11835	3152	5198	20441	9379	2898	1240	0.18	0.44	0.14	0.13
97-08-06 15-12-5	76	S	74.7	7.6	T	18940	12542	3414	4994	22204	9320	3173	1426	0.18	0.4	0.14	0.15
97-08-06 15-12-5	76	S	74.7	7.6	T	18215	14262	2942	5162	20956	10275	2670	1154	0.16	0.36	0.13	0.11
97-08-06 15-12-5	76	S	74.6	7.6	T	20242	11167	3183	4734	21976	8742	2640	1138	0.16	0.42	0.12	0.13
97-08-06 15-12-5	76	S	74.7	7.6	T	21691	13177	4829	6759	22666	10302	3972	2427	0.22	0.51	0.18	0.24
97-08-06 15-12-5	76	S	74.6	7.6	LT	20467	11682	3265	5569	25134	13959	4130	2413	0.16	0.48	0.16	0.17
97-08-06 15-12-5	76	S	74.6	7.6	L	36948	26843	2855	3017	50506	14829	13089	3147	0.08	0.11	0.26	0.21
97-08-06 15-12-5	76	S	74.6	7.6	L	33581	20540	4470	-1067	47878	17773	6088	-367	0.13	-0.05	0.13	-0.02
97-08-06 15-12-5	76	S	74.6	7.6	L	40223	22769	7210	3797	50690	21652	8189	1628	0.18	0.17	0.16	0.08
97-08-06 15-12-5	76	S	74.6	7.6	L	40387	22476	3979	-1077	45828	19094	5744	-380	0.1	-0.05	0.13	-0.02
97-08-06 15-13-2	74	S	58.7	7.8	L	39149	22998	1692	344	51639	18586	4814	912	0.04	0.01	0.09	0.05
97-08-06 15-13-2	74	S	58.7	7.8	L	46868	21519	3084	3489	52824	17862	5334	3078	0.07	0.16	0.1	0.17
97-08-06 15-13-2	74	S	58.7	7.8	L	41380	21924	3507	1090	49079	17133	4164	1615	0.08	0.05	0.08	0.09
97-08-06 15-13-2	74	S	58.7	7.8	L	43092	20580	1031	2993	51093	15947	4525	2443	0.02	0.15	0.09	0.15
97-08-06 15-13-2	74	S	58.7	7.8	LT	19116	13212	1199	423	24056	9584	2506	1226	0.06	0.03	0.1	0.13

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 15-13-23	74	S	58.7	7.8	T	19210	12326	2219	883	28120	11926	1478	1294	0.12	0.07	0.05	0.11
97-08-06 15-13-23	74	S	58.8	7.8	T	17342	12906	1206	867	24143	10913	772	934	0.07	0.07	0.03	0.09
97-08-06 15-13-23	74	S	58.8	7.8	T	17417	12849	1462	840	23765	10594	123	872	0.08	0.07	0.01	0.08
97-08-06 15-13-23	74	S	58.8	7.8	T	18796	12628	1173	684	20927	9758	1390	851	0.06	0.05	0.07	0.09
97-08-06 15-13-23	74	S	58.8	7.8	T	17820	12194	831	774	21443	10549	483	879	0.05	0.06	0.02	0.08
97-08-06 15-13-23	74	S	58.8	7.8	T	17273	11278	636	870	22812	9009	224	997	0.04	0.08	0.01	0.11
97-08-06 15-13-23	74	S	58.8	7.8	T	17119	14218	849	608	22835	10082	1347	846	0.05	0.04	0.06	0.08
97-08-06 15-13-23	74	S	58.8	7.8	T	17640	12239	812	692	21118	9954	1098	902	0.05	0.06	0.05	0.09
97-08-06 15-13-23	74	S	58.8	7.8	T	18365	11991	1766	564	23065	9685	1022	776	0.1	0.05	0.04	0.08
97-08-06 15-13-23	74	S	58.8	7.8	T	18174	12321	569	773	22276	9260	821	919	0.03	0.06	0.04	0.1
97-08-06 15-13-23	74	S	58.8	7.8	T	18515	12119	886	791	23311	9435	1118	916	0.05	0.07	0.05	0.1
97-08-06 15-13-23	74	S	58.8	7.8	T	22657	11899	3387	678	27487	11233	1553	830	0.15	0.06	0.06	0.07
97-08-06 15-13-23	74	S	58.8	7.8	LT	21147	13128	4250	1776	29109	9944	2801	972	0.2	0.14	0.1	0.1
97-08-06 15-13-23	74	S	58.8	7.8	L	46096	27023	7327	1468	52311	18585	9356	1221	0.16	0.05	0.18	0.07
97-08-06 15-13-23	74	S	58.8	7.8	L	44629	21974	3651	1303	51100	18055	3852	996	0.08	0.06	0.08	0.06
97-08-06 15-13-23	74	S	58.8	7.8	L	44801	22901	11573	5010	55264	16782	11753	3158	0.26	0.22	0.21	0.19
97-08-06 15-13-23	74	S	58.8	7.8	L	39439	24384	5951	2389	48926	17207	2681	960	0.15	0.1	0.05	0.06
97-08-06 16-06-31	74	N	56.9	7.1	L	37447	29985	9628	4743	51037	20136	13400	4632	0.26	0.16	0.26	0.23
97-08-06 16-06-31	74	N	56.9	7.1	L	40659	45432	4431	3441	46180	23886	2685	1559	0.11	0.08	0.06	0.07
97-08-06 16-06-31	74	N	56.9	7.1	L	37363	35998	6617	6244	54908	23110	13094	6998	0.18	0.17	0.24	0.3
97-08-06 16-06-31	74	N	56.9	7.1	L	40073	45476	5609	140	47081	20595	4804	1672	0.14	0	0.1	0.08
97-08-06 16-06-31	74	N	56.9	7.1	LT	24100	22192	5757	4205	27418	11275	5441	3164	0.24	0.19	0.2	0.28
97-08-06 16-06-31	74	N	56.9	7.1	T	21729	24406	2971	2457	24404	13550	3844	2851	0.14	0.1	0.16	0.21
97-08-06 16-06-31	74	N	56.9	7.1	T	19432	30794	2167	21	20291	13137	1144	-109	0.11	0	0.06	-0.01
97-08-06 16-06-31	74	N	56.9	7.1	T	20101	17434	1841	-28	21562	9888	2103	1134	0.09	0	0.1	0.11
97-08-06 16-06-31	74	N	56.9	7.1	T	18265	27258	1901	-89	21378	11973	3022	1865	0.1	0	0.14	0.16
97-08-06 16-06-31	74	N	56.9	7.1	T	17588	28183	1990	-84	20769	12004	1702	976	0.11	0	0.08	0.08
97-08-06 16-06-31	74	N	56.9	7.1	T	19397	31986	2024	-107	21968	12777	2540	1324	0.1	0	0.12	0.1
97-08-06 16-06-31	74	N	56.9	7.1	T	18480	28483	1633	32	22664	10257	2446	1870	0.09	0	0.11	0.18
97-08-06 16-06-31	74	N	56.9	7	T	18388	25616	1171	-216	21885	11709	2480	1729	0.06	-0.01	0.11	0.15
97-08-06 16-06-31	74	N	56.8	7	T	19316	26645	1604	-246	22683	10848	1990	1617	0.08	-0.01	0.09	0.15
97-08-06 16-06-31	74	N	56.8	7	T	18648	24988	1771	-171	22315	11111	1963	1394	0.09	-0.01	0.09	0.13
97-08-06 16-06-31	74	N	56.8	7	T	18364	24266	1324	-202	21596	10663	3289	2325	0.07	-0.01	0.15	0.22
97-08-06 16-06-31	74	N	56.8	7	T	19948	41045	4084	1212	20325	14733	1386	-335	0.2	0.03	0.07	-0.02
97-08-06 16-06-31	74	N	56.8	7	LT	21580	18449	6979	3284	23798	11405	5157	1470	0.32	0.18	0.22	0.13
97-08-06 16-06-31	74	N	56.8	7	L	43327	32156	4508	1489	52902	17261	9863	3494	0.1	0.05	0.19	0.2
97-08-06 16-06-31	74	N	56.8	7	L	43627	19258	3152	652	51296	18267	2834	935	0.07	0.03	0.06	0.05
97-08-06 16-06-31	74	N	56.8	7	L	42084	28984	3192	3096	51780	18928	3557	2394	0.08	0.11	0.07	0.13
97-08-06 16-06-31	74	N	56.8	7	L	41800	31538	3773	484	48902	19378	3948	736	0.09	0.02	0.08	0.04
97-08-06 16-09-37	76	N	74.4	7.5	L	39403	20873	8082	1569	50815	18002	10536	638	0.21	0.08	0.21	0.04
97-08-06 16-09-37	76	N	74.4	7.5	L	38998	23740	4724	-857	49069	16104	8454	849	0.12	-0.04	0.17	0.05
97-08-06 18-09-37	76	N	74.4	7.5	L	35495	25655	2263	-494	50795	19772	7314	564	0.06	-0.02	0.14	0.03
97-08-06 16-09-37	76	N	74.4	7.6	L	37545	25722	5745	-307	51469	16302	8685	683	0.15	-0.01	0.17	0.04
07-08-06 16-09-37	76	N	74.4	7.5	LT	21470	14053	5918	2468	28623	15643	3657	120	0.28	0.18	0.13	0.01
07-08-06 18-09-37	76	N	74.4	7.5	T	20608	14423	1227	-130	24670	13165	2707	277	0.06	-0.01	0.11	0.02
07-08-06 16-09-37	76	N	74.4	7.5	T	19702	12905	3502	-774	24538	10237	2846	278	0.18	-0.06	0.12	0.03
97-08-06 16-09-37	76	N	74.4	7.5	T	18758	11678	3169	-495	23990	10493	2852	443	0.17	-0.04	0.12	0.04
97-08-06 16-09-37	76	N	74.4	7.5	T	18366	13010	3091	-775	24798	10277	2711	443	0.17	-0.06	0.11	0.04
97-08-06 16-09-37	76	N	74.4	7.5	T	18486	12096	3144	-743	23021	9348	3015	458	0.17	-0.06	0.13	0.05
97-08-06 16-09-37	76	N	74.5	7.5	T	19229	11259	2853	-741	23654	8890	3230	462	0.15	-0.07	0.14	0.05
97-08-06 16-09-37	76	N	74.5	7.5	T	18214	12296	3413	-689	22924	10505	3497	518	0.19	-0.06	0.15	0.05
97-08-06 16-09-37	76	N	74.5	7.5	T	18725	12274	3704	-767	23715	9476	2812	404	0.2	-0.06	0.12	0.04
97-08-06 16-09-37	76	N	74.5	7.5	T	17810	12531	3278	-855	24739	10195	3039	579	0.18	-0.07	0.12	0.06
97-08-06 16-09-37	76	N	74.6	7.5	T	19115	12909	3518	-748	22849	10327	2723	407	0.18	-0.06	0.12	0.04
97-08-06 16-09-37	76	N	74.6	7.5	T	18435	13073	3052	-653	25248	9406	3091	598	0.17	-0.05	0.12	0.06
97-08-06 16-09-37	76	N	74.6	7.5	T	19685	14625	3940	-732	23977	11875	2870	56	0.2	-0.05	0.12	0
97-08-06 16-09-37	76	N	74.6	7.5	LT	17548	15432	2901	-549	22376	12906	2937	317	0.17	-0.04	0.13	0.02
97-08-06 16-09-37	76	N	74.6	7.5	L	40555	23712	6053	524	49916	19031	10695	1632	0.15	0.02	0.21	0.09
97-08-06 16-09-37	76	N	74.6	7.5	L	35374	27167	4565	918	45022	22314	8431	2630	0.13	0.03	0.19	0.12
97-08-06 16-09-37	76	N	74.6	7.6	L	38382	28779	3062	1203	50392	22194	9621	2637	0.08	0.04	0.19	0.12
97-08-06 16-09-37	76	N	74.6	7.6	L	34753	27376	3941	1713	46597	23050	4655	1971	0.11	0.06	0.1	0.09
97-08-06 16-22-08	76	S	73	7	L	39766	22948	10635	8520	50389	16393	13257	4334	0.27	0.37	0.26	0.26
97-08-06 16-22-08	76	S	73	7	L	40707	24015	7055	3342	44862	20031	6740	2357	0.17	0.14	0.15	0.12
97-08-06 16-22-08	76	S	73.1	7	L	42993	19748	13451	6567	44893	20613	10605	4390	0.31	0.33	0.24	0.21
97-08-06 16-22-08	76	S	73	7	L	40661	22475	5943	-846	42646	19660	6685	-462	0.15	-0.04	0.16	-0.02
97-08-06 16-22-08	76	S	73	7	LT	14949	17795	3737	5403	18297	14009	1507	-267	0.25	0.3	0.08	-0.02
97-08-06 16-22-08	76	S	73	7	T	18813	15051	1471	557	20472	13417	1074	-154	0.08	0.04	0.05	-0.01
97-08-06 16-22-08	76	S	73.1	7	T	17709	14060	2927	3987	20139	10140	1397	-53	0.17	0.28	0.07	-0.01
97-08-06 16-22-08	76	S	73.1	7	T	18053	12770	3554	5067	20735	10656	2810	1315	0.2	0.4	0.14	0.12

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 16-22-08	76	S	73.2	7.1	T	17286	13516	3108	5132	20309	10680	2613	1567	0.18	0.38	0.13	0.15
97-08-06 16-22-08	76	S	73.2	7.1	T	18126	12492	3436	5137	20650	10104	3116	1907	0.19	0.41	0.15	0.19
97-08-06 16-22-08	76	S	73.3	7.1	T	17095	12451	3167	4669	18824	10010	2441	1166	0.19	0.37	0.13	0.12
97-08-06 16-22-08	76	S	73.3	7.1	T	19169	12608	2991	4398	21414	8610	2516	872	0.16	0.35	0.12	0.1
97-08-06 16-22-08	76	S	73.4	7.1	T	16738	12188	3072	4732	20259	10014	2500	1322	0.18	0.39	0.12	0.13
97-08-06 16-22-08	76	S	73.4	7.1	T	17679	12563	2973	4872	20838	10097	2784	1375	0.17	0.39	0.13	0.14
97-08-06 16-22-08	76	S	73.5	7.2	T	17433	13289	2812	5265	20846	10090	2314	1106	0.16	0.4	0.11	0.11
97-08-06 16-22-08	76	S	73.5	7.2	T	18991	11530	3100	4397	21723	9994	2343	1056	0.16	0.38	0.11	0.11
97-08-06 16-22-08	76	S	73.6	7.2	T	19487	14003	3404	6343	24578	11345	3711	2171	0.17	0.45	0.15	0.19
97-08-06 16-22-08	76	S	73.6	7.2	LT	21707	12884	3920	6612	25121	12885	4873	2737	0.18	0.51	0.19	0.21
97-08-06 16-22-08	76	S	73.7	7.2	L	37666	27526	3004	2864	47203	16762	11426	3018	0.08	0.1	0.24	0.18
97-08-06 16-22-08	76	S	73.7	7.2	L	39087	24576	4981	-888	46720	17507	5911	-338	0.13	-0.04	0.13	-0.02
97-08-06 16-22-08	76	S	73.7	7.2	L	40927	24978	7196	4643	49734	18765	8686	1230	0.18	0.19	0.17	0.07
97-08-06 16-22-08	76	S	73.7	7.2	L	35866	22166	3799	-870	44644	17790	6316	-257	0.11	-0.04	0.14	-0.01
97-08-06 16-22-39	74	S	59.2	8	L	40470	28525	110	-137	51346	15889	7298	1650	0	0	0.14	0.12
97-08-06 16-22-39	74	S	59.2	8	L	44289	33624	2781	3372	51975	15874	3173	2674	0.06	0.1	0.06	0.17
97-08-06 16-22-39	74	S	59.2	8	L	40483	26108	2077	685	50259	16105	5356	2284	0.05	0.03	0.11	0.14
97-08-06 16-22-39	74	S	59.2	8	L	43984	52902	1886	3029	52392	14782	6023	2627	0.04	0.06	0.11	0.18
97-08-06 16-22-39	74	S	59.2	8	LT	18447	17498	5055	986	23667	9394	2722	966	0.27	0.06	0.12	0.1
97-08-06 16-22-39	74	S	59.2	8	T	20620	22676	2088	969	24398	11986	1903	846	0.1	0.04	0.08	0.07
97-08-06 16-22-39	74	S	59.2	8	T	18012	21132	2272	961	22367	10050	1459	893	0.13	0.05	0.07	0.09
97-08-06 16-22-39	74	S	59.2	8	T	17692	22946	3070	1151	23180	10411	1257	901	0.17	0.05	0.05	0.09
97-08-06 16-22-39	74	S	59.1	7.9	T	17859	17183	3071	1405	22332	9454	2299	873	0.17	0.08	0.1	0.09
97-08-06 16-22-39	74	S	59.1	7.9	T	17532	26776	2864	1035	22913	10037	1680	956	0.16	0.04	0.07	0.1
97-08-06 16-22-39	74	S	59	7.9	T	18039	23918	2299	934	21662	8817	869	915	0.13	0.04	0.04	0.1
97-08-06 16-22-39	74	S	59	7.9	T	17689	30126	2417	753	22408	9943	2276	906	0.14	0.02	0.1	0.09
97-08-06 16-22-39	74	S	58.9	7.9	T	16217	35697	3274	1322	21587	9635	2193	1005	0.2	0.04	0.1	0.1
97-08-06 16-22-39	74	S	58.9	7.8	T	18090	29603	2579	728	24103	9981	1622	855	0.14	0.02	0.07	0.09
97-08-06 16-22-39	74	S	58.8	7.8	T	18059	17328	2400	1018	23868	9251	1546	1045	0.13	0.06	0.06	0.11
97-08-06 16-22-39	74	S	58.8	7.8	T	18731	15960	3171	1322	24233	9269	2400	1035	0.17	0.08	0.1	0.11
97-08-06 16-22-39	74	S	58.7	7.8	T	21856	26362	4463	2005	25953	10157	3063	913	0.2	0.08	0.12	0.09
97-08-06 16-22-39	74	S	58.7	7.8	LT	20403	20460	6928	4155	28626	9718	5266	1418	0.34	0.2	0.18	0.15
97-08-06 16-22-39	74	S	58.7	7.8	L	41246	28964	8322	3454	54660	16925	14248	4093	0.2	0.12	0.26	0.24
97-08-06 16-22-39	74	S	58.7	7.8	L	45142	23299	3369	1825	49789	17250	15228	9172	0.07	0.08	0.31	0.53
97-08-06 16-22-39	74	S	58.7	7.8	L	43510	37897	12204	5725	54431	16672	14091	6222	0.28	0.15	0.26	0.37
97-08-06 16-22-39	74	S	58.6	7.7	L	45906	43378	6067	3449	51387	17728	4711	1490	0.13	0.08	0.09	0.08
97-08-07 09-29-53	74	N	45.6	3.1	L	35713	30604	7868	6106	43225	28858	16717	11439	0.22	0.2	0.39	0.4
97-08-07 09-29-53	74	N	45.6	3.1	L	36515	34765	3025	2506	37745	29949	2370	5124	0.08	0.07	0.06	0.17
97-08-07 09-29-53	74	N	45.6	3.1	L	35666	31776	5017	5030	44571	28314	10787	8380	0.14	0.16	0.24	0.3
97-08-07 09-29-53	74	N	45.6	3.1	L	38556	32020	1194	-281	41576	26393	-316	1330	0.03	-0.01	-0.01	0.05
97-08-07 09-29-53	74	N	45.6	3.1	LT	19461	16815	5242	3424	19766	16070	5528	5232	0.27	0.2	0.28	0.33
97-08-07 09-29-53	74	N	45.6	3.1	T	18255	19751	792	1429	20418	17678	2711	3472	0.04	0.07	0.13	0.2
97-08-07 09-29-53	74	N	45.6	3.1	T	21120	17309	1493	-144	21922	16035	352	-263	0.07	-0.01	0.02	-0.02
97-08-07 09-29-53	74	N	45.7	3.1	T	19023	19079	2335	284	20500	16837	73	-171	0.12	0.01	0	-0.01
97-08-07 09-29-53	74	N	45.7	3.1	T	19066	17139	2328	102	20236	15192	188	233	0.12	0.01	0.01	0.02
97-08-07 09-29-53	74	N	45.7	3.1	T	18726	17812	4027	1533	19679	15651	7	-460	0.22	0.09	0	-0.03
97-08-07 09-29-53	74	N	45.7	3.1	T	20773	16091	386	-79	23243	13300	2474	2472	0.02	0	0.11	0.19
97-08-07 09-29-53	74	N	45.7	3.1	T	19023	16694	2681	879	19618	15007	339	166	0.14	0.05	0.02	0.01
97-08-07 09-29-53	74	N	45.7	3.1	T	20272	17725	3452	966	21522	15589	1186	-380	0.17	0.05	0.06	-0.02
97-08-07 09-29-53	74	N	45.8	3.2	T	19187	18613	836	-338	21980	15841	2152	2563	0.04	-0.02	0.1	0.16
97-08-07 09-29-53	74	N	45.8	3.2	T	19785	18096	1558	-50	25888	15960	-63	-32	0.08	0	0	0
97-08-07 09-29-53	74	N	45.8	3.2	T	18564	19413	2436	491	21031	16386	732	494	0.13	0.03	0.03	0.03
97-08-07 09-29-53	74	N	45.8	3.2	T	19702	20768	3945	1662	20837	17477	1459	-305	0.2	0.08	0.07	-0.02
97-08-07 09-29-53	74	N	45.9	3.2	T	20185	17912	4433	1497	21567	16094	4474	1657	0.22	0.08	0.21	0.1
97-08-07 09-33-07	76	N	60	3.1	L	38410	27363	2890	-963	42139	27722	5953	167	0.08	-0.04	0.14	0.01
97-08-07 09-33-07	76	N	60	3.1	L	37467	28051	2570	985	44096	27495	4055	1814	0.07	0.04	0.09	0.07
97-08-07 09-33-07	76	N	59.9	3	L	33397	32583	4221	682	42182	27558	7547	2923	0.13	0.02	0.18	0.11
97-08-07 09-33-07	76	N	59.8	3	L	31520	33553	1070	2143	39691	28733	2960	2472	0.03	0.06	0.07	0.09
97-08-07 09-33-07	76	N	59.8	3	LT	21195	13681	5799	4774	21446	13508	2785	1802	0.27	0.35	0.13	0.13
97-08-07 09-33-07	76	N	59.7	3	T	18872	18307	1010	-968	21871	16053	1063	358	0.05	-0.05	0.05	0.02
97-08-07 09-33-07	76	N	59.5	2.9	T	19900	17258	2189	-920	22020	15569	1540	591	0.11	-0.05	0.07	0.04
97-08-07 09-33-07	76	N	59.4	2.9	T	18603	18561	1788	-932	21819	16260	2128	838	0.1	-0.05	0.1	0.05
97-08-07 09-33-07	76	N	59.3	2.9	T	19477	17150	2961	-662	20838	14777	2257	814	0.15	-0.04	0.11	0.06
97-08-07 09-33-07	76	N	59.2	2.9	T	18908	16028	1714	-766	20654	15039	1667	602	0.09	-0.05	0.08	0.04
97-08-07 09-33-07	76	N	59.2	2.8	T	17284	17616	4523	-529	19672	16648	1762	-98	0.26	-0.03	0.09	-0.01
97-08-07 09-33-07	76	N	59.1	2.8	T	16175	17422	2124	-811	17817	16156	1814	894	0.13	-0.05	0.1	0.06
97-08-07 09-33-07	76	N	59.1	2.8	T	19021	17491	3536	-805	20953	16076	1617	546	0.19	-0.05	0.08	0.03
97-08-07 09-33-07	76	N	59	2.8	T	19629	16156	5052	202	21592	15895	1990	422	0.26	0.01	0.09	0.03
97-08-07 09-33-07	76	N	59	2.8	T	19007	17218	3573	-563	21375	16396	1573	68	0.19	-0.03	0.07	0

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-07 09-33-07	76	N	59.1	2.8	T	19684	17001	3985	-637	20966	16104	2075	43	0.2	-0.04	0.1	0
97-08-07 09-33-07	76	N	59.1	2.8	T	19186	19112	2679	-735	22588	16713	1556	628	0.14	-0.04	0.07	0.04
97-08-07 09-33-07	76	N	59.1	2.8	T	18778	17040	3095	-905	20219	17236	1792	391	0.16	-0.05	0.09	0.02
97-08-07 11-15-05	74	N	57.7	7.4	L	44314	25199	11339	4848	52471	17248	16467	5229	0.26	0.19	0.31	0.3
97-08-07 11-15-05	74	N	57.7	7.4	L	42345	29367	4871	3408	46477	20482	3525	1657	0.12	0.12	0.08	0.08
97-08-07 11-15-05	74	N	57.7	7.4	L	38917	29597	7792	5588	51798	20739	15789	7085	0.2	0.19	0.3	0.34
97-08-07 11-15-05	74	N	57.7	7.4	L	40251	27357	5640	-250	50035	22546	5880	2202	0.14	-0.01	0.12	0.1
97-08-07 11-15-05	74	N	57.7	7.4	L	42780	23270	5658	1668	52116	17501	10138	4070	0.13	0.07	0.19	0.23
97-08-07 11-15-05	74	N	57.7	7.4	L	44394	21353	3801	315	51109	17399	4424	1346	0.09	0.01	0.09	0.08
97-08-07 11-15-05	74	N	57.7	7.4	L	43793	28163	1614	1087	52456	20406	3622	3377	0.04	0.04	0.07	0.17
97-08-07 11-15-05	74	N	57.6	7.4	L	44652	25128	4691	341	51494	18801	5175	395	0.11	0.01	0.1	0.02
97-08-07 11-15-05	74	N	57.6	7.4	LT	23491	14156	6797	3508	27797	11330	5866	2956	0.29	0.25	0.21	0.26
97-08-07 11-15-05	74	N	57.6	7.4	T	22485	16127	3361	2225	25773	13622	3464	2593	0.15	0.14	0.13	0.19
97-08-07 11-15-05	74	N	57.6	7.3	T	19590	14650	1858	-126	21077	12760	1398	-309	0.09	-0.01	0.07	-0.02
97-08-07 11-15-05	74	N	57.6	7.3	T	19396	14668	1608	-109	23157	9989	2680	1084	0.08	-0.01	0.12	0.11
97-08-07 11-15-05	74	N	57.6	7.3	T	19135	15921	1589	-152	21804	11529	3484	1842	0.08	-0.01	0.16	0.16
97-08-07 11-15-05	74	N	57.6	7.3	T	18479	14528	1855	-101	21379	11453	2272	1051	0.1	-0.01	0.11	0.09
97-08-07 11-15-05	74	N	57.5	7.3	T	19374	17530	1826	-160	22580	11977	2916	1403	0.09	-0.01	0.13	0.12
97-08-07 11-15-05	74	N	57.5	7.3	T	19287	14564	1866	-25	23630	10065	2977	1944	0.1	0	0.13	0.19
97-08-07 11-15-05	74	N	57.5	7.3	T	19359	14994	1111	-167	21694	11018	2789	1761	0.06	-0.01	0.13	0.16
97-08-07 11-15-05	74	N	57.5	7.3	T	20601	15493	2004	-174	25222	10719	2756	1479	0.1	-0.01	0.11	0.14
97-08-07 11-15-05	74	N	57.5	7.3	T	19444	16252	2085	-151	22865	11289	2106	1200	0.11	-0.01	0.09	0.11
97-08-07 11-15-05	74	N	57.5	7.3	T	18980	15930	1485	-211	23090	10826	3507	2179	0.08	-0.01	0.15	0.2
97-08-07 11-15-05	74	N	57.5	7.3	T	20750	17613	3510	1153	24891	15528	1474	-362	0.17	0.07	0.06	-0.02
97-08-07 11-15-05	74	N	57.5	7.3	T	21896	13850	5829	1985	23458	10597	4073	-25	0.27	0.14	0.17	0
97-08-07 13-51-26	76	S	75.3	7.8	L	40376	23446	10822	9115	50560	15593	12013	2621	0.27	0.39	0.24	0.17
97-08-07 13-51-26	76	S	75.3	7.8	L	41194	26516	9059	8619	45293	20730	6698	2691	0.22	0.33	0.15	0.13
97-08-07 13-51-26	76	S	75.3	7.8	L	42871	22072	11995	7871	46431	19932	9988	3167	0.28	0.36	0.22	0.16
97-08-07 13-51-26	76	S	75.3	7.8	L	40307	22104	5142	-287	44078	19183	7052	11	0.13	-0.01	0.16	0
97-08-07 13-51-26	76	S	75.4	7.8	L	39337	24423	5352	5854	49156	11720	13197	1329	0.14	0.24	0.27	0.11
97-08-07 13-51-26	76	S	75.4	7.8	L	41974	23519	6449	-930	44689	12226	8891	-513	0.15	-0.04	0.2	-0.04
97-08-07 13-51-26	76	S	75.4	7.8	L	43256	22071	9545	3845	47784	19040	9167	1614	0.22	0.17	0.19	0.08
97-08-07 13-51-26	76	S	75.4	7.8	L	44453	26427	4420	-994	47378	18015	8177	-578	0.1	-0.04	0.17	-0.03
97-08-07 13-51-26	76	S	75.5	7.8	LT	16130	17480	5450	6075	18685	13947	2826	27	0.34	0.35	0.15	0
97-08-07 13-51-26	76	S	75.5	7.8	T	19194	15335	1179	-827	21406	12597	2564	-97	0.06	-0.05	0.12	-0.01
97-08-07 13-51-26	76	S	75.6	7.9	T	18290	12875	2518	3559	20634	10578	2201	71	0.14	0.28	0.11	0.01
97-08-07 13-51-26	76	S	75.6	7.9	T	18545	12537	2941	3859	20551	10643	3064	1322	0.16	0.31	0.15	0.12
97-08-07 13-51-26	76	S	75.7	7.9	T	18270	12127	2598	3849	20353	10488	3021	1334	0.14	0.32	0.15	0.13
97-08-07 13-51-26	76	S	75.8	7.9	T	18687	12413	2360	3862	21098	9681	3104	1829	0.13	0.31	0.15	0.19
97-08-07 13-51-26	76	S	75.8	8	T	17215	13398	2862	4104	19405	9774	2916	1143	0.17	0.31	0.15	0.12
97-08-07 13-51-26	76	S	75.9	8	T	18871	11438	2590	3530	18378	9052	3148	936	0.14	0.31	0.17	0.1
97-08-07 13-51-26	76	S	75.9	8	T	17716	11975	2331	3780	19658	9158	3301	1432	0.13	0.32	0.17	0.16
97-08-07 13-51-26	76	S	76	8	T	18439	12033	2351	3801	21692	9813	3403	1277	0.13	0.32	0.16	0.13
97-08-07 13-51-26	76	S	76	8	T	19708	12652	2132	3828	21379	9825	2534	1246	0.11	0.3	0.12	0.13
97-08-07 13-51-26	76	S	76.1	8	T	19858	10808	2773	3192	21708	9377	3056	1297	0.14	0.3	0.14	0.14
97-08-07 13-51-26	76	S	76.1	8.1	T	21015	12607	3750	4053	22514	10496	3605	2076	0.18	0.32	0.16	0.2
97-08-07 13-51-26	76	S	76.1	8.1	T	21859	16605	4401	6720	25907	9374	4650	2685	0.2	0.4	0.18	0.29
97-08-07 13-51-46	74	S	57.8	7.4	L	41056	23077	835	-218	49890	19320	1351	386	0.02	-0.01	0.03	0.02
97-08-07 13-51-46	74	S	57.8	7.4	L	45710	22206	3392	2505	53510	17894	-577	1118	0.07	0.11	-0.01	0.06
97-08-07 13-51-46	74	S	57.9	7.4	L	41383	23558	2215	102	48502	17294	1374	1038	0.05	0	0.03	0 06
97-08-07 13-51-46	74	S	57.9	7.4	L	43868	22172	1591	2143	50751	17060	-839	756	0.04	0.1	-0.02	0.04
97-08-07 13-51-46	74	S	57.9	7.4	L	42794	25214	8429	2437	57278	19735	9027	3143	0.2	0.1	0.16	0.16
97-08-07 13-51-46	74	S	57.9	7.4	L	45463	24696	3201	873	48214	20584	-1933	-65	0.07	0.04	-0.04	0
97-08-07 13-51-46	74	S	57.9	7.5	L	46122	25494	13279	5103	53929	16858	8722	3882	0.29	0.2	0.16	0.23
97-08-07 13-51-46	74	S	57.9	7.5	L	47906	29057	6979	2731	51039	19781	-2085	186	0.15	0.09	-0.04	0.01
97-08-07 13-51-46	74	S	57.9	7.5	LT	18978	15310	2454	389	23982	10561	-2115	-202	0.13	0.03	-0.09	-0.02
97-08-07 13-51-46	74	S	58	7.5	T	22138	13833	2048	548	23015	12899	-3236	-323	0.09	0.04	-0.14	-0.03
97-08-07 13-51-46	74	S	58	7.5	T	18424	14391	2522	523	21169	11218	-4626	-313	0.14	0.04	-0.22	-0.03
97-08-07 13-51-46	74	S	58.1	7.5	T	17583	13271	3336	777	23693	11691	-4589	-444	0.19	0.06	-0.19	-0.04
97-08-07 13-51-46	74	S	58.1	7.5	T	17166	13885	4423	1124	21602	11188	-3703	-383	0.26	0.08	-0.17	-0.03
97-08-07 13-51-46	74	S	58.2	7.6	T	18264	13271	3275	765	21175	11178	-4351	-390	0.18	0.06	-0.21	-0.03
97-08-07 13-51-46	74	S	58.2	7.6	T	19635	12551	2640	641	21755	10403	-4859	-295	0.13	0.05	-0.22	-0.03
97-08-07 13-51-46	74	S	58.2	7.6	T	17627	13781	3259	587	21826	9925	-3594	-78	0.18	0.04	-0.16	-0.01
97-08-07 13-51-46	74	S	58.2	7.6	T	17189	13251	3483	750	21992	10413	-3810	-237	0.2	0.06	-0.17	-0.02
97-08-07 13-51-46	74	S	58.2	7.6	T	19713	13717	3646	343	22212	10594	-4114	-332	0.18	0.03	-0.19	-0.03
97-08-07 13-51-46	74	S	58.3	7.6	T	20953	13175	3058	644	24738	10308	-4308	-186	0.15	0.05	-0.17	-0.02
97-08-07 13-51-46	74	S	58.3	7.6	T	19202	13494	3409	943	22601	10364	-3382	-173	0.18	0.07	-0.15	-0.02
97-08-07 13-51-46	74	S	58.3	7.6	T	20912	13116	5178	1312	24600	11535	-2989	-248	0.25	0.1	-0.12	-0.02
97-08-07 13-51-46	74	S	58.3	7.6	T	20940	15678	5204	2871	24875	10956	-985	258	0.25	0.18	-0.04	0.02

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-07 14-09-50	74	N	20.7	-2.5	T	19746	19810	4414	5476	18214	21797	4671	6133	0.22	0.28	0.26	0.28
97-08-07 14-09-50	74	N	20.6	-2.6	T	16878	18982	1089	2633	16491	21718	3458	5698	0.06	0.14	0.21	0.26
97-08-07 14-09-50	74	N	20.3	-2.6	T	14590	18702	1475	1064	13445	20901	-40	972	0.1	0.06	0	0.05
97-08-07 14-09-50	74	N	19.9	-2.6	T	15671	17976	2389	1671	15729	19111	-130	846	0.15	0.09	-0.01	0.04
97-08-07 14-09-50	74	N	19.6	-2.7	T	14943	18920	2024	1529	14643	19412	-56	788	0.14	0.08	0	0.04
97-08-07 14-09-50	74	N	19.3	-2.7	T	14063	18886	2145	1537	13263	18894	-184	731	0.15	0.08	-0.01	0.04
97-08-07 14-09-50	74	N	18.9	-2.8	T	14367	20288	2267	1674	12589	20412	-80	1464	0.16	0.08	-0.01	0.07
97-08-07 14-09-50	74	N	18.6	-2.8	T	14679	17756	2282	1869	14284	17939	144	1779	0.16	0.11	0.01	0.1
97-08-07 14-09-50	74	N	18.2	-2.9	T	14777	19685	1197	798	13865	19216	-86	1854	0.08	0.04	-0.01	0.1
97-08-07 14-09-50	74	N	17.3	-3	T	16055	18737	2338	1447	15298	20709	1613	2080	0.15	0.08	0.11	0.1
97-08-07 14-09-50	74	N	15.5	-3.2	T	14925	19720	2375	1864	13477	20676	1394	2490	0.16	0.09	0.1	0.12
97-08-07 14-24-19	76	N	16.2	-4.5	T	18595	22002	4100	6892	16164	24315	1896	4136	0.22	0.31	0.12	0.17
97-08-07 14-24-19	76	N	16	-4.5	T	16188	21257	-276	1414	14815	22277	1042	3195	-0.02	0.07	0.07	0.14
97-08-07 14-24-19	76	N	15.8	-4.6	T	14282	19170	361	199	13511	20751	86	1419	0.03	0.01	0.01	0.07
97-08-07 14-24-19	76	N	15.5	-4.6	T	13907	20761	2157	2707	13937	19917	433	1111	0.16	0.13	0.03	0.06
97-08-07 14-24-19	76	N	15.4	-4.6	T	13822	20006	2002	2508	14050	21263	224	1312	0.14	0.13	0.02	0.06
97-08-07 14-24-19	76	N	15.3	-4.6	T	13578	17690	718	393	13084	19946	151	823	0.05	0.02	0.01	0.04
97-08-07 14-24-19	76	N	15.3	-4.6	T	15542	18533	1466	2080	14580	19362	239	1273	0.09	0.11	0.02	0.07
97-08-07 14-24-19	76	N	15.3	-4.6	T	12816	19324	1902	2465	12984	19972	297	1110	0.15	0.13	0.02	0.06
97-08-07 14-24-19	76	N	15.4	-4.6	T	13309	18793	2330	2793	13337	22228	189	435	0.18	0.15	0.01	0.02
97-08-07 14-24-19	76	N	15.5	-4.6	T	14750	22486	1698	2355	13340	20233	154	949	0.12	0.1	0.01	0.05
97-08-07 14-24-19	76	N	15.6	-4.6	T	13347	20036	2071	3015	12817	21290	193	997	0.16	0.15	0.02	0.05
97-08-07 14-24-19	76	N	15.7	-4.6	T	14085	20194	1855	1651	13572	20921	240	548	0.13	0.08	0.02	0.03
97-08-07 14-24-19	76	N	15.9	-4.6	T	16265	23925	2818	3424	15103	25207	2058	2503	0.17	0.14	0.14	0.1
97-08-07 14-24-19	76	N	16	-4.5	LT	13413	21818	2845	2717	13116	22360	2887	3060	0.21	0.12	0.22	0.14
97-08-07 14-24-19	76	N	16	-4.5	L	31380	38035	2507	8330	28288	43959	5545	8368	0.08	0.22	0.2	0.19
97-08-07 14-24-19	76	N	16	-4.5	L	29948	40607	-270	981	26370	46988	413	3343	-0.01	0.02	0.02	0.07
97-08-07 14-24-19	76	N	16.1	-4.5	L	27687	43760	137	7770	28408	43945	4795	8273	0	0.18	0.17	0.19
97-08-07 14-24-19	76	N	16.2	-4.5	L	28555	41912	123	229	27865	45133	527	2278	0	0.01	0.02	0.05
97-08-07 14-24-19	76	N	16.2	-4.5	L	28618	38938	2966	6498	26345	44803	3907	7841	0.1	0.17	0.15	0.18
97-08-07 14-24-19	76	N	16.2	-4.5	L	24665	43462	-52	3318	22026	46983	601	3819	0	0.08	0.03	0.08
97-08-07 14-24-19	76	N	16.3	-4.5	L	28144	41053	3313	9987	26554	45011	4422	8625	0.12	0.24	0.17	0.19
97-08-07 14-24-19	76	N	16.3	-4.5	L	25327	42344	-13	2158	23954	46803	692	3839	0	0.05	0.03	0.08
97-08-07 14-39-16	76	S	73.9	7.3	L	39196	25255	8722	8834	47004	15631	11494	3550	0.22	0.35	0.24	0.23
97-08-07 14-39-16	76	S	74	7.3	L	38933	24570	8062	8422	45005	21574	7249	3185	0.21	0.34	0.16	0.15
97-08-07 14-39-16	76	S	74	7.3	L	40893	22065	10595	6365	45425	21667	9996	2815	0.26	0.29	0.22	0.13
97-08-07 14-39-16	76	S	74	7.3	L	39036	23631	4759	-360	41954	20433	6367	264	0.12	-0.02	0.15	0.01
97-08-07 14-39-16	76	S	74	7.3	L	38766	25095	3756	3786	50800	15730	13749	1372	0.1	0.15	0.27	0.09
97-08-07 14-39-16	76	S	74	7.3	L	43901	25663	5769	-1321	49036	17725	8299	-518	0.13	-0.05	0.17	-0.03
97-08-07 14-39-16	76	S	74.1	7.4	L	41530	22221	8735	3481	46090	17624	8914	1584	0.21	0.16	0.19	0.09
97-08-07 14-39-16	76	S	74.1	7.4	L	41018	23293	4219	-1247	44856	16913	7838	-361	0.1	-0.05	0.17	-0.02
97-08-07 14-39-16	76	S	74.1	7.4	LT	15196	18038	4887	6232	18631	13801	2218	-144	0.32	0.35	0.12	-0.01
97-08-07 14-39-16	76	S	74.1	7.4	T	18964	14998	995	-940	20870	12593	1397	-235	0.05	-0.06	0.07	-0.02
97-08-07 14-39-16	76	S	74.2	7.4	T	18359	13651	2398	3649	21271	10477	2964	571	0.13	0.27	0.14	0.05
97-08-07 14-39-16	76	S	74.3	7.4	T	18218	13053	3138	4420	21355	10069	3211	1400	0.17	0.34	0.15	0.14
97-08-07 14-39-16	76	S	74.3	7.4	T	18671	13453	2727	4638	20064	11114	3055	1400	0.15	0.34	0.15	0.13
97-08-07 14-39-16	76	S	74.4	7.5	T	18561	11954	2981	4180	20133	9833	2938	1758	0.16	0.35	0.15	0.18
97-08-07 14-39-16	76	S	74.5	7.5	T	16494	12474	2965	4263	18939	10511	2890	1072	0.18	0.34	0.15	0.1
97-08-07 14-39-16	76	S	74.5	7.5	T	19303	11812	2802	3825	21672	8776	2986	991	0.15	0.32	0.14	0.11
97-08-07 14-39-16	76	S	74.6	7.5	T	18103	11727	3078	4109	19947	9778	2613	1299	0.17	0.35	0.13	0.13
97-08-07 14-39-16	76	S	74.7	7.6	T	17622	11948	2800	4265	20516	9870	3072	1225	0.16	0.36	0.15	0.12
97-08-07 14-39-16	76	S	74.7	7.6	T	18153	13709	2744	4440	21240	10101	2651	1236	0.15	0.32	0.12	0.12
97-08-07 14-39-16	76	S	74.8	7.6	T	20042	11341	3145	3589	21117	9694	3173	1040	0.16	0.32	0.15	0.11
97-08-07 14-39-16	76	S	74.8	7.6	T	20593	12249	4181	5005	24622	11265	3717	2038	0.2	0.41	0.15	0.18
97-08-07 14-39-16	76	S	74.8	7.6	T	18812	12036	3441	5748	24919	8911	4034	2501	0.18	0.48	0.16	0.28
97-08-07 14-39-37	74	S	58.1	7.5	L	41193	21557	1217	140	49720	17952	6089	1246	0.03	0.01	0.12	0.07
97-08-07 14-39-37	74	S	58.1	7.5	L	45245	20733	3061	3056	52958	15770	5577	2222	0.07	0.15	0.11	0.14
97-08-07 14-39-37	74	S	58.1	7.5	L	40280	20852	2812	542	50890	16217	6087	1411	0.07	0.03	0.12	0.09
97-08-07 14-39-37	74	S	58.1	7.5	L	42506	20138	1572	2983	51582	15261	4836	2011	0.04	0.15	0.09	0.13
97-08-07 14-39-37	74	S	58.1	7.5	L	41820	24423	7712	2535	52750	16610	13916	3678	0.18	0.1	0.26	0.22
97-08-07 14-39-37	74	S	58.1	7.5	L	43347	22968	3387	1414	47076	19365	4632	1245	0.08	0.06	0.1	0.06
97-08-07 14-39-37	74	S	58.2	7.6	L	43014	23856	10271	4907	53541	15749	14000	4288	0.24	0.21	0.26	0.27
97-08-07 14-39-37	74	S	58.2	7.6	L	42977	25331	5819	2474	48298	18751	4204	1398	0.14	0.1	0.09	0.07
97-08-07 14-39-37	74	S	58.2	7.6	LT	18734	13214	3302	529	24046	9152	3417	955	0.18	0.04	0.14	0.1
97-08-07 14-39-37	74	S	58.2	7.6	T	21497	12782	2517	1044	24458	12655	2514	664	0.12	0.08	0.1	0.05
97-08-07 14-39-37	74	S	58.3	7.6	T	17612	12649	2390	1057	23391	10748	1069	697	0.14	0.08	0.05	0.06
97-08-07 14-39-37	74	S	58.4	7.6	T	17434	12599	3202	1300	23247	10580	1192	771	0.18	0.1	0.05	0.07
97-08-07 14-39-37	74	S	58.4	7.7	T	16783	13261	3350	1675	24123	10309	2324	715	0.2	0.13	0.1	0.07
97-08-07 14-39-37	74	S	58.5	7.7	T	18173	12238	3288	1182	21724	10019	1411	822	0.18	0.1	0.06	0.08

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-07 14-39-37	74	S	58.6	7.7	T	18105	11238	2601	882	22657	9146	896	813	0.14	0.08	0.04	0.09
97-08-07 14-39-37	74	S	58.7	7.8	T	17893	15407	3148	820	22693	9292	2099	785	0.18	0.05	0.09	0.08
97-08-07 14-39-37	74	S	58.7	7.8	T	17011	12184	3427	1271	21977	9592	1744	938	0.2	0.1	0.08	0.1
97-08-07 14-39-37	74	S	58.8	7.8	T	18931	12490	3333	831	22140	9972	1869	664	0.18	0.07	0.08	0.07
97-08-07 14-39-37	74	S	58.9	7.9	T	19247	12275	3031	1146	22703	8990	1669	873	0.16	0.09	0.07	0.1
97-08-07 14-39-37	74	S	59	7.9	T	19606	12474	3476	1228	25045	9271	2453	880	0.18	0.1	0.1	0.09
97-08-07 14-39-37	74	S	59.2	8	T	20919	12216	5030	1773	23706	10504	3183	913	0.24	0.15	0.13	0.09
97-08-07 14-39-37	74	S	59.3	8	T	20927	13139	5227	2434	27401	9597	4957	1559	0.25	0.19	0.18	0.16
97-08-11 13-21-08	76	S	72.5	6.8	L	39232	28097	5209	2310	49929	18506	10241	1375	0.13	0.08	0.21	0.07
97-06-11 13-21-08	76	S	72.5	6.8	L	38859	29065	5588	4866	49463	21290	7170	2406	0.14	0.17	0.14	0.11
97-08-11 13-21-08	76	S	72.6	6.9	L	43150	23742	8390	6223	47009	19752	7454	2860	0.19	0.26	0.16	0.14
97-08-11 13-21-08	76	S	72.5	6.8	L	40955	25177	3781	599	44675	24133	4570	647	0.09	0.02	0.1	0.03
97-08-11 13-21-08	76	S	72.6	6.9	L	36585	26819	3832	3973	50144	16375	14303	2081	0.1	0.15	0.29	0.13
97-08-11 13-21-08	76	S	72.6	6.9	L	42092	26826	5393	-1072	49221	19719	7084	-605	0.13	-0.04	0.14	-0.03
97-08-11 13-21-08	76	S	72.6	6.9	L	40903	24176	8145	4832	45943	18429	8692	1329	0.2	0.2	0.19	0.07
97-08-11 13-21-08	76	S	72.6	6.9	L	40080	24920	4048	-784	45855	18079	8025	-428	0.1	-0.03	0.18	-0.02
97-08-11 13-21-08	76	S	72.6	6.9	LT	17449	17404	7555	10254	20452	13689	5406	2124	0.43	0.59	0.26	0.16
97-08-11 13-21-08	76	S	72.6	6.9	T	18665	15625	1995	-924	20969	13080	1821	-328	0.11	-0.06	0.09	-0.03
97-08-11 13-21-08	76	S	72.6	6.9	T	16770	13566	1329	1000	18885	14000	1919	-220	0.08	0.07	0.1	-0.02
97-08-11 13-21-08	76	S	72.7	6.9	T	17228	14090	2059	3276	18328	12124	2282	7	0.12	0.23	0.12	0
97-08-11 13-21-08	76	S	72.7	6.9	T	17576	13671	3114	3917	20134	11841	1687	-49	0.18	0.29	0.08	0
97-08-11 13-21-08	76	S	72.8	6.9	T	16090	13128	1838	2755	18146	11109	1254	236	0.11	0.21	0.07	0.02
97-08-11 13-21-08	76	S	72.8	6.9	T	16732	15528	2394	3228	18236	11609	2168	695	0.14	0.21	0.12	0.06
97-08-11 13-21-08	76	S	72.9	7	T	17138	12739	2600	3912	19968	10794	2461	1106	0.15	0.31	0.12	0.1
97-08-11 13-21-08	76	S	73	7	T	16630	14269	1876	3783	19885	11502	2300	793	0.11	0.27	0.12	0.07
97-08-11 13-21-08	76	S	73	7	T	17128	13443	2179	3116	19784	10835	2426	502	0.13	0.23	0.12	0.05
97-08-11 13-21-08	76	S	73.1	7	T	17375	12940	1990	3380	20135	10824	2348	507	0.11	0.26	0.12	0.05
97-08-11 13-21-08	76	S	73.1	7	T	17726	12702	2146	2957	20655	11053	2541	730	0.12	0.23	0.12	0.07
97-08-11 13-21-08	76	S	73.2	7.1	T	19479	14179	2812	4416	22037	12852	2534	1241	0.14	0.31	0.11	0.1
97-08-11 13-21-08	76	S	73.3	7.1	T	18976	12797	2006	3961	21733	10326	2241	908	0.11	0.31	0.1	0.09
97-08-11 13-24-16	74	S	51.1	4.9	L	41826	25186	9435	6657	52331	23613	14571	7890	0.23	0.26	0.28	0.33
97-08-11 13-24-16	74	S	51.1	4.9	L	43121	24275	1229	1892	48348	22548	1925	2304	0.03	0.08	0.04	0.1
97-08-11 13-24-16	74	S	51.1	4.9	L	39070	26680	7311	4808	48438	23697	11497	6048	0.19	0.18	0.24	0.26
97-08-11 13-24-16	74	S	51.1	4.9	L	41483	25526	1696	2713	45898	23162	1376	2269	0.04	0.11	0.03	0.1
97-08-11 13-24-16	74	S	51.1	4.9	L	43206	33574	11796	7026	51018	22213	16724	7736	0.27	0.21	0.33	0.35
97-08-11 13-24-16	74	S	51.1	4.9	L	42187	29271	2457	1032	47264	25129	2567	857	0.06	0.04	0.05	0.03
97-08-11 13-24-16	74	S	51.1	4.9	L	40708	28658	15342	9996	50224	23139	17204	8191	0.38	0.35	0.34	0.35
97-08-11 13-24-16	74	S	51.1	4.9	L	42165	30851	8565	8703	46858	24550	5019	1566	0.2	0.28	0.11	0.06
97-08-11 13-24-16	74	S	51.1	4.9	LT	19598	16543	3490	572	24790	13207	3914	632	0.18	0.03	0.16	0.05
97-08-11 13-24-16	74	S	51.1	4.9	T	20088	13589	2124	593	23590	14461	2850	215	0.11	0.04	0.12	0.01
97-08-11 13-24-16	74	S	51.1	4.9	T	19242	12129	1680	793	22291	11642	722	500	0.09	0.07	0.03	0.04
97-08-11 13-24-16	74	S	51.1	4.9	T	17677	14036	1625	723	21074	12305	186	376	0.09	0.05	0.01	0.03
97-08-11 13-24-16	74	S	51.1	4.9	T	19390	11265	2285	779	23773	11438	77	481	0.12	0.07	0	0.04
97-08-11 13-24-16	74	S	51.2	5	T	17919	11933	2278	1132	20468	10571	-113	544	0.13	0.09	-0.01	0.05
97-08-11 13-24-16	74	S	51.3	5	T	23133	11191	2790	1402	23002	10846	414	596	0.12	0.13	0.02	0.05
97-08-11 13-24-16	74	S	51.3	5	T	17871	12694	2835	1129	21591	12240	681	414	0.16	0.09	0.03	0.03
97-08-11 13-24-16	74	S	51.4	5	T	18393	12626	488	703	21918	11810	361	364	0.03	0.06	0.02	0.03
97-08-11 13-24-16	74	S	51.6	5.1	T	18587	13306	1731	1032	22293	11347	286	655	0.09	0.08	0.01	0.06
97-08-11 13-24-16	74	S	51.7	5.1	T	19590	12592	1716	1088	21469	11798	-100	525	0.09	0.09	0	0.04
97-08-11 13-24-16	74	S	51.8	5.2	T	19787	11804	1686	885	22405	11165	-34	592	0.09	0.07	0	0.05
97-08-11 13-24-16	74	S	52	5.2	T	18889	14302	4342	1905	23930	14801	765	623	0.23	0.13	0.03	0.04
97-08-11 13-24-16	74	S	52.1	5.3	T	16971	15986	4969	2855	20581	13750	257	401	0.29	0.18	0.01	0.03
97-08-12 16-38-28	34	N	57.1	5.9	L	44256	25713	12474	4989	44341	24634	19327	8514	0.28	0.19	0.44	0.35
97-08-12 16-38-28	34	N	57.1	5.9	L	38957	27971	3815	1324	43560	28505	7997	4779	0.1	0.05	0.18	0.17
97-08-12 16-38-28	34	N	57.1	5.9	L	40471	29004	9126	5654	46017	23908	17475	9144	0.23	0.19	0.38	0.38
97-08-12 16-38-28	34	N	57.1	5.9	L	36064	27540	4989	236	47739	28258	10588	2433	0.14	0.01	0.22	0.09
97-08-12 16-38-28	34	N	57.1	5.9	L	46181	24587	8714	2479	44452	24412	11925	5616	0.19	0.1	0.27	0.23
97-08-12 16-38-28	34	N	57.2	5.9	L	42328	27719	4459	-66	43347	25757	6911	805	0.11	0	0.16	0.03
97-08-12 16-38-28	34	N	57.2	5.9	L	46288	25872	8710	3902	48361	23174	14089	7186	0.19	0.15	0.29	0.31
97-08-12 16-38-28	34	N	57.2	5.9	L	42492	26813	5465	-98	49427	23611	8669	248	0.13	0	0.18	0.01
97-08-12 16-38-28	34	N	57.2	5.9	LT	20756	14760	5752	2362	22125	15085	8441	2854	0.28	0.16	0.38	0.19
97-08-12 16-38-28	34	N	57.2	5.9	T	20053	15085	2618	-129	22556	15412	4287	105	0.13	-0.01	0.19	0.01
97-08-12 16-38-28	34	N	57.3	6	T	20337	12969	6393	916	23288	12639	4207	173	0.31	0.07	0.18	0.01
97-08-12 16-38-28	34	N	57.4	6	T	20257	13257	6311	888	22378	12529	3997	203	0.31	0.07	0.18	0.02
97-08-12 16-38-28	34	N	57.4	6	T	20830	14008	6634	717	22161	12184	4190	119	0.32	0.05	0.19	0.01
97-08-12 16-38-28	34	N	57.5	6	T	20091	12910	5232	1002	22588	12004	6728	2513	0.26	0.08	0.3	0.21
97-08-12 16-38-28	34	N	57.6	6.1	T	18880	13696	5876	976	20951	12833	5799	1551	0.31	0.07	0.28	0.12
97-08-12 16-38-28	34	N	57.6	6.1	T	22366	12912	6257	1293	21739	12176	4868	227	0.28	0.1	0.22	0.02
97-08-12 16-38-28	34	N	57.7	6.1	T	19581	13446	6272	1368	21710	11616	4534	336	0.32	0.1	0.21	0.03

Talgo Trainset Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-12 16-38-2	34	N	57.7	6.1	T	20163	13117	6188	1593	22475	12748	3943	128	0.31	0.12	0.18	0.01
97-08-12 16-38-2	34	N	57.8	6.1	T	19770	13308	6391	1231	22019	12664	4741	107	0.32	0.09	0.22	0.01
97-08-12 16-38-2	34	N	57.9	6.2	T	20432	12567	6188	1362	22439	11791	5890	1509	0.3	0.11	0.26	0.13
97-08-12 16-38-2	34	N	58	6.2	T	20372	16250	6188	1835	23219	15509	4296	292	0.3	0.11	0.19	0.02
97-08-12 16-38-2	34	N	58	6.2	T	22938	14688	6682	1281	26025	12704	7145	-66	0.29	0.09	0.27	-0.01
97-08-13 17-23-3	34	N	61.9	7.7	L	43374	21388	13365	4107	49693	22983	23735	10967	0.31	0.19	0.48	0.48
97-08-13 17-23-3	34	N	61.9	7.7	L	46002	25405	5509	1637	48676	25572	10926	5341	0.12	0.06	0.22	0.21
97-08-13 17-23-3	34	N	61.9	7.7	L	47277	30213	11934	6018	49392	21050	20070	10540	0.25	0.2	0.41	0.5
97-08-13 17-23-3	34	N	61.9	7.7	L	42625	28839	7214	-57	51276	24083	13438	3676	0.17	0	0.26	0.15
97-08-13 17-23-3	34	N	61.9	7.7	L	47067	23670	9983	2730	47634	20849	14137	6130	0.21	0.12	0.3	0.29
97-08-13 17-23-3	34	N	61.9	7.7	L	44858	25488	5385	-200	47345	23158	8196	847	0.12	-0.01	0.17	0.04
97-08-13 17-23-3	34	N	61.9	7.7	L	48111	24182	10495	3362	52233	21035	15680	7603	0.22	0.14	0.3	0.36
97-08-13 17-23-3	34	N	61.9	7.7	L	45430	23784	6119	48	52998	19837	11310	214	0.13	0	0.21	0.01
97-08-13 17-23-3	34	N	61.9	7.7	LT	21483	13399	6342	2544	23934	14008	10770	4178	0.3	0.19	0.45	0.3
97-08-13 17-23-3	34	N	61.9	7.7	T	20802	15058	3099	172	24085	14767	4769	57	0.15	0.01	0.2	0
97-08-13 17-23-3	34	N	62	7.7	T	21600	12460	4194	-264	24773	10963	6479	2030	0.19	-0.02	0.26	0.19
97-08-13 17-23-3	34	N	62	7.7	T	21876	12787	6188	744	24364	11399	6085	2069	0.28	0.06	0.25	0.18
97-08-13 17-23-3	34	N	62	7.7	T	20788	12898	7107	786	25261	10562	6703	1746	0.34	0.06	0.27	0.17
97-08-13 17-23-3	34	N	62.1	7.8	T	20711	12388	3917	-157	23794	10956	7133	2681	0.19	-0.01	0.3	0.24
97-08-13 17-23-3	34	N	62.2	7.8	T	19441	14173	5156	356	21687	12009	6074	1468	0.27	0.03	0.28	0.12
97-08-13 17-23-3	34	N	62.2	7.8	T	22511	11515	6430	1273	26320	10732	6110	922	0.29	0.11	0.23	0.09
97-08-13 17-23-3	34	N	62.3	7.8	T	21222	10396	6866	1535	24015	10141	6682	1894	0.32	0.15	0.28	0.19
97-08-13 17-23-3	34	N	62.4	7.9	T	20905	12098	6009	1059	23537	11245	6446	1380	0.29	0.09	0.27	0.12
97-08-13 17-23-3	34	N	62.5	7.9	T	20308	12714	7143	1094	23355	11130	4789	-43	0.35	0.09	0.21	0
97-08-13 17-23-3	34	N	62.6	8	T	20715	12991	5618	269	25868	10422	7361	2119	0.27	0.02	0.28	0.2
97-08-13 17-23-3	34	N	62.7	8	T	21077	15664	6455	1338	25490	13749	6655	2173	0.31	0.09	0.26	0.16
97-08-13 17-23-3	34	N	62.8	8	T	23524	15022	5007	-205	28806	12557	8044	-42	0.21	-0.01	0.28	0

Appendix C: Regular Traffic Raw Data

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 15-20-14	74	N	37.9	0.9	L	35395	30559	2942	2337	38310	30108	6883	6524	0.08	0.08	0.18	0.22
97-08-05 15-20-14	74	N	37.9	0.9	L	35829	31098	2568	1208	32014	31739	2235	2464	0.07	0.04	0.07	0.08
97-08-05 15-20-14	74	N	37.9	0.9	L	31064	32502	2457	1796	35345	31235	7481	6841	0.08	0.06	0.21	0.22
97-08-05 15-20-14	74	N	37.9	0.9	L	31539	35265	1588	364	33303	32760	2804	3620	0.05	0.01	0.08	0.11
97-08-05 15-20-14	74	N	37.9	0.9	L	34535	30171	7636	7572	36294	31092	9342	9785	0.22	0.25	0.26	0.31
97-08-05 15-20-14	74	N	37.9	0.9	L	33468	34884	4063	2413	33826	34413	2303	2987	0.12	0.07	0.07	0.09
97-08-05 15-20-14	74	N	38	0.9	L	32684	36677	8963	8231	34729	32009	11040	10264	0.27	0.22	0.32	0.32
97-08-05 15-20-14	74	N	37.9	0.9	L	32160	37948	896	425	40277	36088	1202	3201	0.03	0.01	0.03	0.09
97-08-05 15-20-14	74	N	38	0.9	L	35363	29370	3748	3676	34465	26901	6815	8058	0.11	0.13	0.2	0.3
97-08-05 15-20-14	74	N	37.9	0.9	L	35727	35981	1604	1871	41711	34440	2776	4923	0.04	0.05	0.07	0.14
97-08-05 15-20-14	74	N	38	0.9	L	24617	38553	4201	5950	31180	38407	7486	8855	0.17	0.15	0.24	0.23
97-08-05 15-20-14	74	N	38	0.9	L	33333	37295	91	121	38872	33059	-1335	165	0	0	-0.03	0
97-08-05 15-20-14	74	N	37.9	0.9	F	9418	7495	882	1201	9270	7794	497	1590	0.09	0.16	0.05	0.2
97-08-05 15-20-14	74	N	37.9	0.9	F	10139	7665	521	464	9163	8463	-117	849	0.05	0.06	-0.01	0.1
97-08-05 15-20-14	74	N	38	0.9	F	7445	9280	910	1460	9757	8017	435	1829	0.12	0.16	0.04	0.23
97-08-05 15-20-14	74	N	38	0.9	F	8428	10879	328	346	8398	9854	-253	750	0.04	0.03	-0.03	0.08
97-08-05 15-20-14	74	N	37.9	0.9	F	8955	7532	-53	993	7831	8075	-100	1801	-0.01	0.13	-0.01	0.22
97-08-05 15-20-14	74	N	38	0.9	F	8636	8222	-172	737	7550	9204	8	1145	-0.02	0.09	0	0.12
97-08-05 15-20-14	74	N	38	0.9	F	7955	9223	94	843	9998	7748	362	1503	0.01	0.09	0.04	0.19
97-08-05 15-20-14	74	N	38	0.9	F	6683	7725	834	285	9867	8462	-197	1208	0.12	0.04	-0.02	0.14
97-08-05 15-20-14	74	N	38	0.9	F	10358	8629	92	1429	12635	8381	785	1991	0.01	0.17	0.06	0.24
97-08-05 15-20-14	74	N	38	0.9	F	8892	8381	195	965	8452	8989	85	1171	0.02	0.12	0.01	0.13
97-08-05 15-20-14	74	N	38	0.9	F	7787	8749	1057	1589	9199	7833	857	2037	0.14	0.18	0.09	0.26
97-08-05 15-20-14	74	N	38	0.9	F	8789	10526	352	287	9226	9364	-322	1271	0.04	0.03	-0.03	0.14
97-08-05 15-20-14	74	N	38	0.9	F	11213	8892	2091	2709	9842	8524	2791	3260	0.19	0.3	0.28	0.38
97-08-05 15-20-14	74	N	38	0.9	F	10067	9109	174	670	8832	9739	635	2451	0.02	0.07	0.07	0.25
97-08-05 15-20-14	74	N	38	0.9	F	7665	10234	528	1544	8696	7989	232	1776	0.07	0.15	0.03	0.22
97-08-05 15-20-14	74	N	38	0.9	F	8050	8874	229	521	8792	8876	-246	1231	0.03	0.06	-0.03	0.14
97-08-05 15-20-14	74	N	38	0.9	F	9068	8061	578	1281	9114	7900	450	2147	0.06	0.16	0.05	0.27
97-08-05 15-20-14	74	N	38	0.9	F	9298	8556	205	449	8286	8630	-30	1141	0.02	0.05	0	0.13
97-08-05 15-20-14	74	N	38	0.9	F	7664	10957	-135	1605	9252	10168	1334	2864	-0.02	0.15	0.14	0.28
97-08-05 15-20-14	74	N	38	0.9	F	9492	9030	1031	422	8750	10304	-156	1287	0.11	0.05	-0.02	0.12
97-08-05 15-20-14	74	N	38	0.9	F	11541	6091	2077	1811	9035	9458	2181	3155	0.18	0.3	0.24	0.33
97-08-05 15-20-14	74	N	38	0.9	F	9936	7606	139	667	8570	10814	5	1296	0.01	0.09	0	0.12
97-08-05 15-20-14	74	N	38	0.9	F	7264	9520	573	533	9589	8238	2032	3024	0.08	0.06	0.21	0.37
97-08-05 15-20-14	74	N	38	0.9	F	6007	11660	1080	413	7663	8707	-113	1205	0.18	0.04	-0.01	0.14
97-08-05 15-20-14	74	N	38	0.9	F	7884	9122	1563	1852	7675	10032	1062	2657	0.2	0.2	0.14	0.26
97-08-05 15-20-14	74	N	38	0.9	F	8240	9963	162	758	7498	9284	102	1162	0.02	0.08	0.01	0.13
97-08-05 15-20-14	74	N	38	0.9	F	9181	9547	1338	1272	8051	7139	1175	2304	0.15	0.13	0.15	0.32
97-08-05 15-20-14	74	N	38	0.9	F	8685	10313	996	536	8268	10309	209	1485	0.11	0.05	0.03	0.14
97-08-05 15-20-14	74	N	38	0.9	F	13185	8288	1548	1920	9631	10743	684	2948	0.12	0.23	0.07	0.27
97-08-05 15-20-14	74	N	38	0.9	F	10611	8458	67	533	8728	12585	126	1315	0.01	0.06	0.01	0.1
97-08-05 15-20-14	74	N	38	0.9	F	8388	9722	3193	2458	8892	10136	2886	3739	0.38	0.25	0.32	0.37
97-08-05 15-20-14	74	N	38	0.9	F	8298	10669	447	317	9033	9682	-356	1121	0.05	0.03	-0.04	0.12
97-08-05 15-20-14	74	N	38	0.9	F	10733	6944	1770	1840	10277	8395	2507	2997	0.16	0.27	0.24	0.36
97-08-05 15-20-14	74	N	38	0.9	F	9897	8923	1094	1793	8596	9061	753	2894	0.11	0.2	0.09	0.32
97-08-05 15-20-14	74	N	38	0.9	F	8318	8966	1349	1697	8500	7203	1378	1920	0.16	0.19	0.16	0.27
97-08-05 15-20-14	74	N	38	0.9	F	7717	8658	434	446	8815	7936	-228	1005	0.06	0.05	-0.03	0.13
97-08-05 15-20-14	74	N	38	0.9	F	10038	8144	1386	1743	9849	8284	929	2310	0.14	0.21	0.09	0.28
97-08-05 15-20-14	74	N	38	0.9	F	9883	8089	153	345	9449	9659	15	1053	0.02	0.04	0	0.11
97-08-05 15-20-14	74	N	38	0.9	F	7978	11572	1242	1957	8382	10029	1353	2534	0.16	0.17	0.16	0.25
97-08-05 15-20-14	74	N	38	0.9	F	7314	9776	390	408	7498	9458	-199	787	0.05	0.04	-0.03	0.08
97-08-05 15-20-14	74	N	38	0.9	F	9403	8465	-452	1016	10627	10277	84	2181	-0.05	0.12	0.01	0.21
97-08-05 15-20-14	74	N	38	0.9	F	8947	15098	327	1136	7786	10386	469	1542	0.04	0.08	0.06	0.15
97-08-05 15-20-14	74	N	38	0.9	F	8371	10885	3027	2411	12042	10251	4773	3655	0.36	0.22	0.4	0.36
97-08-05 15-20-14	74	N	38	0.9	F	7899	11200	1548	1336	8535	9973	2191	3347	0.2	0.12	0.26	0.34
97-08-05 15-20-14	74	N	38	0.9	F	9807	7457	1866	1751	9343	8754	2864	3280	0.19	0.23	0.31	0.37
97-08-05 15-20-14	74	N	38	0.9	F	10533	7949	396	373	8600	8960	872	2125	0.04	0.05	0.1	0.24
97-08-05 15-20-14	74	N	38	0.9	F	9070	7970	2368	2093	9199	7312	2395	2664	0.26	0.26	0.26	0.36
97-08-05 15-20-14	74	N	38	0.9	F	10397	8156	739	-284	9728	7928	449	1656	0.07	-0.03	0.05	0.21
97-08-05 15-20-14	74	N	38.1	0.9	F	9034	7080	731	1442	8541	7548	935	2418	0.08	0.2	0.11	0.32
97-08-05 15-20-14	74	N	38.1	0.9	F	9446	7214	273	559	7671	7494	117	1209	0.03	0.08	0.02	0.16
97-08-05 15-20-14	74	N	38.1	1	F	7288	9652	1558	2086	9132	9985	2030	2835	0.21	0.22	0.22	0.28
97-08-05 15-20-14	74	N	38.1	1	F	7791	10091	288	56	8881	10080	-41	862	0.04	0.01	0	0.09
97-08-05 15-20-14	74	N	38.1	1	F	7729	7487	1044	1570	9689	7127	1365	2265	0.14	0.21	0.14	0.32
97-08-05 15-20-14	74	N	38.1	0.9	F	11294	5951	514	364	8604	9025	179	1059	0.05	0.06	0.02	0.12
97-08-05 15-20-14	74	N	38.1	1	F	6089	10324	1180	1934	9753	9521	2019	2599	0.19	0.19	0.21	0.27
97-08-05 15-20-14	74	N	38.1	1	F	7458	10159	491	365	9627	9390	121	1135	0.07	0.04	0.01	0.12
97-08-05 15-20-14	74	N	38.1	1	F	10802	7894	1950	1355	13240	10592	775	3207	0.18	0.17	0.06	0.3

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-05 15-20-14	74	N	38.1	1	F	13577	11219	-254	567	13850	9900	710	971	-0.02	0.05	0.05	0.1
97-08-05 15-20-14	74	N	38.1	1	F	9527	12382	1388	1835	12088	11535	1959	3723	0.15	0.15	0.16	0.32
97-08-05 15-20-14	74	N	38.1	1	F	11304	11814	399	-53	10376	11535	154	1025	0.04	0	0.01	0.09
97-08-05 15-20-14	74	N	38.1	1	F	9602	7444	1171	1727	9363	7327	1408	2303	0.12	0.23	0.15	0.31
97-08-05 15-20-14	74	N	38.1	1	F	9876	8047	446	354	8543	7852	-51	915	0.05	0.04	-0.01	0.12
97-08-05 15-20-14	74	N	38.1	1	F	8554	9020	2217	2235	9370	8155	2284	2942	0.26	0.25	0.24	0.36
97-08-05 15-20-14	74	N	38.1	1	F	7678	9958	231	61	9044	8615	-124	754	0.03	0.01	-0.01	0.09
97-08-05 15-20-14	74	N	38.1	1	F	9341	8116	1596	1608	9104	7040	2090	2217	0.17	0.2	0.23	0.31
97-08-05 15-20-14	74	N	38.1	1	F	9731	7977	61	325	9171	7495	90	1057	0.01	0.04	0.01	0.14
97-08-05 15-20-14	74	N	38.2	1	F	7785	9498	2343	2208	9787	7849	2329	2896	0.3	0.23	0.24	0.37
97-08-05 15-20-14	74	N	38.2	1	F	7393	10085	283	20	9703	7887	-9	765	0.04	0	0	0.1
97-08-05 15-20-14	74	N	38.2	1	F	9139	8544	1306	1957	9781	7613	2977	2803	0.14	0.23	0.3	0.37
97-08-05 15-20-14	74	N	38.2	1	F	10228	7104	1578	1147	8629	9025	486	2225	0.15	0.16	0.06	0.25
97-08-05 15-20-14	74	N	38.2	1	F	9085	9550	2065	2715	10465	8128	3512	3513	0.23	0.28	0.34	0.43
97-08-05 15-20-14	74	N	38.2	1	F	10305	9232	635	283	8755	9119	-7	981	0.06	0.03	0	0.11
97-08-05 15-20-14	74	N	38.2	1	F	10182	8583	1205	1867	10038	9632	1476	3262	0.12	0.22	0.15	0.34
97-08-05 15-20-14	74	N	38.2	1	F	11363	8043	-117	523	8600	9876	-159	1502	-0.01	0.07	-0.02	0.15
97-08-05 15-20-14	74	N	38.2	1	F	9525	10186	2629	2660	9862	10915	2194	3706	0.28	0.26	0.22	0.34
97-08-05 15-20-14	74	N	38.2	1	F	8563	11148	201	-124	9147	10602	-342	934	0.02	-0.01	-0.04	0.09
97-08-05 15-20-14	74	N	38.2	1	F	36678	31043	10708	8078	34021	32590	10240	10766	0.29	0.26	0.3	0.33
97-08-05 15-20-14	74	N	38.2	1	F	32589	36884	-239	300	33468	35971	-635	-666	-0.01	0.01	-0.02	-0.02
97-08-05 15-20-14	74	N	38.2	1	F	34250	30079	-142	2806	39238	27107	7763	7872	0	0.09	0.2	0.29
97-08-05 15-20-14	74	N	38.2	1	F	38940	33284	3357	-352	38978	29920	-1039	-385	0.09	-0.01	-0.03	-0.01
97-08-05 15-20-14	74	N	38.2	1	F	11213	8941	1074	1563	9859	10385	1365	2483	0.1	0.17	0.14	0.24
97-08-05 15-20-14	74	N	38.2	1	F	9731	9900	39	617	8522	11329	62	740	0	0.06	0.01	0.07
97-08-05 15-20-14	74	N	38.3	1	F	8906	10280	91	1611	10281	9068	836	2731	0.01	0.16	0.08	0.3
97-08-05 15-20-14	74	N	38.3	1	F	8628	10641	305	292	9738	9585	-159	739	0.04	0.03	-0.02	0.08
97-08-05 15-20-14	74	N	38.3	1	F	10590	8647	719	1449	9664	9574	1123	2965	0.07	0.17	0.12	0.31
97-08-05 15-20-14	74	N	38.3	1	F	10911	9075	337	503	9273	11084	81	1068	0.03	0.06	0.01	0.1
97-08-05 15-20-14	74	N	38.3	1	F	9293	8835	712	1729	10702	9093	2252	3045	0.08	0.2	0.21	0.33
97-08-05 15-20-14	74	N	38.3	1	F	9250	10310	415	356	9936	9413	-142	612	0.04	0.03	-0.01	0.06
97-08-05 15-20-14	74	N	38.3	1	F	10590	8834	1991	2356	9301	9957	1611	3470	0.19	0.27	0.17	0.35
97-08-05 15-20-14	74	N	38.3	1	F	10282	9422	-74	539	9290	10671	11	1070	-0.01	0.06	0	0.1
97-08-05 15-20-14	74	N	38.3	1	F	9416	9134	1368	1442	9492	9069	1342	2544	0.15	0.16	0.14	0.28
97-08-05 15-20-14	74	N	38.3	1	F	8470	11510	192	760	10286	9451	-256	1057	0.02	0.07	-0.02	0.11
97-08-05 15-20-14	74	N	38.4	1	F	10706	7939	1889	1914	9928	9258	1743	3138	0.18	0.24	0.18	0.34
97-08-05 15-20-14	74	N	38.3	1	F	12140	11806	457	917	8220	10349	526	1395	0.04	0.08	0.06	0.13
97-08-05 15-20-14	74	N	38.4	1	F	7207	5663	-392	576	9652	10007	1725	2629	-0.05	0.1	0.18	0.26
97-08-05 15-20-14	74	N	38.4	1	F	9270	10650	566	-125	7604	9092	381	1017	0.06	-0.01	0.05	0.11
97-08-05 15-20-14	74	N	38.4	1	F	10215	8420	880	1905	9836	8773	1175	2663	0.09	0.23	0.12	0.3
97-08-05 15-20-14	74	N	38.4	1	F	10411	9769	356	974	9355	12297	-2	1676	0.03	0.1	0	0.14
97-08-05 15-20-14	74	N	38.4	1	F	9554	9003	2936	2478	9172	10159	2988	4136	0.31	0.28	0.33	0.41
97-08-05 15-20-14	74	N	38.4	1	F	8388	11872	447	60	10195	11782	410	1613	0.05	0.01	0.04	0.14
97-08-05 15-20-14	74	N	38.4	1	F	10391	9397	1885	1933	9441	10704	1802	3266	0.18	0.21	0.19	0.31
97-08-05 15-20-14	74	N	38.4	1	F	10102	9661	-8	-21	9298	10488	116	1162	0	0	0.01	0.11
97-08-05 15-20-14	74	N	38.4	1	F	9033	9077	1771	2207	10044	9470	1160	2810	0.2	0.24	0.12	0.3
97-08-05 15-20-14	74	N	38.5	1.1	F	7921	10342	375	338	9490	9845	128	1215	0.05	0.03	0.01	0.12
97-08-05 15-20-14	74	N	38.4	1	F	10578	8814	1342	1723	8106	9372	2103	3333	0.13	0.2	0.26	0.36
97-08-05 15-20-14	74	N	38.5	1.1	F	9897	7960	-245	756	8986	9630	508	1326	-0.02	0.1	0.06	0.14
97-08-05 15-20-14	74	N	38.5	1.1	F	7434	9231	49	1417	7753	9522	-33	1621	0.01	0.15	0	0.17
97-08-05 15-20-14	74	N	38.5	1.1	F	7151	8903	1053	275	8892	8959	1398	941	0.15	0.03	0.16	0.1
97-08-05 15-20-14	74	N	38.5	1.1	F	9915	6246	2546	2427	9051	8144	2845	3211	0.26	0.39	0.31	0.39
97-08-05 15-20-14	74	N	38.5	1.1	F	10399	6872	959	1921	8656	8025	1562	3440	0.09	0.28	0.18	0.43
97-08-05 15-20-14	74	N	38.6	1.1	F	4646	11340	1174	2300	7920	9680	2436	2392	0.25	0.2	0.31	0.25
97-08-05 15-20-14	74	N	38.6	1.1	F	7015	10524	2284	722	8260	8400	2376	1497	0.33	0.07	0.29	0.18
97-08-05 15-20-14	74	N	38.6	1.1	F	9418	8770	2229	2294	8799	9840	2138	3264	0.24	0.26	0.24	0.33
97-08-05 15-20-14	74	N	38.6	1.1	F	8739	10419	159	264	8366	10961	107	988	0.02	0.03	0.01	0.09
97-08-05 15-20-14	74	N	38.6	1.1	F	9349	8018	1562	2016	10196	7930	1392	2634	0.17	0.25	0.14	0.33
97-08-05 15-20-14	74	N	38.6	1.1	F	8029	10038	192	433	9792	8850	46	1042	0.02	0.04	0	0.12
97-08-05 15-20-14	74	N	38.6	1.1	F	8440	6901	2156	1333	8550	9321	2678	2936	0.26	0.19	0.31	0.32
97-08-05 15-20-14	74	N	38.6	1.1	F	8085	11190	311	711	5262	7876	543	1467	0.04	0.06	0.1	0.19
97-08-05 15-20-14	74	N	38.7	1.1	F	8131	9694	762	1267	9118	6550	142	1236	0.09	0.13	0.02	0.19
97-08-05 15-20-14	74	N	38.7	1.1	F	14066	8996	977	3	8916	7923	1670	571	0.07	0	0.19	0.07
97-08-05 15-20-14	74	N	38.7	1.1	F	9743	7612	2929	1989	7870	11248	3304	4274	0.3	0.26	0.42	0.38
97-08-05 15-20-14	74	N	38.7	1.1	F	8770	9727	-476	724	8732	9749	-211	2128	-0.05	0.07	-0.02	0.22
97-08-05 15-20-14	74	N	38.7	1.1	F	9230	8904	435	1422	9444	9319	1297	2958	0.05	0.16	0.14	0.32
97-08-05 15-20-14	74	N	38.7	1.1	F	9738	9567	1226	245	8911	10251	193	563	0.13	0.03	0.02	0.05
97-08-05 15-20-14	74	N	38.7	1.1	F	9254	7428	1712	2158	9337	7187	1622	2905	0.19	0.29	0.17	0.4
97-08-05 15-20-14	74	N	38.7	1.1	F	10084	7609	809	204	8511	8539	155	777	0.08	0.03	0.02	0.09

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 15-20-14	74	N	38.8	1.1	F	9586	9602	2454	2221	8322	8831	2746	2980	0.26	0.23	0.33	0.34
97-08-05 15-20-14	74	N	38.8	1.1	F	8780	10227	29	56	8978	9685	164	913	0	0.01	0.02	0.09
97-08-05 15-20-14	74	N	38.8	1.1	F	10367	8669	2997	2453	9675	10412	3313	4648	0.29	0.28	0.34	0.45
97-08-05 15-20-14	74	N	38.8	1.1	F	10022	12234	898	1257	8638	10179	2133	3299	0.09	0.1	0.25	0.32
97-08-05 15-20-14	74	N	38.8	1.1	F	8885	9277	725	744	10514	10590	2758	2774	0.08	0.08	0.26	0.26
97-08-05 15-20-14	74	N	38.8	1.1	F	9930	12984	910	-674	10120	10322	165	782	0.09	-0.05	0.02	0.08
97-08-05 15-20-14	74	N	38.8	1.1	F	10450	7842	3026	2073	10035	8814	2667	3387	0.29	0.26	0.27	0.38
97-08-05 15-20-14	74	N	38.8	1.1	F	10233	8454	169	352	8850	9218	98	1388	0.02	0.04	0.01	0.15
97-08-05 15-20-14	74	N	38.8	1.1	F	8493	9546	1593	2266	9400	8147	1585	2731	0.19	0.24	0.17	0.34
97-08-05 15-20-14	74	N	38.8	1.2	F	8528	8235	504	221	9532	8690	82	565	0.06	0.03	0.01	0.07
97-08-05 15-20-14	74	N	38.8	1.2	F	10866	9774	1382	1765	11287	8953	2174	2974	0.13	0.18	0.19	0.33
97-08-05 15-20-14	74	N	38.8	1.2	F	11203	8767	458	412	8854	8511	355	1097	0.04	0.05	0.04	0.13
97-08-05 15-20-14	74	N	38.9	1.2	F	8968	8520	2121	2034	10535	9439	2403	2385	0.24	0.24	0.23	0.25
97-08-05 15-20-14	74	N	38.9	1.2	F	9585	9230	122	349	9674	7937	133	1414	0.01	0.04	0.01	0.18
97-08-05 15-20-14	74	N	38.9	1.2	F	9675	8404	1433	1794	10686	8421	1555	2465	0.15	0.21	0.15	0.29
97-08-05 15-20-14	74	N	38.9	1.2	F	9662	8579	175	121	10191	8719	-28	1370	0.02	0.01	0	0.16
97-08-05 15-20-14	74	N	38.9	1.2	F	8220	8939	1523	2046	9305	8604	2246	3179	0.19	0.23	0.24	0.37
97-08-05 15-20-14	74	N	38.9	1.2	F	7969	9085	421	195	9295	8274	10	855	0.05	0.02	0	0.1
97-08-05 15-20-14	74	N	38.9	1.2	F	11888	5721	2955	1588	9267	9825	3914	4220	0.25	0.28	0.42	0.43
97-08-05 15-20-14	74	N	38.9	1.2	F	9592	8172	-467	762	9543	7596	45	1907	-0.05	0.09	0	0.25
97-08-05 15-20-14	74	N	39	1.2	F	5551	11694	-344	1766	6038	11294	2086	3999	-0.06	0.15	0.35	0.35
97-08-05 15-20-14	74	N	39	1.2	F	8784	10943	1464	55	10633	9838	-62	744	0.17	0.01	-0.01	0.08
97-08-05 15-20-14	74	N	39	1.2	F	38530	32178	4321	5262	39046	39139	10252	11730	0.11	0.16	0.26	0.3
97-08-05 15-20-14	74	N	39	1.2	F	41243	34822	-111	4765	36546	38609	-178	6766	0	0.14	0	0.18
97-08-05 15-20-14	74	N	39	1.2	F	27411	30523	-562	3491	28373	31224	5080	7978	-0.02	0.11	0.18	0.26
97-08-05 15-20-14	74	N	39	1.2	F	26693	36253	3143	1533	28035	36470	178	1258	0.12	0.04	0.01	0.03
97-08-05 15-20-14	74	N	39	1.2	F	42691	28088	8908	5981	41611	28350	14909	10533	0.21	0.21	0.36	0.37
97-08-05 15-20-14	74	N	39	1.2	F	41335	31648	2809	1632	39336	34628	4115	6476	0.07	0.05	0.1	0.19
97-08-05 15-20-14	74	N	39.1	1.2	F	45102	32501	11806	6706	47252	34362	15561	11597	0.26	0.21	0.33	0.34
97-08-05 15-20-14	74	N	39.1	1.2	F	46940	36389	3210	1363	38985	40564	-334	3102	0.07	0.04	-0.01	0.08
97-08-05 15-20-14	74	N	39.1	1.2	F	33473	23725	11594	5206	31987	28298	8267	8297	0.35	0.22	0.26	0.29
97-08-05 15-20-14	74	N	39.1	1.2	F	28557	29222	2223	1458	29274	30127	-855	1353	0.08	0.05	-0.03	0.04
97-08-05 15-20-14	74	N	39.1	1.2	F	38423	32352	6857	6664	40477	29724	11473	11019	0.18	0.21	0.28	0.37
97-08-05 15-20-14	74	N	39.1	1.2	F	39716	32284	3940	1627	42186	36569	-544	2379	0.1	0.05	-0.01	0.07
97-08-05 15-20-14	74	N	39.1	1.2	F	10249	9526	993	1522	6529	8863	1667	2167	0.1	0.16	0.26	0.24
97-08-05 15-20-14	74	N	39.1	1.2	F	9685	8198	-8	874	8660	7841	205	1428	0	0.11	0.02	0.18
97-08-05 15-20-14	74	N	39.2	1.2	F	7887	7861	244	1690	9271	7620	890	2251	0.03	0.21	0.1	0.3
97-08-05 15-20-14	74	N	39.2	1.2	F	8900	10137	977	306	11004	8581	156	1212	0.11	0.03	0.01	0.14
97-08-05 15-20-14	74	N	39.2	1.2	F	11554	5838	3387	1916	9802	7986	4715	3669	0.29	0.33	0.48	0.46
97-08-05 15-20-14	74	N	39.2	1.2	F	10247	7556	943	1862	8115	8391	752	3070	0.09	0.25	0.09	0.37
97-08-05 15-20-14	74	N	39.2	1.3	F	6992	9726	401	569	8610	10150	4056	3984	0.06	0.06	0.47	0.39
97-08-05 15-20-14	74	N	39.2	1.3	F	6435	11471	1337	1123	7720	11568	308	1645	0.21	0.1	0.04	0.14
97-08-05 15-20-14	74	N	39.2	1.3	F	9092	8472	3348	2863	8809	9714	4565	4395	0.37	0.34	0.52	0.45
97-08-05 15-20-14	74	N	39.2	1.3	F	8755	9158	1837	2020	9565	9123	2126	3865	0.21	0.22	0.22	0.42
97-08-05 15-20-14	74	N	39.3	1.3	F	8918	8477	3035	2188	8654	9370	3362	3816	0.34	0.26	0.39	0.41
97-08-05 15-20-14	74	N	39.3	1.3	F	9011	10240	125	68	8709	9661	1689	3006	0.01	0.01	0.19	0.31
97-08-05 15-20-14	74	N	39.3	1.3	F	9389	7017	2690	1867	8598	8334	2081	2819	0.29	0.27	0.24	0.34
97-08-05 15-20-14	74	N	39.3	1.3	F	9318	7045	368	420	9956	8340	331	1181	0.04	0.06	0.03	0.14
97-08-05 15-20-14	74	N	39.3	1.3	F	8444	8740	2346	2158	10366	7658	3775	3526	0.28	0.25	0.36	0.46
97-08-05 15-20-14	74	N	39.3	1.3	F	8680	8951	-26	203	8642	7226	1658	2836	0	0.02	0.19	0.39
97-08-05 15-20-14	74	N	39.3	1.3	F	9271	6228	2710	1737	7700	8956	3642	3869	0.29	0.28	0.47	0.43
97-08-05 15-20-14	74	N	39.3	1.3	F	8219	8371	-12	437	7053	9186	816	2407	0	0.05	0.12	0.26
97-08-05 15-20-14	74	N	39.4	1.3	F	7241	7550	1506	2002	7785	7220	2212	2862	0.21	0.27	0.28	0.4
97-08-05 15-20-14	74	N	39.4	1.3	F	8239	8544	665	699	7965	7518	13	1653	0.08	0.08	0	0.22
97-08-05 15-20-14	74	N	39.4	1.3	F	10808	7922	457	1215	8882	9262	1079	2593	0.04	0.15	0.12	0.28
97-08-05 15-20-14	74	N	39.4	1.3	F	10312	8402	401	376	8965	9467	737	1477	0.04	0.04	0.08	0.16
97-08-05 15-20-14	74	N	39.4	1.3	F	8063	7856	980	1527	8023	7834	805	2456	0.12	0.19	0.1	0.31
97-08-05 15-20-14	74	N	39.4	1.3	F	8813	8717	441	463	8660	7764	12	1071	0.05	0.05	0	0.14
97-08-05 15-20-14	74	N	39.4	1.3	F	8710	6991	1608	1746	7576	7797	2615	3039	0.18	0.25	0.35	0.39
97-08-05 15-20-14	74	N	39.4	1.3	F	8642	7208	667	785	7802	8807	428	1680	0.08	0.11	0.05	0.19
97-08-05 15-20-14	74	N	39.4	1.3	F	6255	7557	926	1764	7596	7717	2305	3026	0.15	0.23	0.3	0.39
97-08-05 15-20-14	74	N	39.4	1.3	F	8084	8032	744	449	7377	8770	47	1279	0.09	0.06	0.01	0.15
97-08-05 15-20-14	74	N	39.5	1.3	F	8041	7038	1700	2330	7865	6460	1710	3314	0.21	0.33	0.22	0.51
97-08-05 15-20-14	74	N	39.4	1.3	F	8046	7412	702	471	6957	7265	279	1046	0.09	0.06	0.04	0.14
97-08-05 15-20-14	74	N	39.5	1.3	F	8166	7470	-214	743	8393	6640	-238	1033	-0.03	0.1	-0.03	0.16
97-08-05 15-20-14	74	N	39.5	1.3	F	8081	7984	491	423	7456	7278	111	794	0.06	0.05	0.01	0.11
97-08-05 16-46-12	76	S	41.4	-1.2		28009	35099	399	10543	29422	36269	234	1164	0.01	0.3	0.01	0.03
97-08-05 16-46-12	76	S	41.4	-1.2		26835	45456	-318	3517	27504	35506	534	3976	-0.01	0.08	0.02	0.11
97-08-05 16-46-12	76	S	41.4	-1.2		25423	36587	1228	-885	24815	32687	948	45	0.05	-0.02	0.04	0

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-46-12	76	S	41.4	-1.2		30726	30435	-871	3571	24085	38185	-16	3025	-0.03	0.12	0	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		32080	29287	13	7145	23574	38904	446	3079	0	0.24	0.02	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		6073	11387	1279	4615	7963	8995	1577	3011	0.21	0.41	0.2	0.33
97-08-05 16-46-12	76	S	41.4	-1.2		6911	10358	1103	5343	11904	9466	1096	4970	0.16	0.52	0.09	0.53
97-08-05 16-46-12	76	S	41.4	-1.2		6688	10296	2011	1909	6838	10152	1836	1373	0.3	0.19	0.27	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		6117	10374	2517	78	6264	12673	1586	1026	0.41	0.01	0.25	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		10836	14870	159	2199	12025	12456	242	1649	0.01	0.15	0.02	0.13
97-08-05 16-46-12	76	S	41.4	-1.2		11551	14347	898	-567	14206	12400	1177	1610	0.08	-0.04	0.08	0.13
97-08-05 16-46-12	76	S	41.4	-1.2		12937	13775	324	2864	10887	16316	1442	2444	0.03	0.21	0.13	0.15
97-08-05 16-46-12	76	S	41.4	-1.2		12776	12268	583	1444	10187	17440	678	1273	0.05	0.12	0.07	0.07
97-08-05 16-46-12	76	S	41.4	-1.2		10590	16150	246	3245	11763	13715	275	1829	0.02	0.2	0.02	0.13
97-08-05 16-46-12	76	S	41.4	-1.2		10972	13588	938	-802	10290	15368	568	1098	0.09	-0.06	0.06	0.07
97-08-05 16-46-12	76	S	41.4	-1.2		11992	12509	267	1768	11575	11877	931	1771	0.02	0.14	0.08	0.15
97-08-05 16-46-12	76	S	41.4	-1.2		12935	11918	857	366	11810	14157	999	719	0.07	0.03	0.08	0.05
97-08-05 16-46-12	76	S	41.4	-1.2		10014	19411	66	3534	14028	12717	215	1269	0.01	0.18	0.02	0.1
97-08-05 16-46-12	76	S	41.4	-1.2		11551	16166	1981	4057	12763	15102	307	1875	0.17	0.25	0.02	0.12
97-08-05 16-46-12	76	S	41.4	-1.2		13485	13116	672	2109	12905	14890	885	1908	0.05	0.16	0.07	0.13
97-08-05 16-46-12	76	S	41.4	-1.2		12172	13377	-299	1110	12718	13771	881	1193	-0.02	0.08	0.07	0.09
97-08-05 16-46-12	76	S	41.4	-1.2		5898	11147	465	2526	6070	9757	306	1390	0.08	0.23	0.05	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		7011	9714	984	377	6690	9370	593	1340	0.14	0.04	0.09	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		7662	8429	721	1133	6707	8200	705	1241	0.09	0.13	0.11	0.15
97-08-05 16-46-12	76	S	41.4	-1.2		7245	7796	848	282	6247	9407	609	775	0.12	0.04	0.1	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		5750	15528	670	3719	7133	12708	415	1792	0.12	0.24	0.06	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		6763	12599	1466	3047	8054	11164	1031	1510	0.22	0.24	0.13	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		11075	9961	645	2366	9170	10756	718	1486	0.06	0.24	0.08	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		9579	9689	1098	2408	8214	10351	901	1137	0.11	0.25	0.11	0.11
97-08-05 16-46-12	76	S	41.4	-1.2		7946	10680	481	2647	9176	8249	481	1123	0.06	0.25	0.05	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		8094	10494	839	-440	8849	9820	631	648	0.1	-0.04	0.07	0.07
97-08-05 16-46-12	76	S	41.4	-1.2		7772	9006	449	1282	6858	9218	816	1501	0.06	0.14	0.12	0.16
97-08-05 16-46-12	76	S	41.4	-1.2		9473	7770	927	123	8876	8375	746	688	0.1	0.02	0.08	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		4845	15424	685	3270	6973	12140	1118	1750	0.14	0.21	0.16	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		5409	13703	1191	2574	6416	13643	816	1883	0.22	0.19	0.13	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		11108	7742	812	1844	9073	9713	505	1545	0.07	0.24	0.06	0.16
97-08-05 16-46-12	76	S	41.4	-1.2		9789	6975	601	190	9405	9372	873	496	0.06	0.03	0.09	0.05
97-08-05 16-46-12	76	S	41.4	-1.2		5347	14490	723	3889	6497	11600	617	1852	0.14	0.27	0.09	0.16
97-08-05 16-46-12	76	S	41.5	-1.2		5380	13392	891	2296	5783	12274	738	1721	0.17	0.17	0.13	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		9503	8977	717	2371	8630	9765	532	1598	0.08	0.26	0.06	0.16
97-08-05 16-46-12	76	S	41.5	-1.2		9590	9141	795	2169	8934	10348	983	913	0.08	0.24	0.11	0.09
97-08-05 16-46-12	76	S	41.5	-1.2		25444	36460	-426	4435	26680	33475	1409	4731	-0.02	0.12	0.05	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		25327	36429	1980	-962	23801	41955	516	2481	0.08	-0.03	0.02	0.06
97-08-05 16-46-12	76	S	41.5	-1.2		29616	40332	2970	7518	26800	33494	1428	4178	0.1	0.19	0.05	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		26586	36900	235	4153	25819	39804	352	1024	0.01	0.11	0.01	0.05
97-08-05 16-46-12	76	S	41.5	-1.2		23467	37496	-509	2030	25441	34026	16	4001	-0.02	0.05	0	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		26644	39529	633	-1077	24267	41325	360	4720	0.02	-0.03	0.01	0.11
97-08-05 16-46-12	76	S	41.5	-1.2		31569	31326	2766	7164	24881	34787	2339	1483	0.09	0.23	0.09	0.04
97-08-05 16-46-12	76	S	41.5	-1.2		30672	34005	35	4087	26969	41276	4088	5459	0	0.12	0.15	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		25917	40288	1338	6581	26317	37614	4159	6428	0.05	0.16	0.16	0.17
97-08-05 16-46-12	76	S	41.5	-1.2		26812	38534	924	-938	24654	43237	150	2591	0.03	-0.02	0.01	0.06
97-08-05 16-46-12	76	S	41.5	-1.2		28929	35443	1979	8813	25083	36208	1863	5453	0.07	0.25	0.07	0.15
97-08-05 16-46-12	76	S	41.5	-1.2		30035	34893	104	5219	27800	39419	270	2336	0	0.15	0.01	0.06
97-08-05 16-46-12	76	S	41.5	-1.2		23017	37669	1964	10911	26445	34610	1952	4167	0.09	0.29	0.07	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		29140	43199	7035	12169	25338	41879	132	5574	0.24	0.28	0.01	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		33374	28672	681	3095	26851	31171	124	2268	0.02	0.11	0	0.07
97-08-05 16-46-12	76	S	41.5	-1.2		32071	31970	54	4000	30094	36689	1268	395	0	0.13	0.04	0.01
97-08-05 16-46-12	76	S	41.5	-1.2		32641	38987	261	5804	31178	34382	2914	5667	0.01	0.15	0.09	0.16
97-08-05 16-46-12	76	S	41.5	-1.2		26239	37594	1078	-883	29836	40196	369	892	0.04	-0.02	0.01	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		32213	31851	3390	7510	31175	31493	4265	4685	0.11	0.24	0.14	0.15
97-08-05 16-46-12	76	S	41.5	-1.2		27251	36814	1719	5884	27196	37049	1030	1622	0.06	0.16	0.04	0.04
97-08-05 16-46-12	76	S	41.5	-1.2		21323	33207	1391	11425	19950	30056	3434	5179	0.07	0.34	0.17	0.17
97-08-05 16-46-12	76	S	41.5	-1.2		23599	27401	5481	7131	20247	31022	117	3754	0.23	0.26	0.01	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		26087	22298	-490	2326	18565	26545	184	2622	-0.02	0.1	0.01	0.1
97-08-05 16-46-12	76	S	41.5	-1.2		25427	22882	102	1549	21294	27107	297	476	0	0.07	0.01	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		26307	38400	-417	6337	32779	30149	1791	2999	-0.02	0.17	0.05	0.1
97-08-05 16-46-12	76	S	41.5	-1.2		27541	37822	2123	-1247	31191	35469	117	1549	0.08	-0.03	0	0.04
97-08-05 16-46-12	76	S	41.5	-1.2		37400	29199	4021	7737	31269	32426	697	3838	0.11	0.26	0.02	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		31364	31267	1	3653	32731	32664	210	1723	0	0.12	0.01	0.05
97-08-05 16-46-12	76	S	41.5	-1.2		22187	34215	247	4846	23399	32429	234	3755	0.01	0.14	0.01	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		24690	31476	1270	-1088	23763	32771	763	633	0.05	-0.03	0.03	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		24110	29897	1033	3007	24441	29405	3007	4574	0.04	0.1	0.12	0.16

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-46-12	76	S	41.5	-1.2		29692	31997	651	-970	25760	34754	459	767	0.02	-0.03	0.02	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		20650	30538	-356	4261	22172	26979	-33	2808	-0.02	0.14	0	0.1
97-08-05 16-46-12	76	S	41.5	-1.2		21561	28096	1317	-1177	22811	29067	407	484	0.06	-0.04	0.02	0.02
97-08-05 16-46-12	76	S	41.6	-1.2		26497	27253	968	7120	24068	27710	840	2935	0.04	0.26	0.03	0.11
97-08-05 16-46-12	76	S	41.6	-1.2		25281	26437	155	1810	23091	32206	401	2222	0.01	0.07	0.02	0.07
97-08-05 16-46-12	76	S	41.6	-1.2		23077	39077	193	6211	25340	35738	1251	4071	0.01	0.16	0.05	0.11
97-08-05 16-46-12	76	S	41.6	-1.2		27489	42454	975	-982	25281	46277	191	2350	0.04	-0.02	0.01	0.05
97-08-05 16-46-12	76	S	41.6	-1.2		35841	30759	2723	6197	28948	32695	902	3894	0.08	0.2	0.03	0.12
97-08-05 16-46-12	76	S	41.6	-1.2		34030	34356	352	4492	29114	43054	1552	1524	0.01	0.13	0.05	0.04
97-08-05 16-46-12	76	S	41.6	-1.2		18836	35019	615	9763	23146	31131	2627	3459	0.03	0.28	0.11	0.11
97-08-05 16-46-12	76	S	41.6	-1.2		21082	32043	1993	6429	19260	34660	375	3546	0.09	0.2	0.02	0.1
97-08-05 16-46-12	76	S	41.6	-1.2		32508	23442	6187	5644	24366	28690	619	2746	0.19	0.24	0.03	0.1
97-08-05 16-46-12	76	S	41.6	-1.2		25678	26133	-173	4381	22063	31777	1427	1487	-0.01	0.17	0.06	0.05
97-08-05 16-46-12	76	S	41.6	-1.2		22934	32549	523	5960	23292	31246	1149	3578	0.02	0.18	0.05	0.11
97-08-05 16-46-12	76	S	41.6	-1.2		23146	30900	610	877	22830	32520	140	2676	0.03	0.03	0.01	0.08
97-08-05 16-46-12	76	S	41.6	-1.2		27551	28590	4267	9131	22136	30479	1769	4550	0.15	0.32	0.08	0.15
97-08-05 16-46-12	76	S	41.6	-1.2		26249	27303	186	736	22242	34006	1331	1159	0.01	0.03	0.06	0.03
97-08-05 16-46-12	76	S	41.6	-1.2		19741	30856	-431	2602	21777	29415	1337	3715	-0.02	0.08	0.06	0.13
97-08-05 16-46-12	76	S	41.6	-1.2		20887	28772	943	-133	19824	31663	179	2241	0.05	0	0.01	0.07
97-08-05 16-46-12	76	S	41.6	-1.2		25797	25683	2729	6036	22321	27543	939	2576	0.11	0.24	0.04	0.09
97-08-05 16-46-12	76	S	41.6	-1.2		24581	26329	515	4836	21344	30547	699	1209	0.02	0.18	0.03	0.04
97-08-05 16-46-12	76	S	41.6	-1.2		26032	36566	-580	2631	29822	32677	563	3688	-0.02	0.07	0.02	0.11
97-08-05 16-46-12	76	S	41.6	-1.2		28028	39735	1436	-1121	28144	38115	142	888	0.05	-0.03	0.01	0.02
97-08-05 16-46-12	76	S	41.6	-1.2		32767	32364	3880	8009	28752	34799	113	4074	0.12	0.25	0	0.12
97-08-05 16-46-12	76	S	41.6	-1.2		32024	35087	-76	4209	29145	36255	732	595	0	0.12	0.03	0.02
97-08-05 16-46-12	76	S	41.6	-1.2		22489	38835	216	2160	29666	29538	3518	4231	0.01	0.06	0.12	0.14
97-08-05 16-46-12	76	S	41.6	-1.2		25240	37374	1746	-1322	29569	36823	1367	224	0.07	-0.04	0.05	0.01
97-08-05 16-46-12	76	S	41.6	-1.2		33475	32332	2519	6817	29168	29976	586	3380	0.08	0.21	0.02	0.11
97-08-05 16-46-12	76	S	41.6	-1.2		28032	33191	800	6212	30360	34844	1138	120	0.03	0.19	0.04	0
97-08-05 16-46-12	76	S	41.5	-1.2		26319	35327	-710	3431	30207	32992	137	3194	-0.03	0.1	0	0.1
97-08-05 16-46-12	76	S	41.6	-1.2		27871	40085	1360	-1263	27076	31536	383	703	0.05	-0.03	0.01	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		31304	29988	1716	7183	28054	33690	844	4276	0.05	0.24	0.03	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		31253	32830	426	-137	26863	33827	590	712	0.01	0	0.02	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		23277	36866	-66	4307	25302	34285	847	4674	0	0.12	0.03	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		26729	37201	1274	-1147	25043	40646	373	1095	0.05	-0.03	0.01	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		30367	31438	633	5714	25696	32804	474	4146	0.02	0.18	0.02	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		27984	35282	188	1236	26710	38429	274	649	0.01	0.04	0.01	0.02
97-08-05 16-46-12	76	S	41.5	-1.2		24263	37536	-73	3283	28285	32872	2317	4656	0	0.09	0.08	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		26777	36571	949	-1101	25535	35553	219	898	0.04	-0.03	0.01	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		30156	32692	2482	8600	28890	33615	2207	4976	0.08	0.26	0.08	0.15
97-08-05 16-46-12	76	S	41.5	-1.2		27003	36653	409	1369	24805	35821	544	976	0.02	0.04	0.02	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		26211	36317	-489	3449	30980	30823	-16	2462	-0.02	0.09	0	0.08
97-08-05 16-46-12	76	S	41.5	-1.2		25977	36126	1791	-1165	27306	31900	176	1320	0.07	-0.03	0.01	0.04
97-08-05 16-46-12	76	S	41.5	-1.2		33644	29478	4152	9413	28495	32400	2405	4356	0.12	0.32	0.08	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		29994	32320	220	8939	27058	34780	622	2684	0.01	0.28	0.02	0.08
97-08-05 16-46-12	76	S	41.5	-1.2		18607	29804	-49	9199	23086	24101	2299	3322	0	0.31	0.1	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		20710	27942	4348	7542	21623	29764	156	3454	0.21	0.27	0.01	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		27594	20431	4048	5220	22694	23512	1550	3063	0.15	0.26	0.07	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		25425	23100	235	1654	25994	28317	984	1805	0.01	0.07	0.04	0.06
97-08-05 16-46-12	76	S	41.5	-1.2		27444	37342	955	6020	28344	36346	3693	6643	0.03	0.16	0.13	0.18
97-08-05 16-46-12	76	S	41.5	-1.2		28663	39291	1317	-1150	28079	44302	567	1530	0.05	-0.03	0.02	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		33576	36251	-221	4058	28233	41618	1600	5764	-0.01	0.11	0.06	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		31972	32503	1190	-1125	28124	39534	857	589	0.04	-0.03	0.03	0.01
97-08-05 16-46-12	76	S	41.5	-1.2		30424	36538	-424	5919	34906	29072	2554	4035	-0.01	0.16	0.07	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		36141	32791	1554	-806	40852	30393	1091	843	0.04	-0.02	0.03	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		33080	37117	-475	5670	25525	42875	152	6288	-0.01	0.15	0.01	0.15
97-08-05 16-46-12	76	S	41.5	-1.2		31570	32350	616	-450	28916	40177	626	1078	0.02	-0.01	0.02	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		18609	33491	481	6053	19841	30295	477	3832	0.03	0.18	0.02	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		21425	30910	241	-3	18889	33151	164	2964	0.01	0	0.01	0.09
97-08-05 16-46-12	76	S	41.5	-1.2		31498	20270	5766	6084	22916	25094	1844	3735	0.18	0.3	0.08	0.15
97-08-05 16-46-12	76	S	41.5	-1.2		24316	24103	-46	4070	21721	28798	432	2129	0	0.17	0.02	0.07
97-08-05 16-46-12	76	S	41.5	-1.2		20515	27901	-120	2417	20723	32893	339	4797	-0.01	0.09	0.02	0.15
97-08-05 16-46-12	76	S	41.5	-1.2		22828	31634	398	-1007	20528	33997	125	978	0.02	-0.03	0.01	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		30119	21347	5554	5950	23479	26300	1126	3470	0.18	0.28	0.05	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		24809	25409	8	4192	23710	28223	812	808	0	0.16	0.03	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		22760	28951	-446	4937	23809	25499	2264	3554	-0.02	0.17	0.1	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		23420	27688	289	1249	22072	30184	237	2231	0.01	0.05	0.01	0.07
97-08-05 16-46-12	76	S	41.5	-1.2		26157	26938	830	7026	24650	26533	1351	3310	0.03	0.26	0.05	0.12
97-08-05 16-46-12	76	S	41.5	-1.2		26420	24688	264	1779	24847	28664	351	1692	0.01	0.07	0.01	0.06

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-46-12	76	S	41.5	-1.2		29971	43177	-549	3821	26214	35778	914	4513	-0.02	0.09	0.03	0.13
97-08-05 16-46-12	76	S	41.5	-1.2		25746	39949	1663	-1262	24913	40660	267	1026	0.06	-0.03	0.01	0.03
97-08-05 16-46-12	76	S	41.5	-1.2		35126	30165	1920	5453	27286	32160	70	2919	0.05	0.18	0	0.09
97-08-05 16-46-12	76	S	41.4	-1.2		33415	34838	181	2952	30052	38658	1677	503	0.01	0.08	0.06	0.01
97-08-05 16-46-12	76	S	41.5	-1.2		23644	39559	-716	3749	28008	35756	-38	4917	-0.03	0.09	0	0.14
97-08-05 16-46-12	76	S	41.5	-1.2		27800	40088	1479	-1269	26738	42537	411	1258	0.05	-0.03	0.02	0.03
97-08-05 16-46-12	76	S	41.4	-1.2		33766	32324	5068	9234	29157	32764	3212	5206	0.15	0.29	0.11	0.16
97-08-05 16-46-12	76	S	41.4	-1.2		34414	34892	87	3341	29784	38381	559	969	0	0.1	0.02	0.03
97-08-05 16-46-12	76	S	41.4	-1.2		21841	32472	-362	4421	23440	30626	1037	3706	-0.02	0.14	0.04	0.12
97-08-05 16-46-12	76	S	41.4	-1.2		20633	30477	1487	-1191	22207	32795	782	523	0.07	-0.04	0.04	0.02
97-08-05 16-46-12	76	S	41.4	-1.2		24364	25230	-397	2893	21650	26201	104	2959	-0.02	0.11	0	0.11
97-08-05 16-46-12	76	S	41.4	-1.2		25186	24541	1135	-1224	22990	26992	1012	154	0.05	-0.05	0.04	0.01
97-08-05 16-46-12	76	S	41.4	-1.2		6394	10137	411	2109	7221	7366	629	1092	0.06	0.21	0.09	0.15
97-08-05 16-46-12	76	S	41.4	-1.2		6186	8268	767	-335	6641	8363	526	687	0.12	-0.04	0.08	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		6134	8215	505	1537	6226	8254	340	1670	0.08	0.19	0.05	0.2
97-08-05 16-46-12	76	S	41.4	-1.2		6312	7244	725	26	5987	7981	765	375	0.11	0	0.13	0.05
97-08-05 16-46-12	76	S	41.4	-1.2		5248	9559	429	1462	6738	8186	592	1057	0.08	0.15	0.09	0.13
97-08-05 16-46-12	76	S	41.4	-1.2		6425	8358	901	-417	6114	8678	710	737	0.14	-0.05	0.12	0.08
97-08-05 16-46-12	76	S	41.4	-1.2		6572	8192	569	1953	6253	7248	355	1079	0.09	0.24	0.06	0.15
97-08-05 16-46-12	76	S	41.4	-1.2		6197	7222	690	974	6748	8582	856	560	0.11	0.13	0.13	0.07
97-08-05 16-46-12	76	S	41.4	-1.2		5781	10113	728	2929	6942	8125	708	1314	0.13	0.29	0.1	0.16
97-08-05 16-46-12	76	S	41.4	-1.2		6061	8826	963	681	6445	8375	605	1302	0.16	0.08	0.09	0.16
97-08-05 16-46-12	76	S	41.4	-1.2		7184	7563	552	2098	6094	7647	516	1380	0.08	0.28	0.08	0.18
97-08-05 16-46-12	76	S	41.4	-1.2		6788	8207	897	1466	7052	8084	759	1167	0.13	0.18	0.11	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		28863	43001	821	7341	33828	25328	4392	6361	0.03	0.17	0.13	0.18
97-08-05 16-46-12	76	S	41.4	-1.2		34252	38293	1189	-1138	32139	32095	952	597	0.03	-0.03	0.03	0.02
97-08-05 16-46-12	76	S	41.4	-1.2		32910	36939	5146	10111	27819	38828	5299	7952	0.16	0.27	0.19	0.2
97-08-05 16-46-12	76	S	41.4	-1.2		31495	38179	77	1104	28328	42592	84	2415	0	0.03	0	0.06
97-08-05 16-46-12	76	S	41.4	-1.2		23943	31883	-195	6349	26675	30108	2228	4732	-0.01	0.2	0.08	0.16
97-08-05 16-46-12	76	S	41.4	-1.2		25375	29442	1699	-1024	24189	30644	170	2030	0.07	-0.03	0.01	0.07
97-08-05 16-46-12	76	S	41.4	-1.2		30124	25374	6652	8576	25153	28593	1879	4910	0.22	0.34	0.07	0.17
97-08-05 16-46-12	76	S	41.4	-1.2		27320	27463	144	3694	26973	30973	1520	1360	0.01	0.13	0.06	0.04
97-08-05 16-46-12	76	S	41.4	-1.2		24523	37342	-623	1253	26878	32525	1820	4716	-0.03	0.03	0.07	0.14
97-08-05 16-46-12	76	S	41.4	-1.2		25803	39982	738	-1306	26562	39133	200	343	0.03	-0.03	0.01	0.01
97-08-05 16-46-12	76	S	41.4	-1.2		33092	28652	942	7704	31110	28434	162	3292	0.03	0.27	0.01	0.12
97-08-05 16-46-12	76	S	41.4	-1.2		34161	31950	327	10565	32761	32776	558	1046	0.01	0.33	0.02	0.03
97-08-05 16-46-12	76	S	41.4	-1.2		22962	40172	-581	2976	29134	32405	3197	5796	-0.03	0.07	0.11	0.18
97-08-05 16-46-12	76	S	41.4	-1.2		26642	39298	2239	-1295	33661	37880	322	639	0.08	-0.03	0.01	0.02
97-08-05 16-46-12	76	S	41.4	-1.2		32623	31348	-775	3980	29740	30575	-121	2734	-0.02	0.13	0	0.09
97-08-05 16-46-12	76	S	41.4	-1.2		29426	33779	179	3097	31724	34881	865	1047	0.01	0.09	0.03	0.03
97-08-05 16-46-12	76	S	41.4	-1.2		26964	37358	1389	13572	27704	32235	2439	6071	0.05	0.36	0.09	0.19
97-08-05 16-46-12	76	S	41.4	-1.2		29412	33797	5481	7537	27460	39081	2072	8170	0.19	0.22	0.08	0.21
97-08-05 16-46-12	76	S	41.3	-1.2		31371	29854	4871	9390	28613	32273	3260	5512	0.16	0.31	0.11	0.17
97-08-05 16-46-12	76	S	41.3	-1.2		28295	35664	-82	2881	27424	37684	292	1259	0	0.08	0.01	0.03
97-08-05 16-46-12	76	S	41.3	-1.2		18790	31405	443	4570	20281	31069	2939	5850	0.02	0.15	0.14	0.19
97-08-05 16-46-12	76	S	41.3	-1.2		19770	30111	304	497	19977	31183	58	2025	0.02	0.02	0	0.06
97-08-05 16-46-12	76	S	41.3	-1.2		28711	22314	3418	7487	22783	27647	443	3978	0.12	0.34	0.02	0.14
97-08-05 16-46-12	76	S	41.3	-1.2		26562	22964	947	5789	21027	29143	738	899	0.04	0.25	0.04	0.03
97-08-05 16-46-12	76	S	41.3	-1.2		5903	9383	102	1408	6707	8352	364	957	0.02	0.15	0.05	0.11
97-08-05 16-46-12	76	S	41.3	-1.2		7228	7427	820	-214	7622	6837	809	255	0.11	-0.03	0.11	0.04
97-08-05 16-46-12	76	S	41.3	-1.2		6248	8201	541	2707	5939	7256	741	1671	0.09	0.33	0.12	0.23
97-08-05 16-46-12	76	S	41.3	-1.2		5654	7596	720	1806	5156	8676	590	1236	0.13	0.24	0.11	0.14
97-08-05 16-47-39	74	S	39.3	1.3	L	33073	33214	6055	4814	38947	28695	9953	6870	0.18	0.14	0.26	0.24
97-08-05 16-47-39	74	S	39.3	1.3	L	37101	31219	4219	1534	38580	31091	2299	1137	0.11	0.05	0.06	0.04
97-08-05 16-47-39	74	S	39.3	1.3	L	34152	42514	16	-84	38993	28807	5799	4182	0	0	0.15	0.15
97-08-05 16-47-39	74	S	39.3	1.3	L	37053	28810	1126	550	38236	28291	1669	1055	0.03	0.02	0.04	0.04
97-08-05 16-47-39	74	S	39.3	1.3	L	38148	41618	6382	4010	38704	31397	9128	6232	0.17	0.1	0.24	0.2
97-08-05 16-47-39	74	S	39.3	1.3	L	42835	39135	944	1164	37958	32065	-730	1013	0.02	0.03	-0.02	0.03
97-08-05 16-47-39	74	S	39.3	1.3	L	36185	29462	-715	140	46260	34798	3665	2989	-0.02	0	0.08	0.09
97-08-05 16-47-39	74	S	39.3	1.3	L	37505	27978	892	843	40759	29295	-539	449	0.02	0.03	-0.01	0.02
97-08-05 16-47-39	74	S	39.3	1.3	L	31481	30387	4658	4198	38205	28512	8497	5574	0.15	0.14	0.22	0.2
97-08-05 16-47-39	74	S	39.3	1.3	L	33917	29178	651	992	37575	30791	-436	361	0.02	0.03	-0.01	0.01
97-08-05 16-47-39	74	S	39.3	1.3	L	34627	30438	6414	5042	36877	29121	9045	7040	0.19	0.17	0.25	0.24
97-08-05 16-47-39	74	S	39.3	1.3	L	35177	31348	1124	811	35798	31223	1856	611	0.03	0.03	0.05	0.02
97-08-05 16-47-39	74	S	39.3	1.3	F	36352	31643	7668	4921	40232	28735	10046	6568	0.21	0.16	0.25	0.23
97-08-05 16-47-39	74	S	39.2	1.3	F	37722	32861	1190	317	43174	31580	864	19	0.03	0.01	0.02	0
97-08-05 16-47-39	74	S	39.2	1.3	F	41168	27999	3094	2456	43195	30368	6452	6174	0.08	0.09	0.15	0.2
97-08-05 16-47-39	74	S	39.2	1.3	F	39962	22595	1660	355	41338	30298	525	-163	0.04	0.02	0.01	-0.01
97-08-05 16-47-39	74	S	39.2	1.3	F	26735	32821	2185	3022	32931	25485	7594	6541	0.08	0.09	0.23	0.26

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-47-39	74	S	39.2	1.3	F	30279	26648	2389	379	39520	28256	1020	89	0.08	0.01	0.03	0
97-08-05 16-47-39	74	S	39.2	1.3	F	31504	29389	4525	4202	31129	23975	7055	5957	0.14	0.14	0.23	0.25
97-08-05 16-47-39	74	S	39.2	1.3	F	34115	20654	1001	447	36475	27080	694	167	0.03	0.02	0.02	0.01
97-08-05 16-47-39	74	S	39.2	1.3	F	23299	26877	1020	2525	30217	23347	6156	7704	0.04	0.09	0.2	0.33
97-08-05 16-47-39	74	S	39.2	1.3	F	23713	23666	1403	741	31773	20393	4902	4340	0.06	0.03	0.15	0.21
97-08-05 16-47-39	74	S	39.2	1.2	F	25893	24480	4193	4295	30216	22487	4259	4905	0.16	0.18	0.14	0.22
97-08-05 16-47-39	74	S	39.2	1.2	F	27367	20629	-55	162	30440	23362	677	43	0	0.01	0.02	0
97-08-05 16-47-39	74	S	39.2	1.2	F	29235	33890	1075	2994	34909	31558	5172	6853	0.04	0.09	0.15	0.22
97-08-05 16-47-39	74	S	39.2	1.2	F	31783	28651	3148	661	39335	29590	1584	-127	0.1	0.02	0.04	0
97-08-05 16-47-39	74	S	39.1	1.2	F	35423	28838	10343	8092	36213	30708	5656	5543	0.29	0.28	0.16	0.18
97-08-05 16-47-39	74	S	39.1	1.2	F	34952	26275	4831	4534	36429	32202	273	358	0.14	0.17	0.01	0.01
97-08-05 16-47-39	74	S	39.1	1.2	F	32461	31333	7453	9629	36583	28993	10427	11058	0.23	0.31	0.29	0.38
97-08-05 16-47-39	74	S	39.1	1.2	F	34936	23770	9420	2370	38005	28600	11822	12795	0.27	0.1	0.31	0.45
97-08-05 16-47-39	74	S	39.1	1.2	F	38035	25899	13194	9660	38208	27552	9755	7830	0.35	0.37	0.26	0.28
97-08-05 16-47-39	74	S	39.1	1.2	F	33853	25264	260	1042	36535	28670	442	386	0.01	0.04	0.01	0.01
97-08-05 16-47-39	74	S	39.1	1.2	F	7910	7702	3061	1363	7848	8766	3840	2670	0.39	0.18	0.49	0.3
97-08-05 16-47-39	74	S	39.1	1.2	F	9397	8134	5548	611	9104	11338	1719	1168	0.59	0.08	0.19	0.1
97-08-05 16-47-39	74	S	39	1.2	F	8737	6166	1717	2467	10007	7337	3585	3523	0.2	0.4	0.36	0.48
97-08-05 16-47-39	74	S	39	1.2	F	9927	6017	1520	859	12724	8665	1009	2511	0.15	0.14	0.08	0.29
97-08-05 16-47-39	74	S	39	1.2	F	11176	14044	1381	2484	13752	10539	4535	4118	0.12	0.18	0.33	0.39
97-08-05 16-47-39	74	S	39	1.2	F	11376	11179	362	423	14196	13001	353	625	0.03	0.04	0.02	0.05
97-08-05 16-47-39	74	S	38.9	1.2	F	15847	10994	4727	3671	16150	11023	3755	3158	0.3	0.33	0.23	0.29
97-08-05 16-47-39	74	S	38.9	1.2	F	15818	10088	2244	1857	15762	10634	-10	680	0.14	0.18	0	0.06
97-08-05 16-47-39	74	S	38.9	1.2	F	12013	12912	1850	1210	14148	11353	3339	2847	0.15	0.09	0.24	0.25
97-08-05 16-47-39	74	S	38.9	1.2	F	12028	13047	234	220	13038	12253	150	544	0.02	0.02	0.01	0.04
97-08-05 16-47-39	74	S	38.8	1.1	F	14029	12389	1829	2021	14618	11042	3297	2840	0.13	0.16	0.23	0.26
97-08-05 16-47-39	74	S	38.8	1.1	F	14302	9362	-563	615	15171	11670	-132	706	-0.04	0.07	-0.01	0.06
97-08-05 16-47-39	74	S	38.8	1.1	F	12538	12221	2574	2727	15266	11508	4760	3912	0.21	0.22	0.31	0.34
97-08-05 16-47-39	74	S	38.8	1.1	F	14383	10842	675	448	16147	11443	239	944	0.05	0.04	0.01	0.08
97-08-05 16-47-39	74	S	38.7	1.1	F	15159	10914	3773	3009	13926	12201	3086	3736	0.25	0.28	0.22	0.31
97-08-05 16-47-39	74	S	38.7	1.1	F	15396	9105	-154	-51	13843	12781	174	777	-0.01	-0.01	0.01	0.06
97-08-05 16-47-39	74	S	38.7	1.1	F	7740	8715	703	344	9620	7925	1215	1691	0.09	0.04	0.13	0.21
97-08-05 16-47-39	74	S	38.7	1.1	F	7365	7598	170	670	8799	7957	187	1014	0.02	0.09	0.02	0.13
97-08-05 16-47-39	74	S	38.6	1.1	F	9026	6320	535	908	8603	7403	449	1236	0.06	0.14	0.05	0.17
97-08-05 16-47-39	74	S	38.6	1.1	F	8141	6162	-39	621	9085	7275	-113	733	0	0.1	-0.01	0.1
97-08-05 16-47-39	74	S	38.6	1.1	F	8149	11812	3525	4564	11862	8207	3305	2852	0.43	0.39	0.28	0.35
97-08-05 16-47-39	74	S	38.6	1.1	F	9133	8820	3636	2090	12144	7771	3538	3538	0.4	0.24	0.29	0.46
97-08-05 16-47-39	74	S	38.6	1.1	F	12352	7915	4461	3246	9760	9001	3982	3108	0.36	0.41	0.41	0.35
97-08-05 16-47-39	74	S	38.6	1.1	F	11354	6510	2494	3292	10311	9213	1309	952	0.22	0.51	0.13	0.1
97-08-05 16-47-39	74	S	38.6	1.1	F	8237	9821	947	1721	9264	8454	2282	1872	0.11	0.18	0.25	0.22
97-08-05 16-47-39	74	S	38.6	1.1	F	8448	7485	477	683	8173	9441	221	597	0.06	0.09	0.03	0.06
97-08-05 16-47-39	74	S	38.5	1.1	F	9373	6690	1542	961	10255	7602	2023	2037	0.16	0.14	0.2	0.27
97-08-05 16-47-39	74	S	38.5	1.1	F	9211	6954	-197	336	9431	7912	11	802	-0.02	0.05	0	0.1
97-08-05 16-47-39	74	S	38.5	1.1	F	7287	10953	1133	1587	10795	7852	2697	2908	0.16	0.14	0.25	0.37
97-08-05 16-47-39	74	S	38.5	1.1	F	8939	8017	207	705	12023	7268	786	1134	0.02	0.09	0.07	0.16
97-08-05 16-47-39	74	S	38.5	1.1	F	10280	7417	1983	1126	9767	9465	2184	2320	0.19	0.15	0.22	0.25
97-08-05 16-47-39	74	S	38.5	1.1	F	10985	5715	-220	490	9445	9421	308	446	-0.02	0.09	0.03	0.05
97-08-05 16-47-39	74	S	38.5	1.1	F	7528	11321	2819	3035	11330	7374	3037	2996	0.37	0.27	0.27	0.41
97-08-05 16-47-39	74	S	38.5	1.1	F	7536	8688	2091	1686	11908	7984	3774	4027	0.28	0.19	0.32	0.5
97-08-05 16-47-39	74	S	38.5	1.1	F	10220	7055	1392	954	11006	9050	2457	2062	0.14	0.14	0.22	0.23
97-08-05 16-47-39	74	S	38.5	1.1	F	11320	5769	-317	750	9305	9826	271	441	-0.03	0.13	0.03	0.04
97-08-05 16-47-39	74	S	38.5	1.1	F	26020	32198	1058	2245	35656	28945	6136	6684	0.04	0.07	0.17	0.23
97-08-05 16-47-39	74	S	38.5	1.1	F	32505	29681	2139	193	39688	25730	1157	808	0.07	0.01	0.03	0.03
97-08-05 16-47-39	74	S	38.5	1.1	F	36349	27972	9823	8396	34864	28186	4194	4714	0.27	0.3	0.12	0.17
97-08-05 16-47-39	74	S	38.4	1	F	33574	24109	6970	6852	39547	29285	552	532	0.21	0.28	0.01	0.02
97-08-05 16-47-39	74	S	38.4	1	F	29437	35057	10272	14432	35100	28430	9939	10890	0.35	0.41	0.28	0.38
97-08-05 16-47-39	74	S	38.4	1	F	32298	29381	13197	11957	38458	29215	12811	12898	0.41	0.41	0.33	0.44
97-08-05 16-47-39	74	S	38.4	1	F	37152	28780	14588	11684	35183	29453	7146	6393	0.39	0.41	0.2	0.22
97-08-05 16-47-39	74	S	38.4	1	F	33746	28036	9908	13134	35873	32360	-235	-149	0.29	0.47	-0.01	0
97-08-05 16-47-39	74	S	38.4	1	F	30081	35268	3242	4270	37143	28655	9011	6332	0.11	0.12	0.24	0.22
97-08-05 16-47-39	74	S	38.4	1	F	31645	29909	1586	677	38274	29559	-298	-70	0.05	0.02	-0.01	0
97-08-05 16-47-39	74	S	38.4	1	F	35376	27992	8607	6054	39104	27149	10684	6339	0.24	0.22	0.27	0.23
97-08-05 16-47-39	74	S	38.4	1	F	35359	23443	-402	135	38885	28333	-236	-28	-0.01	0.01	-0.01	0
97-08-05 16-47-39	74	S	38.4	1	F	28259	35965	8154	12489	38262	29571	9723	10424	0.29	0.35	0.25	0.35
97-08-05 16-47-39	74	S	38.4	1	F	34867	29236	11095	9308	40887	28205	9485	11519	0.32	0.32	0.23	0.41
07-08-05 16-47-39	74	S	38.4	1	F	33031	30024	10672	9390	34937	30430	9721	8234	0.32	0.31	0.28	0.27
97-08-05 16-47-39	74	S	38.4	1	F	32241	27558	1103	381	34394	32459	823	11	0.03	0.01	0.02	0
97-08-05 16-47-39	74	S	38.4	1	F	29309	35215	3824	3806	35406	33268	7535	7317	0.13	0.11	0.21	0.22
97-08-05 16-47-39	74	S	38.4	1	F	32583	29320	2196	99	36170	30832	1767	294	0.07	0	0.05	0.01

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-47-39	74	S	38.4	1	F	33561	32917	11535	9692	34425	32245	11501	8246	0.34	0.29	0.33	0.26
97-08-05 16-47-39	74	S	38.4	1	F	33770	26774	4766	2927	35805	32050	2222	3296	0.14	0.11	0.06	0.1
97-08-05 16-47-39	74	S	38.4	1	F	22718	25749	2148	1476	30456	25352	8044	6514	0.09	0.06	0.26	0.26
97-08-05 16-47-39	74	S	38.4	1	F	22019	25577	1245	125	30491	24286	936	1018	0.06	0	0.03	0.04
97-08-05 16-47-39	74	S	38.4	1	F	27712	22014	8241	6626	29904	21480	6962	5284	0.3	0.3	0.23	0.25
97-08-05 16-47-39	74	S	38.3	1	F	28444	18864	-193	-421	27906	21565	880	32	-0.01	-0.02	0.03	0
97-08-05 16-47-39	74	S	38.3	1	F	32935	30989	927	1473	35760	32451	5803	7800	0.03	0.05	0.16	0.24
97-08-05 16-47-39	74	S	38.3	1	F	32062	31171	2465	-234	36516	30885	679	564	0.08	-0.01	0.02	0.02
97-08-05 16-47-39	74	S	38.4	1	F	37570	28855	5633	4030	39664	31905	6805	5985	0.15	0.14	0.17	0.19
97-08-05 16-47-39	74	S	38.3	1	F	35913	24584	-629	45	36663	30933	348	249	-0.02	0	0.01	0.01
97-08-05 16-47-39	74	S	38.3	1	F	28126	25641	4173	4078	32545	26143	6216	6494	0.15	0.16	0.19	0.25
97-08-05 16-47-39	74	S	38.3	1	F	28477	25944	797	445	31905	27751	-35	-208	0.03	0.02	0	-0.01
97-08-05 16-47-39	74	S	38.4	1	F	31216	25554	6944	5281	30447	26177	8815	5946	0.22	0.21	0.29	0.23
97-08-05 16-47-39	74	S	38.3	1	F	31793	23489	168	113	34898	25705	85	-110	0.01	0	0	0
97-08-05 16-47-39	74	S	38.4	1	F	25897	25498	749	2384	28333	26107	3277	5794	0.03	0.09	0.12	0.22
97-08-05 16-47-39	74	S	38.4	1	F	25632	20877	2273	497	29232	24081	897	301	0.09	0.02	0.03	0.01
97-08-05 16-47-39	74	S	38.4	1	F	26987	25455	2517	3885	29283	26476	3459	5383	0.09	0.15	0.12	0.2
97-08-05 16-47-39	74	S	38.4	1	F	26374	23425	1348	763	29219	25338	849	505	0.05	0.03	0.03	0.02
97-08-05 16-47-39	74	S	38.4	1	F	31202	32652	1627	4171	36491	31273	7426	8915	0.05	0.13	0.2	0.29
97-08-05 16-47-39	74	S	38.4	1	F	38075	29304	2962	297	40868	30636	1475	262	0.08	0.01	0.04	0.01
97-08-05 16-47-39	74	S	38.4	1	F	36114	29663	8946	8382	36313	31228	6244	6493	0.25	0.28	0.17	0.21
97-08-05 16-47-39	74	S	38.4	1	F	36598	27518	3467	3664	37823	33454	-120	571	0.09	0.13	0	0.02
97-08-05 16-47-39	74	S	38.4	1	F	23552	28205	157	2762	28625	26105	3757	5837	0.01	0.1	0.13	0.22
97-08-05 16-47-39	74	S	38.4	1	F	25269	25463	2016	-3	32633	24189	1056	2226	0.08	0	0.03	0.09
97-08-05 16-47-39	74	S	38.4	1	F	29937	24885	6505	4997	31223	25437	4504	4259	0.22	0.2	0.14	0.17
97-08-05 16-47-39	74	S	38.4	1	F	28762	23283	2522	5517	29431	26552	661	422	0.09	0.24	0.02	0.02
97-08-05 16-47-39	74	S	38.4	1	F	28628	24961	1346	1864	32393	24498	4554	5342	0.05	0.07	0.14	0.22
97-08-05 16-47-39	74	S	38.4	1	F	27124	23607	1519	78	33366	25383	564	-215	0.06	0	0.02	-0.01
97-08-05 16-47-39	74	S	38.4	1	F	32281	23968	8760	6594	31557	25099	6415	5926	0.27	0.28	0.2	0.24
97-08-05 16-47-39	74	S	38.4	1	F	31212	21413	6925	6933	32507	25148	4700	3727	0.22	0.32	0.14	0.15
97-08-05 16-47-39	74	S	38.4	1	F	26867	25946	45	1802	28923	22735	7674	9018	0	0.07	0.27	0.4
97-08-05 16-47-39	74	S	38.4	1	F	25568	22102	1819	-93	32387	22078	6205	7211	0.07	0	0.19	0.33
97-08-05 16-47-39	74	S	38.4	1	F	31178	19906	5524	3857	32453	23167	4162	5176	0.18	0.19	0.13	0.22
97-08-05 16-47-39	74	S	38.4	1	F	28675	19375	2861	2769	30808	22019	346	892	0.1	0.14	0.01	0.04
97-08-05 16-47-39	74	S	38.4	1	F	29674	32977	292	3148	35660	32442	9636	10658	0.01	0.1	0.27	0.33
97-08-05 16-47-39	74	S	38.4	1	F	33540	30269	2506	244	37757	31140	11533	11893	0.07	0.01	0.31	0.38
97-08-05 16-47-39	74	S	38.4	1	F	35155	29542	10146	9035	36604	28093	7602	6475	0.29	0.31	0.21	0.23
97-08-05 16-47-39	74	S	38.4	1	F	37316	26047	2227	1551	37858	31640	916	-220	0.06	0.06	0.02	-0.01
97-08-05 16-47-39	74	S	38.4	1	F	30486	33685	2252	2159	37163	27691	9266	8097	0.07	0.06	0.25	0.29
97-08-05 16-47-39	74	S	38.4	1	F	30258	27273	3204	-201	37972	30250	9565	7561	0.11	-0.01	0.25	0.25
97-08-05 16-47-39	74	S	38.4	1	F	37776	27023	13896	10609	37800	27080	7910	6211	0.37	0.39	0.21	0.23
97-08-05 16-47-39	74	S	38.4	1	F	34215	26542	6767	6128	36636	30027	772	240	0.2	0.23	0.02	0.01
97-08-05 16-47-39	74	S	38.4	1	F	31957	31642	539	1751	36300	29210	8638	8946	0.02	0.06	0.24	0.31
97-08-05 16-47-39	74	S	38.4	1	F	28866	28993	2059	395	36735	31156	5859	4145	0.07	0.01	0.16	0.13
97-08-05 16-47-39	74	S	38.5	1.1	F	32630	28088	6475	5023	34921	30865	3324	4356	0.2	0.18	0.1	0.14
97-08-05 16-47-39	74	S	38.5	1.1	F	32030	26644	-52	285	31556	31615	3016	231	0	0.01	0.1	0.01
97-08-05 16-47-39	74	S	38.5	1.1	F	28598	34764	50	2643	33194	28884	9429	8657	0	0.08	0.28	0.3
97-08-05 16-47-39	74	S	38.5	1.1	F	31539	28938	2879	556	37597	29121	2752	618	0.09	0.02	0.07	0.02
97-08-05 16-47-39	74	S	38.5	1.1	F	35206	27752	5665	4897	36414	26033	7566	6002	0.16	0.18	0.21	0.23
97-08-05 16-47-39	74	S	38.5	1.1	F	34869	24454	688	61	38333	28648	691	-204	0.02	0	0.02	-0.01
97-08-05 16-47-39	74	S	38.5	1.1	F	31155	31233	1739	3033	36016	26947	9969	8309	0.06	0.1	0.28	0.31
97-08-05 16-47-39	74	S	38.5	1.1	F	31418	29358	1721	257	36165	30772	895	388	0.05	0.01	0.02	0.01
97-08-05 16-47-39	74	S	38.5	1.1	F	33263	27841	5074	4121	34563	28268	6760	5793	0.15	0.15	0.2	0.2
97-08-05 16-47-39	74	S	38.5	1.1	F	34247	23976	411	315	39240	30421	327	-53	0.01	0.01	0.01	0
97-08-05 16-47-39	74	S	38.5	1.1	F	31051	31020	5408	4957	35336	29536	11266	10286	0.17	0.16	0.32	0.35
97-08-05 16-47-39	74	S	38.5	1.1	F	31090	28333	1300	244	36222	30328	3398	2815	0.04	0.01	0.09	0.09
97-08-05 16-47-39	74	S	38.5	1.1	F	32498	28677	4175	5093	33376	30097	5158	6396	0.13	0.18	0.15	0.21
97-08-05 16-47-39	74	S	38.5	1.1	F	33193	25961	724	347	33750	29891	3246	315	0.02	0.01	0.1	0.01
97-08-05 16-47-39	74	S	38.5	1.1	F	21854	27607	2649	4113	28741	23127	7605	5722	0.12	0.15	0.26	0.25
97-08-05 16-47-39	74	S	38.5	1.1	F	21844	22836	1726	558	27195	22477	377	742	0.08	0.02	0.01	0.03
97-08-05 16-47-39	74	S	38.6	1.1	F	28471	21115	7726	6358	31066	23381	6937	5511	0.27	0.3	0.22	0.24
97-08-05 16-47-39	74	S	38.5	1.1	F	26106	16555	1893	1603	33475	25187	910	636	0.07	0.1	0.03	0.03
97-08-05 16-47-39	74	S	38.6	1.1	F	29330	38558	8781	8317	31410	38120	12645	10878	0.3	0.22	0.4	0.29
97-08-05 16-47-39	74	S	38.6	1.1	F	30079	37510	4252	-418	33062	39791	3414	4014	0.14	-0.01	0.1	0.1
97-08-05 16-47-39	74	S	38.6	1.1	F	41399	27101	8389	8293	45421	28192	9217	7700	0.2	0.31	0.2	0.27
97-08-05 16-47-39	74	S	38.6	1.1	F	37980	26057	3877	1394	41317	31334	1913	2799	0.1	0.05	0.05	0.09
97-08-05 16-47-39	74	S	38.6	1.1	F	33439	38944	5505	4111	34297	32857	10775	9280	0.16	0.11	0.31	0.28
97-08-05 16-47-39	74	S	38.6	1.1	F	30645	33152	2453	-203	35862	41812	490	669	0.08	-0.01	0.01	0.02
97-08-05 16-47-39	74	S	38.6	1.1	F	34886	30572	6002	6354	43251	29443	10449	7064	0.17	0.21	0.24	0.24

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-05 16-47-39	74	S	38.6	1.1	F	37466	30088	144	-174	40000	31151	695	47	0	-0.01	0.02	0
97-08-05 16-47-39	74	S	38.6	1.1	F	21733	28024	399	3963	29627	23881	6237	8026	0.02	0.14	0.21	0.34
97-08-05 16-47-39	74	S	38.6	1.1	F	24612	23405	1818	509	32150	22615	8560	8586	0.07	0.02	0.27	0.38
97-08-05 16-47-39	74	S	38.6	1.1	F	28675	22561	9204	7358	29950	22463	4277	4810	0.32	0.33	0.14	0.21
97-08-05 16-47-39	74	S	38.6	1.1	F	27426	21837	4094	6468	28622	24561	464	420	0.15	0.3	0.02	0.02
97-08-05 16-47-39	74	S	38.6	1.1	F	23643	28888	2212	2968	30520	24134	7688	6144	0.09	0.1	0.25	0.25
97-08-05 16-47-39	74	S	38.6	1.1	F	27248	25563	1699	-383	31751	22917	1113	255	0.06	-0.01	0.04	0.01
97-08-05 16-47-39	74	S	38.7	1.1	F	27576	25681	9870	7867	29530	24044	7767	5395	0.36	0.31	0.26	0.22
97-08-05 16-47-39	74	S	38.7	1.1	F	28540	22021	2142	1776	28973	24418	371	-26	0.08	0.08	0.01	0
97-08-05 16-47-39	74	S	38.7	1.1	F	25819	26140	979	998	27379	26395	6191	6679	0.04	0.04	0.23	0.25
97-08-05 16-47-39	74	S	38.7	1.1	F	23991	22998	1953	-173	28117	26581	827	24	0.08	-0.01	0.03	0
97-08-05 16-47-39	74	S	38.7	1.1	F	28683	24290	3637	3355	28735	24274	5728	5091	0.13	0.14	0.2	0.21
97-08-05 16-47-39	74	S	38.7	1.1	F	27612	20795	44	394	29391	26595	258	634	0	0.02	0.01	0.02
97-08-05 16-47-39	74	S	38.7	1.1	F	34096	34237	294	2513	37967	27232	10196	10948	0.01	0.07	0.27	0.4
97-08-05 16-47-39	74	S	38.7	1.1	F	29509	28405	3513	308	39058	28305	7949	5495	0.12	0.01	0.2	0.19
97-08-05 16-47-39	74	S	38.7	1.1	F	34358	31582	11068	10225	37134	29077	9694	7844	0.32	0.32	0.26	0.27
97-08-05 16-47-39	74	S	38.7	1.1	F	34569	25549	1924	619	35411	33937	1443	199	0.06	0.02	0.04	0.01
97-08-05 16-47-39	74	S	38.7	1.1	F	31525	35686	-170	3556	34809	32607	11600	12987	-0.01	0.1	0.33	0.4
97-08-05 16-47-39	74	S	38.7	1.1	F	32992	31033	3469	37	39058	34533	9289	8034	0.11	0	0.24	0.23
97-08-05 16-47-39	74	S	38.8	1.1	F	36827	28515	15066	11908	35992	30287	8350	6420	0.41	0.42	0.23	0.21
97-08-05 16-47-39	74	S	38.8	1.1	F	42552	30420	7254	13603	37931	31587	-83	-47	0.17	0.45	0	0
97-08-05 16-47-39	74	S	38.8	1.1	F	25467	28195	5268	8170	31325	28951	9460	10056	0.21	0.29	0.3	0.35
97-08-05 16-47-39	74	S	38.8	1.1	F	30203	26382	6653	940	32800	25596	9768	9522	0.22	0.04	0.3	0.37
97-08-05 16-47-39	74	S	38.8	1.1	F	27716	21433	1076	1733	29300	20882	4782	4933	0.04	0.08	0.16	0.24
97-08-05 16-47-39	74	S	38.8	1.1	F	27038	18126	1035	802	30117	20960	308	204	0.04	0.04	0.01	0.01
97-08-05 16-47-39	74	S	38.8	1.1	F	7003	7233	1301	887	8035	7381	3080	2158	0.19	0.12	0.38	0.29
97-08-05 16-47-39	74	S	38.8	1.1	F	7090	6280	230	493	8810	6667	539	854	0.03	0.08	0.06	0.13
97-08-05 16-47-39	74	S	38.8	1.1	F	7142	6236	1274	909	7857	7054	2872	1932	0.18	0.15	0.37	0.27
97-08-05 16-47-39	74	S	38.8	1.1	F	7198	5825	-148	439	8083	6184	239	910	-0.02	0.08	0.03	0.15
97-08-05 16-47-39	74	S	38.8	1.1	F	6552	7167	891	1081	7947	6550	3121	2471	0.14	0.15	0.39	0.38
97-08-05 16-47-39	74	S	38.8	1.1	F	6776	6161	171	429	7542	6401	307	586	0.03	0.07	0.04	0.09
97-08-05 16-47-39	74	S	38.8	1.1	F	8187	6039	1340	889	6856	6826	2769	1987	0.16	0.15	0.4	0.29
97-08-05 16-47-39	74	S	38.8	1.2	F	7516	6029	-353	382	7745	6806	254	733	-0.05	0.06	0.03	0.11
97-08-05 16-47-39	74	S	38.8	1.2	F	7125	7945	1563	1225	9335	6091	3540	2548	0.22	0.15	0.38	0.42
97-08-05 16-47-39	74	S	38.8	1.1	F	6603	5904	183	528	8104	7217	506	754	0.03	0.09	0.06	0.1
97-08-05 16-47-39	74	S	38.9	1.2	F	7753	6852	2187	1205	7986	8259	3111	2112	0.28	0.18	0.39	0.26
97-08-05 16-47-39	74	S	38.8	1.2	F	7924	5837	-184	371	8682	6214	671	812	-0.02	0.06	0.08	0.13
97-08-05 16-47-39	74	S	38.9	1.2	F	34572	37917	6022	3996	36530	31059	10291	7823	0.17	0.11	0.28	0.25
97-08-05 16-47-39	74	S	38.8	1.2	F	32446	29951	2068	104	38535	36585	739	515	0.06	0	0.02	0.01
97-08-05 16-47-39	74	S	38.9	1.2	F	39187	31909	7940	7349	40122	30265	10793	7197	0.2	0.23	0.27	0.24
97-08-05 16-47-30	74	S	38.0	1.2	F	36705	28258	1465	-190	38500	29336	716	-53	0.04	-0.01	0.02	0
97-08-05 16-47-30	74	S	38.9	1.2	F	25088	28741	314	1317	31040	27113	5296	6488	0.01	0.05	0.17	0.24
97-08-05 16-47-39	74	S	38.9	1.2	F	27594	26596	1902	494	32017	26454	1801	832	0.07	0.02	0.06	0.03
97-08-05 16-47-39	74	S	38.9	1.2	F	30012	25769	8675	6372	30967	28793	6847	6272	0.29	0.25	0.22	0.22
97-08-05 16-47-39	74	S	38.9	1.2	F	28179	25611	5752	4695	28726	28570	2442	845	0.2	0.18	0.09	0.03
97-08-05 16-47-39	74	S	38.9	1.2	F	29962	36571	10537	14907	37007	29295	12398	12263	0.35	0.41	0.34	0.42
97-08-05 16-47-39	74	S	38.9	1.2	F	32150	27851	8691	3899	35840	30597	12719	14153	0.27	0.14	0.35	0.46
97-08-05 16-47-39	74	S	39	1.2	F	32113	29454	7582	7354	34224	30664	9459	7766	0.24	0.25	0.28	0.25
97-08-05 16-47-39	74	S	39	1.2	F	33271	26256	617	72	33823	32637	334	35	0.02	0	0.01	0
97-08-05 16-47-39	74	S	39	1.2	F	32806	31413	1655	3352	38434	27641	6788	7179	0.05	0.11	0.18	0.26
97-08-05 16-47-39	74	S	39	1.2	F	32578	27754	2041	82	39718	29324	1306	429	0.06	0	0.03	0.01
97-08-05 16-47-39	74	S	39	1.2	F	36420	27651	15046	13344	37994	28712	8858	7076	0.41	0.48	0.23	0.25
97-08-05 16-47-39	74	S	39	1.2	F	35336	27303	8499	11580	37116	31229	1376	1118	0.24	0.42	0.04	0.04
97-08-05 16-47-39	74	S	39	1.2	F	26977	36359	-160	2393	33590	29186	7678	7207	-0.01	0.07	0.23	0.25
97-08-05 16-47-39	74	S	39	1.2	F	29153	30869	3281	678	35065	34529	713	364	0.11	0.02	0.02	0.01
97-08-05 16-47-39	74	S	39.1	1.2	F	36534	24007	14551	10881	36486	26155	8543	6462	0.4	0.45	0.23	0.25
97-08-05 16-47-39	74	S	39	1.2	F	37086	24401	4796	8911	36649	30242	-116	-298	0.13	0.37	0	-0.01
97-08-05 16-47-39	74	S	39.1	1.2	F	23300	26980	2889	3760	28531	22741	6050	6027	0.12	0.14	0.21	0.27
97-08-05 16-47-39	74	S	39.1	1.2	F	23109	23979	2034	298	30660	21295	1494	641	0.09	0.01	0.05	0.03
97-08-05 16-47-39	74	S	39.1	1.2	F	29122	23729	11088	9039	31381	19450	5536	4579	0.38	0.38	0.18	0.24
97-08-05 16-47-39	74	S	39.1	1.2	F	26331	22857	4935	7004	28681	24587	552	22	0.19	0.31	0.02	0
97-08-05 16-47-39	74	S	39.1	1.2	F	7342	7018	1452	854	9044	6816	2336	2341	0.2	0.12	0.26	0.34
97-08-05 16-47-39	74	S	39.1	1.2	F	7032	6384	60	401	7943	7818	397	799	0.01	0.06	0.05	0.1
97-08-05 16-47-39	74	S	39.1	1.2	F	7261	5986	717	756	8054	6312	2010	1879	0.1	0.13	0.25	0.3
97-08-05 16-47-39	74	S	39.1	1.2	F	7327	5077	84	611	7297	6084	194	462	0.01	0.12	0.03	0.08
97-08-06 14-41-30	76	S	46.3	-0.2	L	28565	37309	2572	5001	34402	38868	4306	5588	0.09	0.13	0.13	0.14
97-08-06 14-41-30	76	S	46.3	-0.2	L	35342	30127	1184	669	37066	32896	681	1269	0.03	0.02	0.02	0.04
97-08-06 14-41-30	76	S	46.3	-0.2	L	33289	34189	36	2874	32234	30870	836	1273	0	0.08	0.03	0.04
97-08-06 14-41-30	76	S	46.3	-0.2	L	34086	33721	1620	4452	37412	34335	1626	3648	0.05	0.13	0.04	0.11

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 14-41-30	76	S	46.3	-0.2	L	31624	37899	5975	9984	39721	43901	6125	8854	0.19	0.26	0.15	0.2
97-08-06 14-41-30	76	S	46.3	-0.2	L	31856	39092	1784	3705	33935	37992	1612	3582	0.06	0.09	0.05	0.09
97-08-06 14-41-30	76	S	46.3	-0.3	L	33619	32914	4330	9561	33918	32170	5488	5932	0.13	0.29	0.16	0.18
97-08-06 14-41-30	76	S	46.3	-0.3	L	31680	38878	989	788	27994	34033	999	450	0.03	0.02	0.04	0.01
97-08-06 14-41-30	76	S	46.3	-0.3	L	28154	31524	2462	5314	36435	35145	3481	5962	0.09	0.17	0.1	0.17
97-08-06 14-41-30	76	S	46.2	-0.3	L	30499	35084	1142	-273	30207	35004	771	1479	0.04	-0.01	0.03	0.04
97-08-06 14-41-30	76	S	46.2	-0.3	L	32652	35017	1462	3097	32737	36032	4674	5343	0.04	0.09	0.14	0.15
97-08-06 14-41-30	76	S	46.2	-0.3	L	31759	34544	978	187	31785	31027	502	565	0.03	0.01	0.02	0.02
97-08-06 14-41-30	76	S	46.2	-0.3	L	31852	34144	-260	1943	35883	34068	-107	2080	-0.01	0.06	0	0.06
97-08-06 14-41-30	76	S	46.2	-0.3	L	31138	38684	657	1233	33040	37543	44	1428	0.02	0.03	0	0.04
97-08-06 14-41-30	76	S	46.2	-0.3	L	31861	34080	-866	3258	33897	36775	-201	1839	-0.03	0.1	-0.01	0.05
97-08-06 14-41-30	76	S	46.2	-0.3	L	31813	37186	1526	1162	29135	37168	1219	1330	0.05	0.03	0.04	0.04
97-08-06 14-41-30	76	S	46.2	-0.3	F	27725	31703	419	3679	28664	29729	2906	5081	0.02	0.12	0.1	0.17
97-08-06 14-41-30	76	S	46.2	-0.3	F	24946	31699	2010	-606	23570	32261	1083	1248	0.08	-0.02	0.05	0.04
97-08-06 14-41-30	76	S	46.2	-0.3	F	33726	22293	3576	7366	27397	26856	2907	4548	0.11	0.33	0.11	0.17
97-08-06 14-41-30	76	S	46.2	-0.3	F	33007	24343	795	5571	27547	30037	428	1711	0.02	0.23	0.02	0.06
97-08-06 14-41-30	76	S	46.2	-0.3	F	23627	33033	1901	9515	26845	29578	4175	5889	0.08	0.29	0.16	0.2
97-08-06 14-41-30	76	S	46.1	-0.3	F	23482	30970	1631	-1108	25397	28787	684	276	0.07	-0.04	0.03	0.01
97-08-06 14-41-30	76	S	46.1	-0.3	F	31861	22509	7347	9401	25783	27283	3307	4422	0.23	0.42	0.13	0.16
97-08-06 14-41-30	76	S	46.1	-0.3	F	31130	27038	138	5724	27301	33203	120	1894	0	0.21	0	0.06
97-08-06 14-41-30	76	S	46.1	-0.3	F	28195	36927	204	4800	29843	30726	463	3698	0.01	0.13	0.02	0.12
97-08-06 14-41-30	76	S	46.1	-0.3	F	30065	31648	2715	-601	29441	31937	508	1241	0.09	-0.02	0.02	0.04
97-08-06 14-41-30	76	S	46.1	-0.3	F	32641	29898	6397	9585	30100	31515	4377	6343	0.2	0.32	0.15	0.2
97-08-06 14-41-30	76	S	46.1	-0.3	F	29860	28914	359	1631	27984	29905	427	714	0.01	0.06	0.02	0.02
97-08-06 14-41-30	76	S	46.1	-0.3	F	27886	40806	59	3636	31218	34921	3951	5109	0	0.09	0.13	0.15
97-08-06 14-41-30	76	S	46.1	-0.3	F	30038	50615	2004	-1079	35015	53742	883	1101	0.06	-0.02	0.03	0.02
97-08-06 14-41-30	76	S	46	-0.3	F	34616	31614	-273	5943	30969	34346	344	4525	-0.01	0.19	0.01	0.13
97-08-06 14-41-30	76	S	46	-0.3	F	35299	31052	722	1640	31810	33891	1073	827	0.02	0.05	0.03	0.02
97-08-06 14-41-30	76	S	46	-0.3	F	23721	32982	2204	8059	27377	29252	5100	6555	0.09	0.24	0.19	0.22
97-08-06 14-41-30	76	S	46.1	-0.3	F	33533	33299	1767	-582	44084	29489	832	1777	0.05	-0.02	0.02	0.06
97-08-06 14-41-30	76	S	46	-0.3	F	32489	25814	5273	7975	26980	28378	3627	5105	0.16	0.31	0.13	0.18
97-08-06 14-41-30	76	S	46	-0.3	F	29402	26426	129	4257	27500	29827	366	1841	0	0.16	0.01	0.06
97-08-06 14-41-30	76	S	46	-0.3	F	26429	35353	511	3576	25586	32439	3429	5929	0.02	0.1	0.13	0.18
97-08-06 14-41-30	76	S	46	-0.3	F	24857	32078	1040	210	29872	31484	421	1168	0.04	0.01	0.01	0.04
97-08-06 14-41-30	76	S	46	-0.3	F	33862	27010	7362	10500	29185	26747	3335	5367	0.22	0.39	0.11	0.2
97-08-06 14-41-30	76	S	46	-0.3	F	28986	28270	-161	4091	30238	29150	327	1122	-0.01	0.14	0.01	0.04
97-08-06 14-41-30	76	S	46	-0.3	F	25335	35862	193	7354	26646	32954	3237	6342	0.01	0.21	0.12	0.19
97-08-06 14-41-30	76	S	46	-0.3	F	25991	35527	579	-867	25198	32046	-147	1273	0.02	-0.02	-0.01	0.04
97-08-06 14-41-30	76	S	46	-0.3	F	30418	30622	2206	9132	29552	28956	3232	5768	0.07	0.3	0.11	0.2
97-08-06 14-41-30	76	S	46	-0.3	F	29860	28392	-241	886	27617	28494	83	879	-0.01	0.03	0	0.03
97-08-06 14-41-30	76	S	45.9	-0.3	F	26198	29610	1216	8003	29270	29305	3651	5941	0.05	0.27	0.12	0.2
97-08-06 14-41-30	76	S	45.9	-0.3	F	25516	31682	879	-436	27824	30614	-178	1405	0.03	-0.01	-0.01	0.05
97-08-06 14-41-30	76	S	45.9	-0.3	F	30564	26852	4199	10884	29687	28962	3340	5710	0.14	0.41	0.11	0.2
97-08-06 14-41-30	76	S	45.9	-0.3	F	32932	29108	2309	10805	25202	28152	1562	1440	0.07	0.37	0.06	0.05
97-08-06 14-41-30	76	S	45.9	-0.3	F	24382	33719	394	3468	26574	28362	3428	5503	0.02	0.1	0.13	0.19
97-08-06 14-41-30	76	S	45.9	-0.3	F	23941	29314	1091	-813	24514	30985	447	430	0.05	-0.03	0.02	0.01
97-08-06 14-41-30	76	S	45.9	-0.3	F	31094	23859	5209	7787	26912	26782	4934	5507	0.17	0.33	0.18	0.21
97-08-06 14-41-30	76	S	45.9	-0.3	F	28875	25466	423	-239	25042	29163	721	846	0.01	-0.01	0.03	0.03
97-08-06 14-41-30	76	S	45.9	-0.3	F	33615	34006	3424	7348	32703	38592	5863	7932	0.1	0.22	0.18	0.21
97-08-06 14-41-30	76	S	45.9	-0.3	F	30572	37813	990	-1066	27027	43979	215	1925	0.03	-0.03	0.01	0.04
97-08-06 14-41-30	76	S	45.9	-0.3	F	34544	35913	4119	10755	39549	27038	7580	6074	0.12	0.3	0.19	0.22
97-08-06 14-41-30	76	S	45.9	-0.3	F	33951	33187	697	410	39443	29222	1148	-147	0.02	0.01	0.03	-0.01
97-08-06 14-41-30	76	S	45.9	-0.3	F	24715	41412	269	4522	30335	36771	4602	6843	0.01	0.11	0.15	0.19
97-08-06 14-41-30	76	S	45.9	-0.3	F	28384	37392	2215	-1042	27956	37017	488	127	0.08	-0.03	0.02	0
97-08-06 14-41-30	76	S	45.8	-0.3	F	38608	31624	9568	15116	35204	33984	4926	7274	0.25	0.48	0.14	0.21
97-08-06 14-41-30	76	S	45.8	-0.3	F	34270	35310	1709	15047	36712	34243	1632	900	0.05	0.43	0.04	0.03
97-08-06 14-41-30	76	S	45.8	-0.3	F	28723	33339	864	11200	26662	38191	3176	7003	0.03	0.34	0.12	0.18
97-08-06 14-41-30	76	S	45.8	-0.3	F	27993	34924	2459	4937	26605	39270	-194	6966	0.09	0.14	-0.01	0.18
97-08-06 14-41-30	76	S	45.8	-0.3	F	40623	21808	8792	9120	29588	32111	4622	7471	0.22	0.42	0.16	0.23
97-08-06 14-41-30	76	S	45.8	-0.3	F	31121	26523	34	10343	29200	36339	173	4616	0	0.39	0.01	0.13
97-08-06 14-41-30	76	S	45.8	-0.4	F	26958	33076	-379	3514	25375	29054	1506	4359	-0.01	0.11	0.06	0.15
97-08-06 14-41-30	76	S	45.8	-0.4	F	24638	29534	1738	-685	24586	29423	496	779	0.07	-0.02	0.02	0.03
97-08-06 14-41-30	76	S	45.8	-0.4	F	31477	26949	2183	7840	27701	26407	2226	4626	0.07	0.29	0.08	0.18
97-08-06 14-41-30	76	S	45.8	-0.4	F	26814	26495	959	2381	26665	27522	1077	609	0.04	0.09	0.04	0.02
97-08-06 14-41-30	76	S	45.8	-0.4	F	6668	10856	534	2879	7488	8750	1549	2103	0.08	0.27	0.21	0.24
97-08-06 14-41-30	76	S	45.8	-0.4	F	6280	8166	1078	24	5943	8581	501	1125	0.17	0	0.08	0.13
97-08-06 14-41-30	76	S	45.8	-0.4	F	6508	8862	2402	3198	7512	6925	2380	2074	0.37	0.36	0.32	0.3
97-08-06 14-41-30	76	S	45.8	-0.4	F	8612	8365	770	1731	8317	8662	635	1303	0.09	0.21	0.08	0.15
97-08-06 14-41-30	76	S	45.8	-0.4	F	28000	35555	6343	17555	30198	30240	5152	7480	0.23	0.49	0.17	0.25

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 14-41-30	76	S	45.8	-0.4	F	29176	35310	10241	17878	28998	34349	4690	9445	0.35	0.51	0.16	0.27
97-08-06 14-41-30	76	S	45.8	-0.4	F	30971	32070	6005	10933	29187	31259	5194	6685	0.19	0.34	0.18	0.21
97-08-06 14-41-30	76	S	45.8	-0.4	F	28461	33167	-36	4349	27816	36957	872	1616	0	0.13	0.03	0.04
97-08-06 14-41-30	76	S	45.7	-0.4	F	20597	28116	91	3988	22004	25658	3037	4679	0	0.14	0.14	0.18
97-08-06 14-41-30	76	S	45.7	-0.4	F	20930	27255	693	758	21323	25098	-163	1522	0.03	0.03	-0.01	0.06
97-08-06 14-41-30	76	S	45.7	-0.4	F	25358	25843	2638	7491	20773	31596	4140	6516	0.1	0.29	0.2	0.21
97-08-06 14-41-30	76	S	45.7	-0.4	F	25290	26118	443	1085	20109	31309	666	1910	0.02	0.04	0.03	0.06
97-08-06 14-41-30	76	S	45.7	-0.4	F	26992	36806	954	7669	29350	29874	6063	6662	0.04	0.21	0.21	0.22
97-08-06 14-41-30	76	S	45.7	-0.4	F	28217	34106	1446	-790	27278	35276	154	1234	0.05	-0.02	0.01	0.03
97-08-06 14-41-30	76	S	45.7	-0.4	F	41599	31698	-525	5814	35293	33248	32	4916	-0.01	0.18	0	0.15
97-08-06 14-41-30	76	S	45.7	-0.4	F	31783	30859	216	3050	34202	35170	232	1102	0.01	0.1	0.01	0.03
97-08-06 14-41-30	76	S	45.7	-0.4	F	30679	38688	-78	7880	30944	37165	3951	8800	0	0.2	0.13	0.24
97-08-06 14-41-30	76	S	45.7	-0.4	F	28895	34957	3842	-1335	29432	36406	1546	467	0.13	-0.04	0.05	0.01
97-08-06 14-41-30	76	S	45.7	-0.4	F	38540	29724	5361	9858	32268	33253	3389	7211	0.14	0.33	0.11	0.22
97-08-06 14-41-30	76	S	45.7	-0.4	F	33796	32551	630	1202	31966	34731	1745	-89	0.02	0.04	0.05	0
97-08-06 14-41-30	76	S	45.7	-0.4	F	30592	40184	-16	5215	29126	36064	3781	7758	0	0.13	0.13	0.22
97-08-06 14-41-30	76	S	45.7	-0.4	F	31351	32909	2957	-1372	30838	36076	990	634	0.09	-0.04	0.03	0.02
97-08-06 14-41-30	76	S	45.7	-0.4	F	34528	32648	2980	6985	33682	31617	3489	5330	0.09	0.21	0.1	0.17
97-08-06 14-41-30	76	S	45.7	-0.4	F	34958	36964	1142	-251	35056	37740	1300	73	0.03	-0.01	0.04	0
97-08-06 14-41-30	76	S	45.7	-0.4	F	30851	45356	33	8259	33055	39567	3381	8233	0	0.18	0.1	0.21
97-08-06 14-41-30	76	S	45.7	-0.4	F	33724	37281	1550	-1110	35846	35626	725	-433	0.05	-0.03	0.02	-0.01
97-08-06 14-41-30	76	S	45.7	-0.4	F	36481	33880	8222	12689	36575	31403	7812	7495	0.23	0.37	0.21	0.24
97-08-06 14-41-30	76	S	45.7	-0.4	F	32164	38829	26	4776	31282	35941	462	1952	0	0.12	0.01	0.05
97-08-06 14-41-30	76	S	45.7	-0.4	F	27585	46049	-213	8080	36869	39624	4990	9431	-0.01	0.18	0.14	0.24
97-08-06 14-41-30	76	S	45.7	-0.4	F	35891	35540	2343	-987	35911	35500	2227	4238	0.07	-0.03	0.06	0.12
97-08-06 14-41-30	76	S	45.7	-0.4	F	32489	39804	8586	16269	31397	33955	3885	6881	0.26	0.41	0.12	0.2
97-08-06 14-41-30	76	S	45.7	-0.4	F	31354	38004	571	10410	32609	36258	1085	436	0.02	0.27	0.03	0.01
97-08-06 14-41-30	76	S	45.7	-0.4	F	31457	56546	106	6706	34630	43122	3645	9474	0	0.12	0.11	0.22
97-08-06 14-41-30	76	S	45.7	-0.4	F	31924	38782	1409	-1126	34253	34433	1231	-550	0.04	-0.03	0.04	-0.02
97-08-06 14-41-30	76	S	45.7	-0.4	F	32702	36320	3106	9400	34782	34515	3090	6492	0.09	0.26	0.09	0.19
97-08-06 14-41-30	76	S	45.7	-0.4	F	30591	35234	356	3723	34052	37381	953	744	0.01	0.11	0.03	0.02
97-08-06 14-41-30	76	S	45.7	-0.4	F	7543	11690	556	3054	8597	10274	1709	2323	0.07	0.26	0.2	0.23
97-08-06 14-41-30	76	S	45.7	-0.4	F	7334	9131	1012	-69	7526	9678	712	859	0.14	-0.01	0.09	0.09
97-08-06 14-41-30	76	S	45.7	-0.4	F	8199	9539	1108	3683	8930	9011	1944	2469	0.14	0.39	0.22	0.27
97-08-06 14-41-30	76	S	45.7	-0.4	F	7941	8454	717	726	7577	9312	607	966	0.09	0.09	0.08	0.1
97-08-06 14-41-30	76	S	45.7	-0.4	F	20684	32443	961	4316	21293	30776	2453	6596	0.05	0.13	0.12	0.21
97-08-06 14-41-30	76	S	45.7	-0.4	F	20849	32060	3662	851	21865	32450	2389	-498	0.18	0.03	0.11	-0.02
97-08-06 14-41-30	76	S	45.7	-0.4	F	30117	27554	3104	6729	25962	25379	1833	4856	0.1	0.24	0.07	0.19
97-08-06 14-41-30	76	S	45.7	-0.4	F	28360	25527	428	1782	27565	28647	545	749	0.02	0.07	0.02	0.03
97-08-06 14-41-30	76	S	45.7	-0.4	F	33827	38330	7829	19195	37564	31058	9378	9225	0.23	0.5	0.25	0.3
97-08-06 14-41-30	76	S	45.7	-0.4	F	31754	36542	8118	17334	33895	31592	4486	8125	0.26	0.47	0.13	0.26
97-08-06 14-41-30	76	S	45.7	-0.4	F	36458	30248	3719	9050	30784	34505	3416	7312	0.1	0.3	0.11	0.21
97-08-06 14-41-30	76	S	45.7	-0.4	F	34066	33861	2719	-638	32205	35071	2852	-509	0.08	-0.02	0.09	-0.01
97-08-06 14-41-30	76	S	45.7	-0.4	F	5994	8659	509	3311	6502	7883	1408	2164	0.08	0.38	0.22	0.27
97-08-06 14-41-30	76	S	45.7	-0.4	F	6886	7592	1107	1054	6587	8207	580	1485	0.16	0.14	0.09	0.18
97-08-06 14-41-30	76	S	45.7	-0.4	F	6466	7570	873	2900	6168	6717	1221	1930	0.14	0.38	0.2	0.29
97-08-06 14-41-30	76	S	45.7	-0.4	F	5861	6364	2835	1447	5003	6545	1884	1215	0.48	0.23	0.38	0.19
97-08-06 14-42-45	74	S	40.8	1.7	L	40918	34168	-960	-374	40139	27574	2613	1075	-0.02	-0.01	0.07	0.04
97-08-06 14-42-45	74	S	40.8	1.7	L	29339	33246	459	1053	34150	34842	-836	423	0.02	0.03	-0.02	0.01
97-08-06 14-42-45	74	S	40.7	1.7	L	36128	30596	3851	2958	35708	32071	6202	6122	0.11	0.1	0.17	0.19
97-08-06 14-42-45	74	S	40.7	1.7	L	39938	26378	476	1204	43236	27292	1703	2760	0.01	0.05	0.04	0.1
97-08-06 14-42-45	74	S	40.7	1.7	L	33792	33962	6147	4052	38895	27494	7282	5023	0.18	0.12	0.19	0.18
97-08-06 14-42-45	74	S	40.7	1.7	L	32768	31710	1499	298	37276	34217	-145	61	0.05	0.01	0	0
97-08-06 14-42-45	74	S	40.7	1.7	L	38985	34636	6517	5055	38594	28159	8172	5535	0.17	0.15	0.21	0.2
97-08-06 14-42-45	74	S	40.7	1.7	L	35961	24870	1834	528	37759	24817	-749	234	0.05	0.02	-0.02	0.01
97-08-06 14-42-45	74	S	40.7	1.6	L	31793	34626	1592	352	37206	30141	6017	3702	0.05	0.01	0.16	0.12
97-08-06 14-42-45	74	S	40.7	1.6	L	31555	32576	956	410	35140	34480	494	441	0.03	0.01	0.01	0.01
97-08-06 14-42-45	74	S	40.6	1.6	L	36784	31464	3553	2509	36883	27465	5880	5025	0.1	0.08	0.16	0.18
97-08-06 14-42-45	74	S	40.6	1.6	L	35914	28332	1206	560	39429	25427	3613	2567	0.03	0.02	0.09	0.1
97-08-06 14-42-45	74	S	40.6	1.6	L	31147	35436	-756	57	37324	31474	2475	2916	-0.02	0	0.07	0.09
97-08-06 14-42-45	74	S	40.6	1.6	L	34374	30421	834	727	38527	31414	-900	467	0.02	0.02	-0.03	0.01
97-08-06 14-42-45	74	S	40.6	1.6	L	37087	29832	2508	2369	42409	28132	7804	6118	0.07	0.08	0.18	0.22
97-08-06 14-42-45	74	S	40.6	1.6	L	39512	27778	482	1013	40422	29158	-990	1165	0.01	0.04	-0.02	0.04
97-08-06 14-42-45	74	S	40.6	1.6	F	28182	30583	-265	213	32162	26930	4858	3965	-0.01	0.01	0.15	0.15
97-08-06 14-42-45	74	S	40.6	1.6	F	28818	32561	3177	547	35697	30065	-511	422	0.11	0.02	-0.01	0.01
97-08-06 14-42-45	74	S	40.5	1.6	F	31150	24767	4401	3340	31752	26875	3733	4770	0.14	0.13	0.12	0.18
97-08-06 14-42-45	74	S	40.5	1.6	F	29508	24016	235	294	33018	28450	312	103	0.01	0.01	0.01	0.01
97-08-06 14-42-45	74	S	40.5	1.6	F	24307	32386	-274	267	30907	25904	6101	4985	-0.01	0.01	0.2	0.19
97-08-06 14-42-45	74	S	40.5	1.6	F	25260	28014	669	646	32832	27069	4413	3850	0.03	0.02	0.13	0.14

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 14-42-45	74	S	40.5	1.6	F	27829	24803	-776	2438	32286	25218	-942	-546	-0.03	0.1	-0.03	-0.02
97-08-06 14-42-45	74	S	40.5	1.6	F	29613	24592	1446	1346	32843	26645	2842	357	0.05	0.05	0.09	0.01
97-08-06 14-42-45	74	S	40.5	1.6	F	30740	30716	33	1180	34705	27725	7616	7185	0	0.04	0.22	0.26
97-08-06 14-42-45	74	S	40.5	1.6	F	31583	34123	5885	699	35239	31470	6301	5606	0.19	0.02	0.18	0.18
97-08-06 14-42-45	74	S	40.5	1.6	F	32392	28802	9925	5842	34223	26838	7710	4799	0.31	0.2	0.23	0.18
97-08-06 14-42-45	74	S	40.5	1.6	F	32477	26578	5774	4666	33945	29976	-252	-12	0.18	0.18	-0.01	0
97-08-06 14-42-45	74	S	40.4	1.6	F	36812	26937	204	-616	41271	25133	3807	4461	0.01	-0.02	0.09	0.18
97-08-06 14-42-45	74	S	40.5	1.6	F	32738	30927	7274	-246	36759	25675	78	186	0.22	-0.01	0	0.01
97-08-06 14-42-45	74	S	40.4	1.6	F	36910	29265	8861	7013	38389	29594	9035	7914	0.24	0.24	0.24	0.27
97-08-06 14-42-45	74	S	40.4	1.6	F	38186	24600	-1036	666	39100	31052	-289	1265	-0.03	0.03	-0.01	0.04
97-08-06 14-42-45	74	S	40.4	1.6	F	29292	29152	2951	-28	33791	26118	7174	5968	0.1	0	0.21	0.23
97-08-06 14-42-45	74	S	40.4	1.6	F	28325	33711	1182	353	32544	27969	5379	5955	0.04	0.01	0.17	0.21
97-08-06 14-42-45	74	S	40.4	1.6	F	31048	23643	4513	3504	32703	23986	-780	1088	0.15	0.15	-0.02	0.05
97-08-06 14-42-45	74	S	40.4	1.6	F	30900	22807	-351	514	34446	25078	4076	165	-0.01	0.02	0.12	0.01
97-08-06 14-42-45	74	S	40.4	1.6	F	27204	31550	3692	3302	33387	28049	6634	4783	0.14	0.1	0.2	0.17
97-08-06 14-42-45	74	S	40.4	1.6	F	27113	31508	1559	440	32476	23312	493	96	0.06	0.01	0.02	0
97-08-06 14-42-45	74	S	40.4	1.6	F	33958	26154	3813	3001	32360	26415	6013	5101	0.11	0.11	0.19	0.19
97-08-06 14-42-45	74	S	40.3	1.6	F	28413	26235	-320	149	31582	27995	-173	220	-0.01	0.01	-0.01	0.01
97-08-06 14-42-45	74	S	40.3	1.6	F	28867	27383	-222	398	33750	25440	5019	5399	-0.01	0.01	0.15	0.21
97-08-06 14-42-45	74	S	40.3	1.6	F	30005	26575	4839	296	35714	26942	130	-161	0.16	0.01	0	-0.01
97-08-06 14-42-45	74	S	40.3	1.6	F	34249	32161	4137	3745	32740	25875	6376	5552	0.12	0.12	0.19	0.21
97-08-06 14-42-45	74	S	40.3	1.6	F	30230	25528	41	-33	34129	28072	-54	98	0	0	0	0
97-08-06 14-42-45	74	S	40.3	1.6	F	27363	30526	21	1352	30649	28889	4619	6296	0	0.04	0.15	0.22
97-08-06 14-42-45	74	S	40.3	1.6	F	26536	28332	2600	409	30223	28452	1243	776	0.1	0.01	0.04	0.03
97-08-06 14-42-45	74	S	40.3	1.5	F	31213	24355	4477	3973	29866	25134	-393	781	0.14	0.16	-0.01	0.03
97-08-06 14-42-45	74	S	40.3	1.5	F	30842	23380	-218	806	31455	25617	8843	3473	-0.01	0.03	0.28	0.14
97-08-06 14-42-45	74	S	40.3	1.5	F	24844	29067	2547	2656	28605	26158	6067	5371	0.1	0.09	0.21	0.21
97-08-06 14-42-45	74	S	40.3	1.5	F	25938	28813	1549	595	31013	28120	-301	110	0.06	0.02	-0.01	0
97-08-06 14-42-45	74	S	40.3	1.5	F	33549	23712	8472	5417	32240	24538	6190	5438	0.25	0.23	0.19	0.22
97-08-06 14-42-45	74	S	40.3	1.5	F	32177	21184	5013	3277	32622	24452	1707	1224	0.16	0.15	0.05	0.05
97-08-06 14-42-45	74	S	40.3	1.5	F	31725	35642	906	1677	36717	34532	5728	7502	0.03	0.05	0.16	0.22
97-08-06 14-42-45	74	S	40.3	1.5	F	31340	31375	3022	-128	39154	32425	1206	486	0.1	0	0.03	0.01
97-08-06 14-42-45	74	S	40.2	1.5	F	40250	27566	6145	5387	39070	33519	7911	7484	0.15	0.2	0.2	0.22
97-08-06 14-42-45	74	S	40.2	1.5	F	39661	24202	2458	-104	39072	32218	103	797	0.06	0	0	0.02
97-08-06 14-42-45	74	S	40.2	1.5	F	32878	36732	-105	1146	39923	27938	10602	9434	0	0.03	0.27	0.34
97-08-06 14-42-45	74	S	40.2	1.5	F	30935	29290	3352	324	40341	32388	5065	4793	0.11	0.01	0.13	0.15
97-08-06 14-42-45	74	S	40.2	1.5	F	42369	25367	7502	3824	43151	32623	3782	4431	0.18	0.15	0.09	0.14
97-08-06 14-42-45	74	S	40.2	1.5	F	36834	29336	4232	6816	39377	32944	476	238	0.11	0.23	0.01	0.01
97-08-06 14-42-45	74	S	40.2	1.5	F	24757	38879	-310	1223	34144	28316	4257	4692	-0.01	0.03	0.12	0.17
97-08-06 14-42-45	74	S	40.2	1.5	F	24775	32633	1990	-386	31744	35948	-643	-53	0.08	-0.01	-0.02	0
97-08-06 14-42-45	74	S	40.2	1.5	F	32996	28458	3	2427	34184	27801	4075	5074	0	0.09	0.12	0.18
97-08-06 14-42-45	74	S	40.2	1.5	F	34177	23887	-640	531	32655	34060	-623	243	-0.02	0.02	-0.02	0.01
97-08-06 14-42-45	74	S	40.2	1.5	F	26406	30313	-142	185	32080	25584	7318	7061	-0.01	0.01	0.23	0.28
97-08-06 14-42-45	74	S	40.2	1.5	F	25333	27693	5025	399	32225	27256	637	377	0.2	0.01	0.02	0.01
97-08-06 14-42-45	74	S	40.2	1.5	F	32174	26439	7987	7139	32402	24548	6270	5389	0.25	0.27	0.19	0.22
97-08-06 14-42-45	74	S	40.2	1.5	F	29851	23880	5598	2363	33428	26412	355	655	0.19	0.1	0.01	0.02
97-08-06 14-42-45	74	S	40.2	1.5	F	7514	8026	1153	556	8078	6343	2313	1826	0.15	0.07	0.29	0.29
97-08-06 14-42-45	74	S	40.1	1.5	F	7305	6380	286	313	9872	6756	72	823	0.04	0.05	0.01	0.12
97-08-06 14-42-45	74	S	40.1	1.5	F	8111	6609	931	1469	9651	8646	2803	2305	0.11	0.22	0.29	0.27
97-08-06 14-42-45	74	S	40.1	1.5	F	7290	5898	239	987	10502	7224	256	956	0.03	0.17	0.02	0.13
97-08-06 14-42-45	74	S	40.1	1.5	F	28199	32689	-218	1000	37924	27859	6706	6118	-0.01	0.03	0.18	0.22
97-08-06 14-42-45	74	S	40.1	1.5	F	27774	30740	5347	421	36206	28872	935	1151	0.19	0.01	0.03	0.04
97-08-06 14-42-45	74	S	40.1	1.5	F	35502	26569	6098	4579	39371	26236	5924	5832	0.17	0.17	0.15	0.22
97-08-06 14-42-45	74	S	40.1	1.5	F	38611	22398	-508	75	36588	27181	273	174	-0.01	0	0.01	0.01
97-08-06 14-42-45	74	S	40.1	1.5	F	26490	22281	2818	2301	30464	18701	6145	5315	0.11	0.1	0.2	0.28
97-08-06 14-42-45	74	S	40.1	1.5	F	25523	19815	1090	199	29060	21014	442	1213	0.04	0.01	0.02	0.06
97-08-06 14-42-45	74	S	40.1	1.5	F	29014	19666	2532	1752	32954	21383	5487	4702	0.09	0.09	0.17	0.22
97-08-06 14-42-45	74	S	40.1	1.5	F	30404	18529	1418	-135	32135	22035	-37	614	0.05	-0.01	0	0.03
97-08-06 14-42-45	74	S	40.1	1.5	F	30228	32982	981	2879	40044	26508	7538	6255	0.03	0.09	0.19	0.24
97-08-06 14-42-45	74	S	40.1	1.5	F	33419	25367	2515	573	38315	27068	339	965	0.08	0.02	0.01	0.04
97-08-06 14-42-45	74	S	40	1.5	F	34460	29115	11755	11865	36111	28544	11352	11851	0.34	0.41	0.31	0.42
97-08-06 14-42-45	74	S	40	1.5	F	35081	30452	8292	8716	37702	27258	6360	8289	0.24	0.29	0.17	0.3
97-08-06 14-42-45	74	S	40	1.5	F	28919	34454	-199	1387	35444	30851	6029	6601	-0.01	0.04	0.17	0.21
97-08-06 14-42-45	74	S	40	1.5	F	30753	32467	2431	1086	38754	32152	478	1005	0.08	0.03	0.01	0.03
97-08-06 14-42-45	74	S	40	1.5	F	36078	29782	2633	3668	38786	29046	6580	5986	0.07	0.12	0.17	0.21
97-08-06 14-42-45	74	S	40	1.5	F	34530	27362	-446	905	39283	29783	-617	678	-0.01	0.03	-0.02	0.02
97-08-06 14-42-45	74	S	40	1.5	F	30219	34914	2825	3323	36999	31304	7365	7187	0.09	0.1	0.2	0.23
97-08-06 14-42-45	74	S	40	1.5	F	30656	31651	1960	988	35861	33356	-169	780	0.06	0.03	0	0.02
97-08-06 14-42-45	74	S	40	1.5	F	34825	27893	7697	5751	41971	30580	9168	6973	0.22	0.21	0.22	0.23

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-06 14-42-45	74	S	40	1.5	F	39783	27930	2856	371	41340	36835	1123	717	0.07	0.01	0.03	0.02
97-08-06 14-42-45	74	S	40	1.5	F	36481	36662	6351	4842	39254	39200	12910	12783	0.17	0.13	0.33	0.33
97-08-06 14-42-45	74	S	40	1.5	F	38357	34368	6105	166	37785	40002	6512	4211	0.16	0	0.17	0.11
97-08-06 14-42-45	74	S	40	1.5	F	36150	33439	9302	6871	38861	38321	11435	9800	0.26	0.21	0.29	0.26
97-08-06 14-42-45	74	S	40	1.5	F	37764	32335	5083	91	36423	38682	1293	870	0.13	0	0.04	0.02
97-08-06 14-42-45	74	S	40	1.5	F	38585	34455	5055	3820	41723	40437	14853	13260	0.13	0.11	0.36	0.33
97-08-06 14-42-45	74	S	40	1.5	F	36966	36193	4623	380	40247	36751	4094	1125	0.13	0.01	0.1	0.03
97-08-06 14-42-45	74	S	39.9	1.5	F	41061	31502	14192	10249	40726	32991	13658	11084	0.35	0.33	0.34	0.34
97-08-06 14-42-45	74	S	39.9	1.5	F	35788	31271	5507	3088	36383	37636	1224	1266	0.15	0.1	0.03	0.03
97-08-06 14-42-45	74	S	39.9	1.4	F	50443	35851	4716	3493	41427	39178	14753	13339	0.09	0.1	0.36	0.34
97-08-06 14-42-45	74	S	39.9	1.5	F	38385	34731	4374	429	38878	36928	4759	3095	0.11	0.01	0.12	0.08
97-08-06 14-42-45	74	S	39.9	1.4	F	36626	31618	11300	7725	38661	35037	13114	10293	0.31	0.24	0.34	0.29
97-08-06 14-42-45	74	S	39.9	1.4	F	35529	32469	2132	-86	34792	38525	-206	1405	0.06	0	-0.01	0.04
97-08-06 14-42-45	74	S	39.9	1.4	F	7410	8875	706	770	9707	7638	3113	2283	0.1	0.09	0.32	0.3
97-08-06 14-42-45	74	S	39.9	1.4	F	8001	7864	418	625	10046	7935	194	584	0.05	0.08	0.02	0.07
97-08-06 14-42-45	74	S	39.9	1.4	F	9583	6436	1637	807	8330	7535	2311	2361	0.17	0.13	0.28	0.31
97-08-06 14-42-45	74	S	39.9	1.4	F	9035	6685	-250	760	9212	8323	-74	909	-0.03	0.11	-0.01	0.11
97-08-06 14-42-45	74	S	39.9	1.4	F	27408	29061	6842	9306	31540	23496	7553	8520	0.25	0.32	0.24	0.36
97-08-06 14-42-45	74	S	39.9	1.4	F	27166	25649	13692	13756	33103	23699	13424	15261	0.5	0.54	0.41	0.64
97-08-06 14-42-45	74	S	39.9	1.4	F	30788	25184	9575	8390	30444	23979	8338	7816	0.31	0.33	0.27	0.33
97-08-06 14-42-45	74	S	39.9	1.4	F	27705	25467	2483	2464	33388	25955	2078	1756	0.09	0.1	0.06	0.07
97-08-06 14-42-45	74	S	39.9	1.4	F	37752	32465	481	2722	39525	32185	7333	8706	0.01	0.08	0.19	0.27
97-08-06 14-42-45	74	S	39.9	1.4	F	35435	27738	4243	269	39932	31131	2275	338	0.12	0.01	0.06	0.01
97-08-06 14-42-45	74	S	39.9	1.4	F	38129	29358	11531	11698	44857	26913	8807	8203	0.3	0.4	0.2	0.3
97-08-06 14-42-45	74	S	39.9	1.4	F	39096	28542	9274	12189	43040	29127	5232	6280	0.24	0.43	0.12	0.22
97-08-06 14-42-45	74	S	39.9	1.4	F	7225	6641	919	1103	8355	6589	1386	1715	0.13	0.17	0.17	0.26
97-08-06 14-42-45	74	S	39.9	1.4	F	7608	5733	305	1000	8065	7054	-57	931	0.04	0.17	-0.01	0.13
97-08-06 14-42-45	74	S	39.9	1.4	F	6533	5568	-18	612	7951	6237	1100	1435	0	0.11	0.14	0.23
97-08-06 14-42-45	74	S	39.9	1.4	F	6628	4521	1557	2943	7095	6786	14	2400	0.23	0.65	0	0.35
97-08-07 14-46-59	76	S	43.3	-0.9	L	32996	40645	2350	4560	32102	39641	3193	4872	0.07	0.11	0.1	0.12
97-08-07 14-46-59	76	S	43.3	-0.9	L	34234	39429	895	407	39773	46317	991	2412	0.03	0.01	0.02	0.05
97-08-07 14-46-59	76	S	43.3	-0.9	L	34731	43758	2727	6552	36211	42264	4076	6027	0.08	0.15	0.11	0.14
97-08-07 14-46-59	76	S	43.3	-0.9	L	37835	32642	1541	1431	33153	33709	1448	876	0.04	0.04	0.04	0.03
97-08-07 14-46-59	76	S	43.3	-0.9	L	31801	42304	3725	10039	32762	40512	3362	7145	0.12	0.24	0.1	0.18
97-08-07 14-46-59	76	S	43.3	-0.9	L	28992	40201	2192	8511	29475	40167	2495	5886	0.08	0.21	0.08	0.15
97-08-07 14-46-59	76	S	43.2	-0.9	L	34798	33379	5200	11738	35349	37781	3391	6332	0.15	0.35	0.1	0.17
97-08-07 14-46-59	76	S	43.2	-0.9	L	33300	33607	553	6634	33779	35131	847	2494	0.02	0.2	0.03	0.07
97-08-07 14-46-59	76	S	43.2	-0.9	L	31878	46338	991	-1304	30968	41422	3760	4147	0.03	-0.03	0.12	0.1
97-08-07 14-46-59	76	S	43.2	-0.9	L	34367	35134	1277	5270	34283	35669	1144	3849	0.04	0.15	0.03	0.11
97-08-07 14-46-59	76	S	43.2	-0.9	L	33359	38209	3468	6668	34105	40880	5471	6199	0.1	0.17	0.16	0.15
97-08-07 14-46-59	76	S	43.2	-0.9	L	31902	36744	1001	3864	30887	40302	2961	4524	0.03	0.11	0.1	0.11
97-08-07 14-46-59	76	S	43.2	-0.9	F	20671	33222	521	7985	21125	30896	1181	4685	0.03	0.24	0.06	0.15
97-08-07 14-46-59	76	S	43.2	-0.9	F	20033	30997	21	1317	18560	33697	-65	3319	0	0.04	0	0.1
97-08-07 14-46-59	76	S	43.2	-0.9	F	23137	27653	-113	5045	21569	26280	114	2832	0	0.18	0.01	0.11
97-08-07 14-46-59	76	S	43.1	-0.9	F	24402	25150	1119	-834	24704	26619	1017	-296	0.05	-0.03	0.04	-0.01
97-08-07 14-46-59	76	S	43.1	-0.9	F	21637	30229	675	7323	23788	27168	2857	3996	0.03	0.24	0.12	0.15
97-08-07 14-46-59	76	S	43.1	-0.9	F	20540	28191	994	-747	20248	29793	322	1374	0.05	-0.03	0.02	0.05
97-08-07 14-46-59	76	S	43.1	-0.9	F	24970	24669	6084	9512	22220	26584	2982	4215	0.24	0.39	0.13	0.16
97-08-07 14-46-59	76	S	43.1	-0.9	F	23606	28201	429	10070	22520	29867	927	2482	0.02	0.36	0.04	0.08
97-08-07 14-46-59	76	S	43.1	-0.9	F	26910	40252	1410	9528	34124	32189	4357	5632	0.05	0.24	0.13	0.17
97-08-07 14-46-59	76	S	43.1	-0.9	F	31448	39464	1510	-1235	35312	36299	1745	198	0.05	-0.03	0.05	0.01
97-08-07 14-46-59	76	S	43.1	-0.9	F	34935	33088	1099	8124	28966	37715	2344	7167	0.03	0.25	0.08	0.19
97-08-07 14-46-59	76	S	43.1	-0.9	F	34471	35294	782	916	32241	39051	1205	1620	0.02	0.03	0.04	0.04
97-08-07 14-46-59	76	S	43.1	-0.9	F	27140	39171	502	5315	37337	31505	4422	5835	0.02	0.14	0.12	0.19
97-08-07 14-46-59	76	S	43	-0.9	F	32146	37753	1887	-1108	35392	37202	1363	7	0.06	-0.03	0.04	0
97-08-07 14-46-59	76	S	43	-0.9	F	33348	37954	1525	7557	27571	41705	3254	7439	0.05	0.2	0.12	0.18
97-08-07 14-46-59	76	S	43	-0.9	F	32194	34312	330	441	31236	41265	511	898	0.01	0.01	0.02	0.02
97-08-07 14-46-59	76	S	43	-0.9	F	32048	35849	2288	7605	35579	32795	4167	5500	0.07	0.21	0.12	0.17
97-08-07 14-46-59	76	S	43	-0.9	F	33294	35991	1726	-1166	32533	41742	883	186	0.05	-0.03	0.03	0
97-08-07 14-46-59	76	S	43	-0.9	F	32213	32410	4206	9350	37597	32802	4789	5990	0.13	0.29	0.13	0.18
97-08-07 14-46-59	76	S	43	-0.9	F	33742	36885	762	1067	37417	34704	1503	1469	0.02	0.03	0.04	0.04
97-08-07 14-46-59	76	S	43	-0.9	F	32122	37295	144	7330	33426	29493	3540	5308	0	0.2	0.11	0.18
97-08-07 14-46-59	76	S	43	-0.9	F	31759	37040	1615	-1219	40203	34095	1973	-531	0.05	-0.03	0.05	-0.02
97-08-07 14-46-59	76	S	43	-0.9	F	37992	31280	-546	3597	26512	43108	690	7321	-0.01	0.11	0.03	0.17
97-08-07 14-46-59	76	S	43	-0.9	F	36245	29599	1575	-841	27178	41621	742	562	0.04	-0.03	0.03	0.01
97-08-07 14-46-59	76	S	42.9	-0.9	F	28892	42031	3818	8356	35454	31249	6614	5298	0.13	0.2	0.19	0.17
97-08-07 14-46-59	76	S	42.9	-0.9	F	28800	41040	1573	-1114	35937	36435	1734	-204	0.05	-0.03	0.05	-0.01
97-08-07 14-46-59	76	S	42.9	-0.9	F	33999	37791	5808	8055	26412	43533	5348	7566	0.17	0.21	0.2	0.17
97-08-07 14-46-59	76	S	42.9	-0.9	F	30744	37100	1097	2553	28018	42860	1209	2010	0.04	0.07	0.04	0.05

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-07 14-46-59	76	S	42.9	-0.9	F	27687	41995	452	5667	32995	33692	3881	5784	0.02	0.13	0.12	0.17
97-08-07 14-46-59	76	S	42.9	-0.9	F	30629	41566	1425	-1407	35653	39002	1212	-922	0.05	-0.03	0.03	-0.02
97-08-07 14-46-59	76	S	42.9	-0.9	F	34585	35442	1229	7938	29523	39825	2784	7323	0.04	0.22	0.09	0.18
97-08-07 14-46-59	76	S	42.9	-0.9	F	30674	34160	551	174	29875	40302	835	1080	0.02	0.01	0.03	0.03
97-08-07 14-46-59	76	S	42.9	-0.9	F	29227	36942	1466	7671	35037	29082	4673	5301	0.05	0.21	0.13	0.18
97-08-07 14-46-59	76	S	42.9	-0.9	F	34149	33406	1902	-1226	39469	30897	1722	-293	0.06	-0.04	0.04	-0.01
97-08-07 14-46-59	76	S	42.9	-0.9	F	34083	37904	-422	7417	25766	42617	852	7260	-0.01	0.2	0.03	0.17
97-08-07 14-46-59	76	S	42.9	-0.9	F	33575	33197	1059	-868	30497	42237	826	455	0.03	-0.03	0.03	0.01
97-08-07 14-46-59	76	S	42.9	-0.9	F	32699	36474	-272	1758	33289	28015	1132	4073	-0.01	0.05	0.03	0.15
97-08-07 14-46-59	76	S	42.9	-0.9	F	35052	32863	2123	-1014	39958	29582	2202	-758	0.06	-0.03	0.06	-0.03
97-08-07 14-46-59	76	S	42.9	-0.9	F	33810	37933	-217	5123	27008	43343	1478	7725	-0.01	0.14	0.05	0.18
97-08-07 14-46-59	76	S	42.9	-0.9	F	33334	34137	1617	-1024	36445	43758	1181	1180	0.05	-0.03	0.03	0.03
97-08-07 14-46-59	76	S	42.8	-0.9	F	29345	44374	-255	6394	32593	34940	2669	5932	-0.01	0.14	0.08	0.17
97-08-07 14-46-59	76	S	42.8	-0.9	F	26737	39020	1279	-1254	30333	38310	995	621	0.05	-0.03	0.03	0.02
97-08-07 14-46-59	76	S	42.8	-1	F	37202	31231	-554	3695	33822	31504	2040	4774	-0.01	0.12	0.06	0.15
97-08-07 14-46-59	76	S	42.8	-1	F	36176	28819	962	-1013	37105	32839	1376	-211	0.03	-0.04	0.04	-0.01
97-08-07 14-46-59	76	S	42.8	-1	F	26276	35283	-312	4957	32346	30261	1651	4359	-0.01	0.14	0.05	0.14
97-08-07 14-46-59	76	S	42.8	-1	F	28774	37525	1658	-1125	31390	32576	1428	-670	0.06	-0.03	0.05	-0.02
97-08-07 14-46-59	76	S	42.8	-1	F	35085	27550	2417	6839	31387	30451	2965	5454	0.07	0.25	0.09	0.18
97-08-07 14-46-59	76	S	42.8	-1	F	33832	33266	1027	-330	33121	33021	1428	362	0.03	-0.01	0.04	0.01
97-08-07 14-46-59	76	S	42.8	-1	F	26001	37601	60	6038	28586	34083	3819	6581	0	0.16	0.13	0.19
97-08-07 14-46-59	76	S	42.8	-1	F	28224	38590	1502	-1263	28712	41995	481	835	0.05	-0.03	0.02	0.02
97-08-07 14-46-59	76	S	42.7	-1	F	34841	29060	7908	8055	28522	32353	3889	5935	0.23	0.28	0.14	0.18
97-08-07 14-46-59	76	S	42.7	-1	F	31511	36712	220	3993	28899	40139	1158	758	0.01	0.11	0.04	0.02
97-08-07 14-46-59	76	S	42.7	-1	F	29880	37387	-412	6888	32577	33198	2001	5017	-0.01	0.18	0.06	0.15
97-08-07 14-46-59	76	S	42.7	-1	F	29553	38913	1289	-1481	30556	38907	489	69	0.04	-0.04	0.02	0
97-08-07 14-46-59	76	S	42.7	-1	F	36686	31493	4274	8385	31936	35338	1814	6176	0.12	0.27	0.06	0.17
97-08-07 14-46-59	76	S	42.7	-1	F	33783	34240	538	1812	31767	35592	1728	710	0.02	0.05	0.05	0.02
97-08-07 14-46-59	76	S	42.7	-1	F	29090	43970	685	10903	33343	39382	5648	8543	0.02	0.25	0.17	0.22
97-08-07 14-46-59	76	S	42.7	-1	F	30733	43896	1794	-1358	31436	42514	532	1015	0.06	-0.03	0.02	0.02
97-08-07 14-46-59	76	S	42.7	-1	F	32137	32960	4798	9284	30029	33526	2283	5738	0.15	0.28	0.08	0.17
97-08-07 14-46-59	76	S	42.7	-1	F	31285	33956	228	1923	25284	35441	1727	1039	0.01	0.06	0.07	0.03
97-08-07 14-46-59	76	S	42.6	-1	F	5969	8133	701	2903	6846	6757	998	1567	0.12	0.36	0.15	0.23
97-08-07 14-46-59	76	S	42.6	-1	F	5737	6863	907	-160	6208	6712	582	697	0.16	-0.02	0.09	0.1
97-08-07 14-46-59	76	S	42.6	-1	F	6466	8923	594	2604	6113	7704	425	1656	0.09	0.29	0.07	0.22
97-08-07 14-46-59	76	S	42.6	-1	F	7053	7278	783	252	6576	8703	432	620	0.11	0.03	0.07	0.07
97-08-07 14-48-18	74	S	38.2	1	L	40449	41976	926	554	41351	30479	5165	4241	0.02	0.01	0.12	0.14
97-08-07 14-48-18	74	S	38.2	1	L	35449	36850	891	428	40536	36063	34	577	0.03	0.01	0	0.02
97-08-07 14-48-18	74	S	38.2	1	L	29280	31002	2585	796	42689	33218	5926	5131	0.09	0.03	0.14	0.15
97-08-07 14-48-18	74	S	38.2	1	L	38509	40219	946	822	34733	35625	56	495	0.02	0.02	0	0.01
97-08-07 14-48-18	74	S	38.2	1	L	32724	34995	1653	3721	38111	30504	6672	7242	0.05	0.11	0.18	0.24
97-08-07 14-48-18	74	S	38.2	1	L	34274	30984	1312	512	39328	30336	41	297	0.04	0.02	0	0.01
97-08-07 14-48-18	74	S	38.2	1	L	32568	32419	4460	4715	38963	31466	8637	7641	0.14	0.15	0.22	0.24
97-08-07 14-48-18	74	S	38.2	1	L	34363	31973	682	729	35653	33055	-73	350	0.02	0.02	0	0.01
97-08-07 14-48-18	74	S	38.2	1	L	36926	33155	5370	4297	41163	27390	7943	5531	0.15	0.13	0.19	0.2
97-08-07 14-48-18	74	S	38.2	1	L	30656	36500	1265	1591	32797	35185	-598	1233	0.04	0.04	-0.02	0.04
97-08-07 14-48-18	74	S	38.1	1	L	37935	30806	5699	3987	41416	29151	8858	6127	0.15	0.13	0.21	0.21
97-08-07 14-48-18	74	S	38.1	1	L	39089	29835	481	277	38862	31075	-412	29	0.01	0.01	-0.01	0
97-08-07 14-48-18	74	S	38.1	1	F	24583	26329	3937	3139	29257	24158	5684	5759	0.16	0.12	0.19	0.24
97-08-07 14-48-18	74	S	38.1	1	F	24304	23729	784	-95	30918	21913	2093	1837	0.03	0	0.07	0.08
97-08-07 14-48-18	74	S	38.1	1	F	28480	20914	3486	2995	30521	21534	4708	4400	0.12	0.14	0.15	0.2
97-08-07 14-48-18	74	S	38.1	1	F	27818	19970	653	428	30154	21783	-622	266	0.02	0.02	-0.02	0.01
97-08-07 14-48-18	74	S	38.1	1	F	23896	27772	531	2298	28415	23887	2658	4470	0.02	0.08	0.09	0.19
97-08-07 14-48-18	74	S	38.1	0.9	F	22532	24131	1407	523	29585	23283	876	339	0.06	0.02	0.03	0.01
97-08-07 14-48-18	74	S	38	0.9	F	27989	19329	5726	3019	29379	23340	2697	3273	0.2	0.16	0.09	0.14
97-08-07 14-48-18	74	S	38	0.9	F	27659	20163	917	2516	29424	22824	-181	1061	0.03	0.12	-0.01	0.05
97-08-07 14-48-18	74	S	38	0.9	F	31610	34149	2531	2628	38980	34774	3765	5302	0.08	0.08	0.1	0.15
97-08-07 14-48-18	74	S	38	0.9	F	32603	31583	2854	955	36673	39874	1070	520	0.09	0.03	0.03	0.01
97-08-07 14-48-18	74	S	38	0.9	F	38720	35719	3759	3530	41314	36213	6368	4889	0.1	0.1	0.15	0.14
97-08-07 14-48-18	74	S	38	0.9	F	31834	32815	1415	477	40300	37757	1542	451	0.04	0.01	0.04	0.01
97-08-07 14-48-18	74	S	38	0.9	F	35931	32844	5687	3616	36993	30122	7022	5797	0.16	0.11	0.19	0.19
97-08-07 14-48-18	74	S	38	0.9	F	32538	29835	2358	600	38438	34796	-252	-94	0.07	0.02	-0.01	0
97-08-07 14-48-18	74	S	37.9	0.9	F	38841	27807	5459	4634	43961	28449	7650	5944	0.14	0.17	0.17	0.21
97-08-07 14-48-18	74	S	37.9	0.9	F	37910	26594	1211	153	41677	30521	-273	76	0.03	0.01	-0.01	0
97-08-07 14-48-18	74	S	37.9	0.9	F	31200	39592	1842	3143	38536	29763	7131	5799	0.06	0.08	0.19	0.19
97-08-07 14-48-18	74	S	37.9	0.9	F	31328	34204	2394	627	38031	34239	-258	150	0.08	0.02	-0.01	0
97-08-07 14-48-18	74	S	37.9	0.9	F	36647	30261	2621	3107	40094	31303	6016	4966	0.07	0.1	0.15	0.16
97-08-07 14-48-18	74	S	37.9	0.9	F	38775	25000	2388	535	40134	31475	999	317	0.06	0.02	0.02	0.01
97-08-07 14-48-18	74	S	37.9	0.9	F	34539	40230	3194	3770	33951	31536	5979	5912	0.09	0.09	0.18	0.19

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-07 14-48-1	74	S	37.9	0.9	F	28552	32450	1836	483	37929	35396	613	113	0.06	0.01	0.02	0
97-08-07 14-48-1	74	S	37.9	0.9	F	38425	27821	6363	5069	39729	28881	7384	6327	0.17	0.18	0.19	0.22
97-08-07 14-48-1	74	S	37.9	0.9	F	35493	27935	-142	206	39120	32889	-331	63	0	0.01	-0.01	0
97-08-07 14-48-1	74	S	37.8	0.9	F	33835	36042	7594	5081	34948	32747	9838	6564	0.22	0.14	0.28	0.2
97-08-07 14-48-1	74	S	37.8	0.9	F	34666	31741	4986	413	39078	36600	2350	416	0.14	0.01	0.06	0.01
97-08-07 14-48-1	74	S	37.8	0.9	F	39085	29498	8584	4670	41792	31356	9087	5667	0.22	0.16	0.22	0.18
97-08-07 14-48-1	74	S	37.8	0.9	F	36073	27372	2832	794	39935	30009	539	140	0.08	0.03	0.01	0
97-08-07 14-48-1	74	S	37.8	0.9	F	34735	35153	5465	4375	37740	30862	8393	6791	0.16	0.12	0.22	0.22
97-08-07 14-48-1	74	S	37.8	0.9	F	33751	30834	1832	444	40883	33928	242	87	0.05	0.01	0.01	0
97-08-07 14-48-1	74	S	37.8	0.9	F	37817	30207	5180	4180	38645	32488	6107	5965	0.14	0.14	0.16	0.18
97-08-07 14-48-1	74	S	37.8	0.9	F	38436	27166	1372	204	39038	30775	665	382	0.04	0.01	0.02	0.01
97-08-07 14-48-1	74	S	37.8	0.9	F	31562	37228	5332	4948	35907	34583	8347	8097	0.17	0.13	0.23	0.23
97-08-07 14-48-1	74	S	37.7	0.9	F	30688	34552	1706	415	37537	36440	338	75	0.06	0.01	0.01	0
97-08-07 14-48-1	74	S	37.7	0.9	F	38523	28947	8938	7083	42784	31249	9361	7017	0.23	0.24	0.22	0.22
97-08-07 14-48-1	74	S	37.7	0.9	F	37672	28930	1604	669	37684	32421	-216	451	0.04	0.02	-0.01	0.01
97-08-07 14-48-1	74	S	37.7	0.9	F	35549	36766	5612	5092	36836	37396	7263	7930	0.16	0.14	0.2	0.21
97-08-07 14-48-1	74	S	37.7	0.9	F	33059	34836	1682	-17	37102	40062	1120	384	0.05	0	0.03	0.01
97-08-07 14-48-1	74	S	37.7	0.9	F	38854	27460	7210	5255	44273	29874	8102	6518	0.19	0.19	0.18	0.22
97-08-07 14-48-1	74	S	37.7	0.9	F	38523	29386	-462	-13	48718	29928	1027	353	-0.01	0	0.02	0.01
97-08-07 14-48-1	74	S	37.7	0.9	F	30404	39021	3041	2733	34232	39469	9880	7923	0.1	0.07	0.29	0.2
97-08-07 14-48-1	74	S	37.7	0.9	F	27291	34112	1142	196	34746	37022	5985	43	0.04	0.01	0.17	0
97-08-07 14-48-1	74	S	37.7	0.8	F	37887	25602	6881	4422	42670	29279	7184	6105	0.18	0.17	0.17	0.21
97-08-07 14-48-1	74	S	37.7	0.8	F	41000	27887	252	112	36662	30099	590	223	0.01	0	0.02	0.01
97-08-07 14-48-1	74	S	37.6	0.8	F	31319	33044	2708	4102	37920	27312	4569	5784	0.09	0.12	0.12	0.21
97-08-07 14-48-1	74	S	37.6	0.8	F	31968	29364	1228	153	40102	28594	1356	133	0.04	0.01	0.03	0
97-08-07 14-48-1	74	S	37.6	0.8	F	35728	28375	4920	4276	36409	28787	5293	5647	0.14	0.15	0.15	0.2
97-08-07 14-48-1	74	S	37.6	0.8	F	34649	26029	704	61	36710	33559	338	263	0.02	0	0.01	0.01
97-08-07 14-48-1	74	S	37.6	0.8	F	29283	35735	2535	4556	34590	32518	5200	6972	0.09	0.13	0.15	0.21
97-08-07 14-48-1	74	S	37.6	0.8	F	30219	30874	1946	167	37349	32800	1958	112	0.06	0.01	0.05	0
97-08-07 14-48-1	74	S	37.6	0.8	F	35540	28829	10831	7938	34651	31999	4422	5936	0.3	0.28	0.13	0.19
97-08-07 14-48-1	74	S	37.6	0.8	F	36450	26635	3762	4039	37655	31807	1394	244	0.1	0.15	0.04	0.01
97-08-07 14-48-1	74	S	37.6	0.8	F	32039	34062	7230	10474	42223	33275	9570	8477	0.23	0.31	0.23	0.25
97-08-07 14-48-1	74	S	37.6	0.8	F	37782	31060	8105	1964	38228	32792	10257	10101	0.21	0.06	0.27	0.31
97-08-07 14-48-1	74	S	37.6	0.8	F	39853	30811	9458	7435	39192	30579	4910	5308	0.24	0.24	0.13	0.17
97-08-07 14-48-1	74	S	37.6	0.8	F	36337	27695	3588	4347	38553	34879	724	477	0.1	0.16	0.02	0.01
97-08-07 14-48-1	74	S	37.6	0.8	F	34492	37352	-313	112	39854	34034	8850	8889	-0.01	0	0.22	0.26
97-08-07 14-48-1	74	S	37.6	0.8	F	36818	34805	1258	206	42441	35756	8107	5232	0.03	0.01	0.19	0.15
97-08-07 14-48-1	74	S	37.6	0.8	F	38107	32846	10553	9373	34232	32778	5258	5964	0.28	0.29	0.15	0.18
97-08-07 14-48-1	74	S	37.6	0.8	F	33552	28496	4913	3502	35055	33857	1839	126	0.15	0.12	0.05	0
97-08-07 14-48-1	74	S	37.5	0.8	F	6163	6253	168	266	7863	6526	325	866	0.03	0.04	0.04	0.13
97-08-07 14-48-1	74	S	37.6	0.8	F	6553	5062	218	403	7195	6414	113	765	0.03	0.08	0.02	0.12
97-08-07 14-48-1	74	S	37.5	0.8	F	7022	6308	608	448	9034	6561	1251	1473	0.09	0.07	0.14	0.22
97-08-07 14-48-1	74	S	37.6	0.8	F	7507	6558	43	546	7351	7422	9	471	0.01	0.08	0	0.06
97-08-11 16-19-3	74	N	40.8	1.7	L	35753	39503	3641	4349	33976	30286	8924	7207	0.1	0.11	0.26	0.24
97-08-11 16-19-3	74	N	40.8	1.7	L	36990	32959	812	-372	37920	29430	1276	1684	0.02	-0.01	0.03	0.06
97-08-11 16-19-3	74	N	40.8	1.7	L	31522	35672	3474	3216	37000	35557	8597	7836	0.11	0.09	0.23	0.22
97-08-11 16-19-3	74	N	40.7	1.7	L	35812	28341	300	229	41525	31251	329	531	0.01	0.01	0.01	0.02
97-08-11 16-19-3	74	N	40.7	1.7	L	34022	30590	4434	5106	40467	33565	6114	5566	0.13	0.17	0.15	0.17
97-08-11 16-19-3	74	N	40.7	1.7	L	35032	36372	1607	2627	34732	34667	-427	712	0.05	0.07	-0.01	0.02
97-08-11 16-19-3	74	N	40.7	1.7	L	30951	33878	2910	4836	37586	29845	4308	4703	0.09	0.14	0.11	0.16
97-08-11 16-19-3	74	N	40.7	1.7	L	36852	38700	779	663	37949	30840	-429	791	0.02	0.02	-0.01	0.03
97-08-11 16-19-3	74	N	40.7	1.7	L	36986	29878	3400	5583	40179	27445	4100	5780	0.09	0.19	0.1	0.21
97-08-11 16-19-3	74	N	40.7	1.7	L	39546	34988	505	416	39205	32875	-577	533	0.01	0.01	-0.01	0.02
97-08-11 16-19-3	74	N	40.7	1.7	L	30255	34530	5084	7657	36504	31980	7069	9199	0.17	0.22	0.19	0.29
97-08-11 16-19-3	74	N	40.7	1.7	L	32093	40222	810	950	34746	35370	-448	1028	0.03	0.02	-0.01	0.03
97-08-11 16-19-3	74	N	40.6	1.6	F	10209	7591	1602	1233	8957	9288	666	1560	0.16	0.16	0.07	0.17
97-08-11 16-19-3	74	N	40.7	1.6	F	9066	8662	92	1178	9136	8818	182	1500	0.01	0.14	0.02	0.17
97-08-11 16-19-3	74	N	40.6	1.6	F	7546	9287	647	1384	8874	8325	839	1519	0.09	0.15	0.09	0.18
97-08-11 16-19-3	74	N	40.6	1.6	F	7530	9371	931	316	8427	7594	121	1093	0.12	0.03	0.01	0.14
97-08-11 16-19-3	74	N	40.6	1.6	F	10255	6680	3303	1107	9864	9186	2484	1622	0.32	0.17	0.25	0.18
97-08-11 16-19-3	74	N	40.6	1.6	F	11531	9234	4	1648	7831	8781	8	1726	0	0.18	0	0.2
97-08-11 16-19-3	74	N	40.6	1.6	F	6673	7736	649	1362	7699	9557	791	1668	0.1	0.18	0.1	0.17
97-08-11 16-19-3	74	N	40.6	1.6	F	7014	10104	761	625	8012	9663	96	1231	0.11	0.06	0.01	0.13
97-08-11 16-19-3	74	N	40.6	1.6	F	9916	7809	725	823	10441	8274	565	1139	0.07	0.11	0.05	0.14
97-08-11 16-19-3	74	N	40.6	1.6	F	10102	7714	852	-73	9411	8784	179	11	0.08	-0.01	0.02	0
97-08-11 16-19-3	74	N	40.6	1.6	F	8267	9669	1484	1570	10181	8206	1785	1740	0.18	0.16	0.18	0.21
97-08-11 16-19-3	74	N	40.6	1.6	F	8009	10380	317	272	8277	9484	-70	682	0.04	0.03	-0.01	0.07
97-08-11 16-19-3	74	N	40.6	1.6	F	10063	6401	939	1334	7961	9286	115	1720	0.09	0.21	0.01	0.19
97-08-11 16-19-3	74	N	40.6	1.6	F	9345	7796	-166	1172	7031	9221	408	2014	-0.02	0.15	0.06	0.22

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-11 16-20-54	76	N	45	-0.5	L	41137	34834	6017	6113	37875	32010	7307	3832	0.15	0.18	0.19	0.12
97-08-11 16-20-54	76	N	45	-0.5	L	32341	38752	1438	-80	32567	35930	2084	-329	0.04	0	0.06	-0.01
97-08-11 16-20-54	76	N	45	-0.5	L	39532	33210	3494	3905	34202	33262	6130	4215	0.09	0.12	0.18	0.13
97-08-11 16-20-54	76	N	45	-0.5	L	27170	34598	1734	-56	33536	37077	1923	-226	0.06	0	0.06	-0.01
97-08-11 16-20-54	76	N	45.1	-0.5	L	35576	27339	7062	5099	37567	30488	5218	2210	0.2	0.19	0.14	0.07
97-08-11 16-20-54	76	N	45.1	-0.5	L	37532	30588	1979	1415	37574	32817	3239	721	0.05	0.05	0.09	0.02
97-08-11 16-20-54	76	N	45.1	-0.5	L	32826	31097	5691	4477	38006	32574	5372	2414	0.17	0.14	0.14	0.07
97-08-11 16-20-54	76	N	45.1	-0.5	L	32160	35004	1964	-293	32765	34914	2300	324	0.06	-0.01	0.07	0.01
97-08-11 16-20-54	76	N	45.1	-0.5	L	33514	33193	5359	6931	33845	34427	5658	2884	0.16	0.21	0.17	0.08
97-08-11 16-20-54	76	N	45.1	-0.5	L	35426	37219	5002	5708	33600	35354	3539	3243	0.14	0.15	0.11	0.09
97-08-11 16-20-54	76	N	45.1	-0.5	L	37361	29753	6955	5860	37137	30038	4753	2180	0.19	0.2	0.13	0.07
97-08-11 16-20-54	76	N	45.1	-0.5	L	34375	34782	4423	5082	35807	32548	1780	2157	0.13	0.15	0.05	0.07
97-08-11 16-20-54	76	N	45.1	-0.5	F	9900	7187	1473	1292	8981	8413	469	1159	0.15	0.18	0.05	0.14
97-08-11 16-20-54	76	N	45.1	-0.5	F	9469	7274	814	1433	9175	7593	936	500	0.09	0.2	0.1	0.07
97-08-11 16-20-54	76	N	45.2	-0.5	F	7520	9169	934	-762	8012	7935	722	1369	0.12	-0.08	0.09	0.17
97-08-11 16-20-54	76	N	45.2	-0.5	F	7037	9476	992	-259	8184	8397	571	795	0.14	-0.03	0.07	0.09
97-08-11 16-20-54	76	N	45.2	-0.5	F	9693	7670	1601	1785	9376	8331	1365	1200	0.17	0.23	0.15	0.14
97-08-11 16-20-54	76	N	45.2	-0.5	F	9299	8466	506	1844	7813	9225	485	820	0.05	0.22	0.06	0.09
97-08-11 16-20-54	76	N	45.2	-0.5	F	7221	8409	1048	697	8490	7306	1376	1320	0.15	0.08	0.16	0.18
97-08-11 16-20-54	76	N	45.2	-0.5	F	7185	7940	1431	-170	8817	8528	863	443	0.2	-0.02	0.1	0.05
97-08-11 16-20-54	76	N	45.2	-0.5	F	9733	8155	1376	1637	10102	8365	621	1303	0.14	0.2	0.06	0.16
97-08-11 16-20-54	76	N	45.2	-0.5	F	9201	8028	917	672	9286	8848	1001	247	0.1	0.08	0.11	0.03
97-08-11 16-20-54	76	N	45.3	-0.5	F	8404	8712	1094	1552	9928	7836	1026	926	0.13	0.18	0.1	0.12
97-08-11 16-20-54	76	N	45.3	-0.5	F	8479	9191	1061	193	10634	8360	973	214	0.13	0.02	0.09	0.03
97-08-11 16-20-54	76	N	45.3	-0.5	F	10155	6890	2222	1678	7845	9232	1028	1240	0.22	0.24	0.13	0.13
97-08-11 16-20-54	76	N	45.3	-0.5	F	9145	6407	919	1541	8725	8296	763	893	0.1	0.24	0.09	0.11
97-08-11 16-20-54	76	N	45.3	-0.5	F	6601	9523	781	388	9523	8084	1066	1447	0.12	0.04	0.11	0.18
97-08-11 16-20-54	76	N	45.3	-0.5	F	6528	9100	1015	-469	8965	7973	934	1148	0.16	-0.05	0.1	0.14
97-08-11 16-20-54	76	N	45.3	-0.5	F	9495	5952	845	1501	8962	7072	1651	1148	0.09	0.25	0.18	0.16
97-08-11 16-20-54	76	N	45.3	-0.5	F	8319	5971	672	1441	7137	8155	654	764	0.08	0.24	0.09	0.09
97-08-11 16-20-54	76	N	45.4	-0.4	F	5832	10010	1219	122	8714	7919	1415	470	0.21	0.01	0.16	0.06
97-08-11 16-20-54	76	N	45.4	-0.4	F	6331	10516	1354	-299	10427	7693	1962	4	0.21	-0.03	0.19	0
97-08-11 16-20-54	76	N	45.4	-0.4	F	9582	7455	815	1964	11212	9371	889	1341	0.09	0.26	0.08	0.14
97-08-11 16-20-54	76	N	45.4	-0.4	F	7950	8140	1372	1835	8188	10739	794	1400	0.17	0.23	0.1	0.13
97-08-11 16-20-54	76	N	45.4	-0.4	F	8554	11494	1091	-1042	8537	10311	1057	760	0.13	-0.09	0.12	0.07
97-08-11 16-20-54	76	N	45.4	-0.4	F	7911	10166	1306	-409	8677	12057	1103	-327	0.17	-0.04	0.13	-0.03
97-08-11 16-20-54	76	N	45.4	-0.4	F	9682	8386	1046	1571	9569	8861	754	1236	0.11	0.19	0.08	0.14
97-08-11 16-20-54	76	N	45.4	-0.4	F	8747	9516	432	1334	9342	9995	607	1068	0.05	0.14	0.07	0.11
97-08-11 16-20-54	76	N	45.4	-0.4	F	8980	9724	957	-206	8706	9341	759	1474	0.11	-0.02	0.09	0.16
97-08-11 16-20-54	76	N	45.4	-0.4	F	7828	10275	1202	-421	9130	9623	902	684	0.15	-0.04	0.1	0.07
97-08-11 16-20-54	76	N	45.5	-0.4	F	10052	9063	2007	2252	9315	9246	1191	948	0.2	0.25	0.13	0.1
97-08-11 16-20-54	76	N	45.5	-0.4	F	8655	9945	918	1826	9444	9418	997	-58	0.11	0.18	0.11	-0.01
97-08-11 16-20-54	76	N	45.5	-0.4	F	7431	10838	747	90	9069	9311	741	1467	0.1	0.01	0.08	0.16
97-08-11 16-20-54	76	N	45.5	-0.4	F	8304	9973	1092	-129	9594	9413	1221	805	0.13	-0.01	0.13	0.09
97-08-11 16-20-54	76	N	45.5	-0.4	F	10008	7999	871	1542	10694	7252	1561	972	0.09	0.19	0.15	0.13
97-08-11 16-20-54	76	N	45.5	-0.4	F	9265	8705	502	1080	10244	8449	472	921	0.05	0.12	0.05	0.11
97-08-11 16-20-54	76	N	45.5	-0.4	F	8538	11300	848	1704	9435	10005	1246	1691	0.1	0.15	0.13	0.17
97-08-11 16-20-54	76	N	45.5	-0.4	F	8409	9631	1078	49	10102	9221	1112	198	0.13	0.01	0.11	0.02
97-08-11 16-20-54	76	N	45.5	-0.4	F	9468	9060	1890	1749	8937	10037	1104	1205	0.2	0.19	0.12	0.12
97-08-11 16-20-54	76	N	45.5	-0.4	F	10533	10055	1180	1196	10406	9995	1053	521	0.11	0.12	0.1	0.05
97-08-11 16-20-54	76	N	45.6	-0.4	F	8406	10051	802	911	9460	8407	1592	1392	0.1	0.09	0.17	0.17
97-08-11 16-20-54	76	N	45.6	-0.4	F	7854	10376	1186	248	8781	9693	873	478	0.15	0.02	0.1	0.05
97-08-11 16-20-54	76	N	45.6	-0.4	F	10340	8474	2143	2180	9158	9318	1467	1331	0.21	0.26	0.16	0.14
97-08-11 16-20-54	76	N	45.6	-0.4	F	9794	9163	569	1934	10088	9550	723	849	0.06	0.21	0.07	0.09
97-08-11 16-20-54	76	N	45.6	-0.4	F	8582	10003	1030	-593	8264	9066	1512	1669	0.12	-0.06	0.18	0.18
97-08-11 16-20-54	76	N	45.6	-0.4	F	8697	10545	1378	-133	9514	10208	949	361	0.16	-0.01	0.1	0.04
97-08-11 16-20-54	76	N	45.6	-0.4	F	10291	9191	1064	2042	11818	9880	785	1185	0.1	0.22	0.07	0.12
97-08-11 16-20-54	76	N	45.6	-0.4	F	9085	8568	779	905	9801	8829	874	391	0.09	0.11	0.09	0.04
97-08-11 16-20-54	76	N	45.7	-0.4	F	7822	11948	933	805	8161	8140	880	1515	0.12	0.07	0.11	0.19
97-08-11 16-20-54	76	N	45.7	-0.4	F	8448	9042	1481	-209	10106	9206	1500	982	0.18	-0.02	0.15	0.11
97-08-11 16-20-54	76	N	45.7	-0.4	F	9431	8295	1252	1712	9833	9086	1532	1355	0.13	0.21	0.16	0.15
97-08-11 16-20-54	76	N	45.7	-0.4	F	9443	8756	933	965	9395	9337	1007	441	0.1	0.11	0.11	0.05
97-08-11 16-20-54	76	N	45.7	-0.4	F	8395	10230	960	625	9206	9191	1345	1290	0.11	0.06	0.15	0.14
97-08-11 16-20-54	76	N	45.7	-0.4	F	8167	9548	1411	-97	9518	9709	1101	869	0.17	-0.01	0.12	0.09
97-08-11 16-20-54	76	N	45.7	-0.4	F	10147	8231	878	1913	9550	8858	977	1190	0.09	0.23	0.1	0.13
97-08-11 16-20-54	76	N	45.7	-0.4	F	8622	8560	1383	1126	9830	8527	1400	1158	0.16	0.13	0.14	0.14
97-08-11 16-20-54	76	N	45.8	-0.4	F	8670	11876	446	1316	9032	10459	1742	1535	0.05	0.11	0.19	0.15
97-08-11 16-20-54	76	N	45.8	-0.4	F	9491	10530	1587	-17	11395	10579	1157	305	0.17	0	0.1	0.03
97-08-11 16-20-54	76	N	45.8	-0.4	F	11528	6844	1224	1581	14263	7927	1264	1094	0.11	0.23	0.09	0.14

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/\	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-11 16-20-54	76	N	45.8	-0.4	F	8819	5687	1147	1313	9832	7007	740	862	0.13	0.23	0.08	0.12
97-08-11 16-20-54	76	N	45.9	-0.3	F	6830	7912	1371	-459	7052	7920	1381	773	0.2	-0.06	0.2	0.1
97-08-11 16-20-54	76	N	45.9	-0.3	F	6774	11014	1358	59	8475	8746	1476	341	0.2	0.01	0.17	0.04
97-08-11 16-20-54	76	N	45.9	-0.3	F	9253	6570	1505	1361	8797	8533	633	1104	0.16	0.21	0.07	0.13
97-08-11 16-20-54	76	N	45.9	-0.3	F	9507	7701	1747	1518	9018	9521	1412	1095	0.18	0.2	0.16	0.12
97-08-11 16-20-54	76	N	45.9	-0.3	F	7273	9863	841	419	9114	8013	542	1413	0.12	0.04	0.06	0.18
97-08-11 16-20-54	76	N	45.9	-0.3	F	7140	8923	1189	-567	10117	8041	1377	784	0.17	-0.06	0.14	0.1
97-08-11 16-20-54	76	N	45.9	-0.3	F	8124	8812	863	2168	9495	7985	787	1183	0.11	0.25	0.08	0.15
97-08-11 16-20-54	76	N	46	-0.3	F	8653	8409	1746	1825	10913	6014	827	1121	0.2	0.22	0.08	0.19
97-08-11 16-20-54	76	N	46	-0.3	F	6923	9576	645	2004	8356	8465	552	1494	0.09	0.21	0.07	0.18
97-08-11 16-20-54	76	N	46	-0.3	F	7705	9409	928	227	8568	9204	656	723	0.12	0.02	0.08	0.08
97-08-11 16-20-54	76	N	46	-0.3	F	11723	7778	2919	2016	10856	7589	1875	1282	0.25	0.26	0.17	0.17
97-08-11 16-20-54	76	N	46	-0.3	F	10799	8982	632	330	11079	10662	551	-56	0.06	0.04	0.05	-0.01
97-08-11 16-20-54	76	N	46.1	-0.3	F	9258	10776	1577	2091	11159	8748	1959	1477	0.17	0.19	0.18	0.17
97-08-11 16-20-54	76	N	46.1	-0.3	F	8457	11043	1006	556	11551	10702	693	427	0.12	0.05	0.06	0.04
97-08-11 16-20-54	76	N	46.1	-0.3	F	9717	6665	1827	1603	9133	7368	1306	1155	0.19	0.24	0.14	0.16
97-08-11 16-20-54	76	N	46.1	-0.3	F	8856	5557	1054	1282	8831	7481	784	590	0.12	0.23	0.09	0.08
97-08-11 16-20-54	76	N	46.1	-0.3	F	6486	9416	661	1421	9172	8000	997	1342	0.1	0.15	0.11	0.17
97-08-11 16-20-54	76	N	46.1	-0.3	F	6361	9928	1121	-40	7677	8764	511	322	0.18	0	0.07	0.04
97-08-11 16-20-54	76	N	46.1	-0.3	F	10309	6168	2169	1576	10024	7888	1223	1362	0.21	0.26	0.12	0.17
97-08-11 16-20-54	76	N	46.1	-0.3	F	11748	7459	1434	2214	8642	10653	619	1263	0.12	0.3	0.07	0.12
97-08-11 16-20-54	76	N	46.2	-0.3	F	7760	9833	1001	1650	9911	8177	1151	1366	0.13	0.17	0.12	0.17
97-08-11 16-20-54	76	N	46.2	-0.3	F	7567	9210	1574	-617	8149	8169	569	216	0.21	-0.07	0.07	0.03
97-08-11 16-20-54	76	N	46.2	-0.3	F	10863	6339	1901	1754	10142	8394	1879	1289	0.18	0.28	0.19	0.15
97-08-11 16-20-54	76	N	46.2	-0.3	F	9428	7283	256	1604	10247	9050	415	897	0.03	0.22	0.04	0.1
97-08-11 16-20-54	76	N	46.2	-0.3	F	7075	10289	1602	-251	9424	9894	2012	560	0.23	-0.02	0.21	0.06
97-08-11 16-20-54	76	N	46.3	-0.3	F	6994	10294	1635	-518	11061	8407	1949	66	0.23	-0.05	0.18	0.01
97-08-11 16-20-54	76	N	46.3	-0.3	F	8657	7645	935	1963	9568	7190	500	1182	0.11	0.26	0.05	0.16
97-08-11 16-20-54	76	N	46.3	-0.3	F	9338	6730	551	1214	9626	7612	859	829	0.06	0.18	0.09	0.11
97-08-11 16-20-54	76	N	46.3	-0.2	F	6957	9411	643	1323	9142	8129	755	1326	0.09	0.14	0.08	0.16
97-08-11 16-20-54	76	N	46.3	-0.2	F	7507	8701	1389	397	9913	7817	980	561	0.19	0.05	0.1	0.07
97-08-11 16-20-54	76	N	46.3	-0.2	F	11380	8894	2652	1853	11628	9475	1677	1292	0.23	0.21	0.14	0.14
97-08-11 16-20-54	76	N	46.3	-0.2	F	11099	8463	789	913	11498	9662	764	129	0.07	0.11	0.07	0.01
97-08-11 16-20-54	76	N	46.4	-0.2	F	10081	10182	1022	451	11097	8822	489	1081	0.1	0.04	0.04	0.12
97-08-11 16-20-54	76	N	46.4	-0.2	F	9799	9209	1345	-313	12609	8792	1127	130	0.14	-0.03	0.09	0.01
97-08-11 16-20-54	76	N	46.4	-0.2	F	10147	8061	1354	1996	9729	8314	908	1246	0.13	0.25	0.09	0.15
97-08-11 16-20-54	76	N	46.4	-0.2	F	9087	8749	404	914	10268	9698	387	546	0.04	0.1	0.04	0.06
97-08-11 16-20-54	76	N	46.4	-0.2	F	10028	8634	1557	2082	10046	8393	834	1457	0.16	0.24	0.08	0.17
97-08-11 16-20-54	76	N	46.4	-0.2	F	9055	8726	1025	623	10614	8385	820	754	0.11	0.07	0.08	0.09
97-08-11 16-20-54	76	N	46.4	-0.2	F	9199	6819	2071	1639	10084	7445	1887	1386	0.23	0.24	0.19	0.19
97-08-11 16-20-54	76	N	46.4	-0.2	F	10140	6571	1168	672	8353	8807	764	733	0.12	0.1	0.09	0.08
97-08-11 16-20-54	76	N	46.5	-0.2	F	9473	7731	1792	1736	9024	6965	989	1258	0.19	0.22	0.11	0.18
97-08-11 16-20-54	76	N	46.5	-0.2	F	9103	6186	1284	259	8777	9163	824	240	0.14	0.04	0.09	0.03
97-08-11 16-20-54	76	N	46.5	-0.2	F	9581	7882	2148	2259	8673	8505	765	1502	0.22	0.29	0.09	0.18
97-08-11 16-20-54	76	N	46.5	-0.2	F	7940	9810	1243	1720	9995	8669	1570	1078	0.16	0.18	0.16	0.12
97-08-11 16-20-54	76	N	46.6	-0.2	F	7365	11315	383	1100	9929	8846	1023	1498	0.05	0.1	0.1	0.17
97-08-11 16-20-54	76	N	46.6	-0.2	F	8077	9425	1165	364	9260	7726	1150	601	0.14	0.04	0.12	0.08
97-08-11 16-20-54	76	N	46.6	-0.2	F	10686	7990	3002	1702	10820	8329	1469	1358	0.28	0.21	0.14	0.16
97-08-11 16-20-54	76	N	46.6	-0.2	F	9847	8199	699	931	9421	8379	628	717	0.07	0.11	0.07	0.09
97-08-11 16-20-54	76	N	46.6	-0.2	F	7870	9613	450	1727	9135	8527	765	1387	0.06	0.18	0.08	0.16
97-08-11 16-20-54	76	N	46.6	-0.2	F	8468	8977	1242	226	9785	8941	806	334	0.15	0.03	0.08	0.04
97-08-11 16-20-54	76	N	46.6	-0.2	F	9726	5961	2076	1655	9080	8097	900	1403	0.21	0.28	0.1	0.17
97-08-11 16-20-54	76	N	46.6	-0.2	F	9718	6352	829	1393	10584	7521	1119	781	0.09	0.22	0.11	0.1
97-08-11 16-20-54	76	N	46.7	-0.2	F	6451	9868	863	347	8162	8754	755	1333	0.13	0.04	0.09	0.15
97-08-11 16-20-54	76	N	46.7	-0.2	F	7151	9317	1294	-308	9344	8458	794	369	0.18	-0.03	0.08	0.04
97-08-11 16-20-54	76	N	46.7	-0.2	F	10939	6596	2504	1642	9980	7725	1515	1188	0.23	0.25	0.15	0.15
97-08-11 16-20-54	76	N	46.7	-0.2	F	10191	7076	-91	1566	9725	7588	293	1113	-0.01	0.22	0.03	0.15
97-08-11 16-20-54	76	N	46.8	-0.2	F	6734	11213	1129	1773	8912	8627	688	1524	0.17	0.16	0.08	0.18
97-08-11 16-20-54	76	N	46.8	-0.1	F	5705	10765	1891	-417	8125	8065	1277	1064	0.33	-0.04	0.16	0.13
97-08-11 16-20-54	76	N	46.8	-0.2	F	9811	5786	2251	1600	9032	7915	615	1196	0.23	0.28	0.07	0.15
97-08-11 16-20-54	76	N	46.8	-0.1	F	8503	6222	196	1339	8300	7165	750	836	0.02	0.22	0.09	0.12
97-08-11 16-20-54	76	N	46.8	-0.1	F	6533	9386	1034	-336	7711	8135	1339	377	0.16	-0.04	0.17	0.05
97-08-11 16-20-54	76	N	46.8	-0.1	F	7194	9393	1363	-536	9672	8477	1583	1	0.19	-0.06	0.16	0
97-08-11 16-20-54	76	N	46.8	-0.1	F	9739	6588	1170	1662	9080	7030	485	1301	0.12	0.25	0.05	0.19
97-08-11 16-20-54	76	N	46.8	-0.1	F	9488	7359	408	1280	8912	9301	394	953	0.04	0.17	0.04	0.1
97-08-11 16-20-54	76	N	46.9	-0.1	F	6891	9113	875	-581	9112	7078	567	1217	0.13	-0.06	0.06	0.17
97-08-11 16-20-54	76	N	46.9	-0.1	F	6433	9565	1290	-274	9969	7937	792	206	0.2	-0.03	0.08	0.03
97-08-11 16-20-54	76	N	46.9	-0.1	F	10326	7564	1771	1837	10517	8142	1118	1289	0.17	0.24	0.11	0.16
97-08-11 16-20-54	76	N	46.9	-0.1	F	9922	5368	1152	855	9711	7437	1131	807	0.12	0.16	0.12	0.11

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-11 16-20-54	76	N	47	-0.1	F	6822	9610	891	1269	8973	7777	795	1390	0.13	0.13	0.09	0.18
97-08-11 16-20-54	76	N	47	-0.1	F	6509	9869	827	-5	10013	7540	639	976	0.13	0	0.06	0.13
97-08-11 16-20-54	76	N	47	-0.1	F	11101	8068	1800	1905	10495	9032	957	1378	0.16	0.24	0.09	0.15
97-08-11 16-20-54	76	N	47	-0.1	F	9979	8131	724	1011	10202	8532	1389	818	0.07	0.12	0.14	0.1
97-08-11 16-20-54	76	N	47	-0.1	F	7620	10630	362	1293	8964	8488	931	1114	0.05	0.12	0.1	0.13
97-08-11 16-20-54	76	N	47	-0.1	F	8613	10287	1513	34	9932	9281	881	543	0.18	0	0.09	0.06
97-08-11 16-20-54	76	N	47	-0.1	F	10304	8024	1403	1806	9705	9584	736	1199	0.14	0.23	0.08	0.13
97-08-11 16-20-54	76	N	47	-0.1	F	10153	8735	943	1457	10220	9386	862	759	0.09	0.17	0.08	0.08
97-08-11 16-20-54	76	N	47.1	-0.1	F	8648	10771	922	1559	9822	9554	1853	1459	0.11	0.14	0.19	0.15
97-08-11 16-20-54	76	N	47.1	-0.1	F	7747	10442	1290	-25	9946	10304	830	783	0.17	0	0.08	0.08
97-08-11 16-20-54	76	N	47.1	-0.1	F	10588	8442	2406	1881	9500	9709	1779	1495	0.23	0.22	0.19	0.15
97-08-11 16-20-54	76	N	47.1	-0.1	F	14772	8873	1519	1766	9177	7869	1059	1244	0.1	0.2	0.12	0.16
97-08-11 16-20-54	76	N	47.1	-0.1	F	8137	10532	699	347	7951	7768	1309	1133	0.09	0.03	0.16	0.15
97-08-11 16-20-54	76	N	47.1	-0.1	F	8614	11561	1378	360	9727	7969	1063	251	0.16	0.03	0.11	0.03
97-08-11 16-20-54	76	N	47.1	-0.1	F	10590	9310	1273	2382	9603	8815	576	1337	0.12	0.26	0.06	0.15
97-08-11 16-20-54	76	N	47.1	-0.1	F	9956	8623	847	805	9661	9658	880	352	0.09	0.09	0.09	0.04
97-08-11 16-20-54	76	N	47.2	-0.1	F	8841	11116	1972	1124	8782	9655	1580	1257	0.22	0.1	0.18	0.13
97-08-11 16-20-54	76	N	47.2	-0.1	F	8093	10791	1097	404	9452	11376	1117	484	0.14	0.04	0.12	0.04
97-08-11 16-20-54	76	N	47.2	-0.1	F	11586	9846	1711	1281	9745	8401	1609	1209	0.15	0.13	0.17	0.14
97-08-11 16-20-54	76	N	47.2	-0.1	F	10579	8096	1031	725	10380	8963	801	303	0.1	0.09	0.08	0.03
97-08-11 16-20-54	76	N	47.2	-0.1	F	9812	11929	1527	1431	10160	9693	1637	1431	0.16	0.12	0.16	0.15
97-08-11 16-20-54	76	N	47.2	0	F	7816	10047	773	254	9680	9183	911	334	0.1	0.03	0.09	0.04
97-08-11 16-20-54	76	N	47.2	-0.1	F	10825	9942	1021	1650	9862	10522	613	996	0.09	0.17	0.06	0.09
97-08-11 16-20-54	76	N	47.2	-0.1	F	8496	7847	1479	920	9806	8983	887	225	0.17	0.12	0.09	0.03
97-08-11 16-20-54	76	N	47.3	0	F	8148	10817	791	1406	8433	8758	1114	1166	0.1	0.13	0.13	0.13
97-08-11 16-20-54	76	N	47.3	0	F	9299	10014	1666	-224	10309	9832	1248	465	0.18	-0.02	0.12	0.05
97-08-11 16-20-54	76	N	47.3	0	F	9847	8985	1343	1784	9935	10023	1054	1270	0.14	0.2	0.11	0.13
97-08-11 16-20-54	76	N	47.3	0	F	10537	8831	1670	1624	10159	8348	1972	1017	0.16	0.18	0.19	0.12
97-08-11 16-20-54	76	N	47.3	0	F	9046	11245	462	1494	10065	8269	868	1283	0.05	0.13	0.09	0.16
97-08-11 16-20-54	76	N	47.3	0	F	8181	10004	1325	-126	10500	9104	828	211	0.16	-0.01	0.08	0.02
97-08-11 16-20-54	76	N	47.3	0	F	9423	8255	1743	1701	8326	9057	983	1069	0.18	0.21	0.12	0.12
97-08-11 16-20-54	76	N	47.3	0	F	9769	8523	724	715	8731	9067	622	436	0.07	0.08	0.07	0.05
97-08-11 16-20-54	76	N	47.4	0	F	9151	9511	810	1580	10536	8764	1359	1445	0.09	0.17	0.13	0.16
97-08-11 16-20-54	76	N	47.4	0	F	8233	10254	1186	88	10887	8485	1059	912	0.14	0.01	0.1	0.11
97-08-11 16-20-54	76	N	47.4	0	F	11556	7525	2071	2054	8078	9721	1089	1527	0.18	0.27	0.13	0.16
97-08-11 16-20-54	76	N	47.4	0	F	10687	8563	636	1248	8518	10964	656	904	0.06	0.15	0.08	0.08
97-08-11 16-20-54	76	N	47.4	0	F	8172	10592	884	1059	10760	8938	2092	1408	0.11	0.1	0.19	0.16
97-08-11 16-20-54	76	N	47.4	0	F	7526	11333	1423	29	10001	10873	1097	517	0.19	0	0.11	0.05
97-08-11 16-20-54	76	N	47.4	0	F	10858	6046	1933	1235	8296	9450	941	1344	0.18	0.2	0.11	0.14
97-08-11 16-20-54	76	N	47.4	0	F	11790	7975	1026	1207	9981	11757	1398	1141	0.09	0.15	0.14	0.1
97-08-11 16-20-54	76	N	47.5	0	F	7941	11500	541	868	10123	8769	660	1233	0.07	0.08	0.07	0.14
97-08-11 16-20-54	76	N	47.5	0	F	7385	11019	1472	-281	10532	9803	1157	-57	0.2	-0.03	0.11	-0.01
97-08-11 16-20-54	76	N	47.5	0	F	12220	6156	2783	1508	10070	9284	1538	1505	0.23	0.24	0.15	0.16
97-08-11 16-20-54	76	N	47.5	0	F	10060	7413	246	1045	8910	10977	1216	1190	0.02	0.14	0.14	0.11
97-08-11 16-20-54	76	N	47.5	0	F	7120	12411	824	627	9908	9944	1567	1342	0.12	0.05	0.16	0.13
97-08-11 16-20-54	76	N	47.5	0	F	7164	11283	1408	-212	8633	8632	1081	785	0.2	-0.02	0.13	0.09
97-08-11 16-20-54	76	N	47.5	0	F	11431	7695	1367	1555	8637	10709	1227	1564	0.12	0.2	0.14	0.15
97-08-11 16-20-54	76	N	47.5	0	F	11384	8432	603	1000	9416	11535	610	431	0.05	0.12	0.06	0.04
97-08-11 16-20-54	76	N	47.6	0	F	7749	10929	546	600	10268	8948	1056	1443	0.07	0.05	0.1	0.16
97-08-11 16-20-54	76	N	47.6	0	F	7877	11268	1385	-227	10585	10028	1010	80	0.18	-0.02	0.1	0.01
97-08-11 16-20-54	76	N	47.6	0	F	11532	7600	1894	1547	11076	7583	2115	1036	0.16	0.2	0.19	0.14
97-08-11 16-20-54	76	N	47.6	0	F	10489	7976	594	896	8863	10224	716	565	0.06	0.11	0.08	0.06
97-08-11 16-20-54	76	N	47.6	0	F	8028	10521	745	1387	11077	7569	1407	1294	0.09	0.13	0.13	0.17
97-08-11 16-20-54	76	N	47.6	0	F	8886	11190	2571	976	11965	9631	1199	403	0.29	0.09	0.1	0.04
97-08-11 16-20-54	76	N	47.6	0	F	11864	7215	2614	1243	9891	10644	1046	1629	0.22	0.17	0.11	0.15
97-08-11 16-20-54	76	N	47.6	0	F	10451	7228	727	696	8758	10549	1427	817	0.07	0.1	0.16	0.08
97-08-11 16-20-54	76	N	47.7	0	F	8301	10685	376	1763	9862	9284	959	1430	0.05	0.17	0.1	0.15
97-08-11 16-20-54	76	N	47.7	0	F	8947	9975	2311	108	10433	11083	936	289	0.26	0.01	0.09	0.03
97-08-11 16-20-54	76	N	47.7	0	F	10718	6926	1491	1607	9409	10247	1530	1628	0.14	0.23	0.16	0.16
97-08-11 16-20-54	76	N	47.7	0	F	10660	7798	1223	1035	10297	10871	1643	1236	0.11	0.13	0.16	0.11
97-08-11 16-20-54	76	N	47.7	0.1	F	10366	10206	1361	1288	11254	9546	2094	1515	0.13	0.13	0.19	0.16
97-08-11 16-20-54	76	N	47.7	0.1	F	7797	11122	1479	-330	10537	10038	778	339	0.19	-0.03	0.07	0.03
97-08-11 16-20-54	76	N	47.7	0.1	F	11129	7212	2349	1204	9999	9002	2422	1047	0.21	0.17	0.24	0.12
97-08-11 16-20-54	76	N	47.7	0.1	F	10666	8615	1068	1205	7884	12159	908	1194	0.1	0.14	0.12	0.1
97-08-11 16-20-54	76	N	47.8	0.1	F	8722	10224	1050	994	10763	8773	1654	1387	0.12	0.1	0.15	0.16
97-08-11 16-20-54	76	N	47.8	0.1	F	7947	10836	1372	-134	10168	10079	902	323	0.17	-0.01	0.09	0.03
97-08-11 16-20-54	76	N	47.8	0.1	F	11636	6430	2730	1369	9749	9237	1943	1407	0.23	0.21	0.2	0.15
97-08-11 16-20-54	76	N	47.8	0.1	F	10578	8300	805	1283	7878	11838	962	1269	0.08	0.15	0.12	0.11
97-08-11 16-20-54	76	N	47.8	0.1	F	8621	10563	558	920	11037	8626	986	1511	0.06	0.09	0.09	0.18

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-11 16-20-54	76	N	47.8	0.1	F	7479	9772	1581	-209	9540	10563	967	468	0.21	-0.02	0.1	0.04
97-08-11 16-20-54	76	N	47.8	0.1	F	11700	7185	1666	1441	9126	9664	2528	1472	0.14	0.2	0.28	0.15
97-08-11 16-20-54	76	N	47.8	0.1	F	10043	7305	972	666	7618	11461	511	792	0.1	0.09	0.07	0.07
97-08-11 16-20-54	76	N	47.9	0.1	F	8608	9751	544	1633	10973	8562	1328	1426	0.06	0.17	0.12	0.17
97-08-11 16-20-54	76	N	47.9	0.1	F	8635	11210	1627	379	10995	9437	1078	634	0.19	0.03	0.1	0.07
97-08-11 16-20-54	76	N	47.9	0.1	F	10133	6419	1329	1078	11879	7540	1017	1131	0.13	0.17	0.09	0.15
97-08-11 16-20-54	76	N	47.9	0.1	F	10458	8714	1098	900	10782	7748	565	579	0.1	0.1	0.05	0.07
97-08-11 16-20-54	76	N	47.9	0.1	F	8246	9982	855	1540	12280	9376	1144	1699	0.1	0.15	0.09	0.18
97-08-11 16-20-54	76	N	47.9	0.1	F	7895	9745	1663	-183	10571	8200	1220	149	0.21	-0.02	0.12	0.02
97-08-11 16-20-54	76	N	47.9	0.1	F	12143	8438	2961	1591	10681	9387	2119	1581	0.24	0.19	0.2	0.17
97-08-11 16-20-54	76	N	47.9	0.1	F	9982	7668	1191	899	9534	9490	990	503	0.12	0.12	0.1	0.05
97-08-11 16-20-54	76	N	48	0.1	F	9445	9082	2064	1300	12791	7144	1702	1261	0.22	0.14	0.13	0.18
97-08-11 16-20-54	76	N	48	0.1	F	8226	11994	1336	189	12375	7618	1053	430	0.16	0.02	0.09	0.06
97-08-11 16-20-54	76	N	48	0.1	F	11841	10747	2346	1869	10959	8074	1979	1223	0.2	0.17	0.18	0.15
97-08-11 16-20-54	76	N	48	0.1	F	11477	9350	1367	189	11668	11594	765	-200	0.12	0.02	0.07	-0.02
97-08-11 16-20-54	76	N	48	0.1	F	10363	11854	1700	1740	11968	9389	1670	1413	0.16	0.15	0.14	0.15
97-08-11 16-20-54	76	N	48	0.1	F	10670	11732	1158	216	12280	11692	829	192	0.11	0.02	0.07	0.02
97-08-11 16-20-54	76	N	48	0.1	F	10794	6817	2568	2194	9920	7244	1435	1298	0.24	0.32	0.14	0.18
97-08-11 16-20-54	76	N	48.1	0.1	F	8906	6672	151	1440	9012	7629	1049	746	0.02	0.22	0.12	0.1
97-08-11 16-20-54	76	N	48.1	0.1	F	7647	9468	1151	-639	10419	7012	907	1345	0.15	-0.07	0.09	0.19
97-08-11 16-20-54	76	N	48.1	0.1	F	6920	9014	1477	607	9696	8554	1233	613	0.21	0.07	0.13	0.07
97-08-11 16-20-54	76	N	48.1	0.1	F	8745	7461	827	1866	9604	7416	857	1288	0.09	0.25	0.09	0.17
97-08-11 16-20-54	76	N	48.1	0.1	F	9200	9393	1404	282	13137	7902	1215	179	0.15	0.03	0.09	0.02
97-08-11 16-20-54	76	N	48.1	0.1	F	8511	7761	1696	1290	9050	7760	1213	989	0.2	0.17	0.13	0.13
97-08-11 16-20-54	76	N	48.2	0.2	F	8466	6920	1521	-246	9452	7614	1334	231	0.18	-0.04	0.14	0.03
97-08-11 16-20-54	76	N	48.2	0.2	F	10310	7087	361	1193	9444	11118	136	1500	0.04	0.17	0.01	0.13
97-08-11 16-20-54	76	N	48.2	0.2	F	10044	7687	697	551	8648	10559	1359	508	0.07	0.07	0.16	0.05
97-08-11 16-20-54	76	N	48.2	0.2	F	9328	11287	1079	1308	13695	8620	1322	1317	0.12	0.12	0.1	0.15
97-08-11 16-20-54	76	N	48.2	0.2	F	8106	10996	1806	-228	10624	9290	1098	332	0.22	-0.02	0.1	0.04
97-08-11 16-20-54	76	N	48.2	0.2	F	12101	6981	2583	1249	10338	8602	1999	1173	0.21	0.18	0.19	0.14
97-08-11 16-20-54	76	N	48.2	0.2	F	10867	7953	592	804	10417	9790	835	529	0.05	0.1	0.08	0.05
97-08-11 16-20-54	76	N	48.2	0.2	F	8461	9569	445	1360	11084	7212	1220	1296	0.05	0.14	0.11	0.18
97-08-11 16-20-54	76	N	48.3	0.2	F	8617	11178	1597	-338	12644	7957	1503	606	0.19	-0.03	0.12	0.08
97-08-11 16-20-54	76	N	48.3	0.2	F	12580	8172	1409	1769	9148	11279	1470	1557	0.11	0.22	0.16	0.14
97-08-11 16-20-54	76	N	48.3	0.2	F	11052	7662	662	318	8272	9906	682	121	0.06	0.04	0.08	0.01
97-08-11 16-20-54	76	N	48.3	0.2	F	7858	11412	695	1361	11194	9352	1313	1520	0.09	0.12	0.12	0.16
97-08-11 16-20-54	76	N	48.3	0.2	F	9211	11174	1786	-443	10651	9887	1122	345	0.19	-0.04	0.11	0.03
97-08-11 16-20-54	76	N	48.3	0.2	F	12063	5875	2073	1511	11206	8436	1759	1302	0.17	0.26	0.16	0.15
97-08-11 16-20-54	76	N	48.3	0.2	F	10547	8186	479	1122	9260	10529	1117	1180	0.05	0.14	0.12	0.11
97-08-11 16-20-54	76	N	48.3	0.2	F	7822	10788	1373	-832	9591	9727	1375	245	0.18	-0.08	0.14	0.03
97-08-11 16-20-54	76	N	48.4	0.2	F	7353	11925	1645	-202	9449	11301	1555	130	0.22	-0.02	0.16	0.01
97-08-11 16-20-54	76	N	48.3	0.2	F	9506	6912	2378	1971	8783	7134	921	1453	0.25	0.29	0.1	0.2
97-08-11 16-20-54	76	N	48.4	0.2	F	8585	7475	772	953	9024	8666	1103	881	0.09	0.13	0.12	0.1
97-08-11 16-20-54	76	N	48.4	0.2	F	9561	8321	1414	1078	10398	7605	849	1196	0.15	0.13	0.08	0.16
97-08-11 16-20-54	76	N	48.4	0.2	F	8368	7960	1426	-157	10094	8184	884	85	0.17	-0.02	0.09	0.01
97-08-11 16-20-54	76	N	48.4	0.2	F	11232	6001	2712	1483	11107	6906	1994	1158	0.24	0.25	0.18	0.17
97-08-11 16-20-54	76	N	48.4	0.2	F	9459	7295	-26	1765	10281	6643	204	827	0	0.24	0.02	0.12
97-08-11 16-20-54	76	N	48.5	0.2	F	6818	10013	1485	677	8489	10353	1260	790	0.22	0.07	0.15	0.08
97-08-11 16-20-54	76	N	48.5	0.2	F	7537	10459	1949	-432	9690	8812	1654	-83	0.26	-0.04	0.17	-0.01
97-08-11 16-20-54	76	N	48.5	0.2	F	9271	9017	1416	1873	10086	8892	782	1447	0.15	0.21	0.08	0.16
97-08-11 16-20-54	76	N	48.5	0.2	F	9420	7927	945	1501	11317	7577	899	633	0.1	0.19	0.08	0.08
97-08-11 16-20-54	76	N	48.5	0.2	F	7977	8901	942	1549	9358	8105	803	1286	0.12	0.17	0.09	0.16
97-08-11 16-20-54	76	N	48.5	0.2	F	7871	8398	1398	404	9901	8552	1095	1066	0.18	0.05	0.11	0.12
97-08-11 16-20-54	76	N	48.5	0.2	F	11056	7079	2090	1794	10741	6989	2601	1254	0.19	0.25	0.24	0.18
97-08-11 16-20-54	76	N	48.5	0.2	F	10166	4139	95	975	10146	7099	307	930	0.01	0.24	0.03	0.13
97-08-11 16-20-54	76	N	48.6	0.2	F	6490	10050	1636	-1	7367	10309	1340	921	0.25	0	0.18	0.09
97-08-11 16-20-54	76	N	48.6	0.2	F	6950	11122	1822	-241	9670	9653	1842	32	0.26	-0.02	0.19	0
97-08-11 16-20-54	76	N	48.6	0.2	F	9949	6370	2015	2021	10436	6140	1473	1296	0.2	0.32	0.14	0.21
97-08-11 16-20-54	76	N	48.6	0.2	F	9862	6177	889	1400	10597	6351	991	705	0.09	0.23	0.09	0.11
97-08-11 16-20-54	76	N	48.7	0.3	F	6515	9917	457	849	8872	8275	1172	1297	0.07	0.09	0.13	0.16
97-08-11 16-20-54	76	N	48.7	0.3	F	6700	9887	1273	-309	9467	8033	913	327	0.19	-0.03	0.1	0.04
97-08-11 16-20-54	76	N	48.7	0.3	F	9396	6392	1989	1757	8758	8001	1400	1280	0.21	0.27	0.16	0.16
97-08-11 16-20-54	76	N	48.7	0.3	F	10414	6720	988	1082	10199	6547	1352	745	0.09	0.16	0.13	0.11
97-08-11 16-20-54	76	N	48.7	0.3	F	6715	10000	921	1588	8592	7930	613	1060	0.14	0.16	0.07	0.13
97-08-11 16-20-54	76	N	48.7	0.3	F	7011	9011	1362	-24	9927	7456	1014	253	0.19	0	0.1	0.03
97-08-11 16-20-54	76	N	48.7	0.3	F	10509	8896	2199	1086	9432	9348	1177	784	0.21	0.12	0.12	0.08
97-08-11 16-20-54	76	N	48.7	0.3	F	10957	9300	878	334	10296	9496	840	424	0.08	0.04	0.08	0.04
97-08-11 16-20-54	76	N	48.8	0.3	F	8984	10340	703	492	9298	9195	1909	1493	0.08	0.05	0.21	0.16
97-08-11 16-20-54	76	N	48.8	0.3	F	8370	10619	1527	-455	9250	10682	1112	219	0.18	-0.04	0.12	0.02

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-11 16-20-54	76	N	48.8	0.3	F	8416	5061	696	958	6984	4787	627	1072	0.08	0.19	0.09	0.22
97-08-11 16-20-54	76	N	48.8	0.3	F	8254	4567	872	781	11050	5857	704	667	0.11	0.17	0.06	0.11
97-08-11 16-20-54	76	N	48.8	0.3	F	4505	6678	762	1157	6137	6013	731	1209	0.17	0.17	0.12	0.2
97-08-11 16-20-54	76	N	48.8	0.3	F	4441	8408	1079	41	6629	5387	741	314	0.24	0	0.11	0.06
97-08-11 16-20-54	76	N	48.8	0.3	F	10959	7083	2045	1480	10445	7735	1705	1137	0.19	0.21	0.16	0.15
97-08-11 16-20-54	76	N	48.8	0.3	F	8986	8192	671	389	8908	8606	816	89	0.07	0.05	0.09	0.01
97-08-11 16-20-54	76	N	48.9	0.3	F	9242	7113	1945	1139	10764	8663	1526	1114	0.21	0.16	0.14	0.13
97-08-11 16-20-54	76	N	48.9	0.3	F	9051	7443	1195	-73	10259	6794	941	222	0.13	-0.01	0.09	0.03
97-08-11 16-20-54	76	N	48.9	0.3	F	9180	7723	396	1097	8479	7268	808	1054	0.04	0.14	0.1	0.15
97-08-11 16-20-54	76	N	48.9	0.3	F	10288	6969	1036	839	8607	8099	714	828	0.1	0.12	0.08	0.1
97-08-11 16-20-54	76	N	48.9	0.3	F	8536	8136	825	1257	9163	6823	820	1205	0.1	0.15	0.09	0.18
97-08-11 16-20-54	76	N	48.9	0.3	F	8882	7768	1261	572	11265	8650	975	852	0.14	0.07	0.09	0.1
97-08-11 16-20-54	76	N	48.9	0.3	F	12435	8771	946	2116	10251	8905	1091	1781	0.08	0.24	0.11	0.2
97-08-11 16-20-54	76	N	48.9	0.3	F	12724	8236	4408	1913	12957	9896	2261	1208	0.35	0.23	0.17	0.12
97-08-11 16-20-54	76	N	48.9	0.3	F	8731	11171	1298	1938	9879	9842	699	1146	0.15	0.17	0.07	0.12
97-08-11 16-20-54	76	N	48.9	0.3	F	10340	12467	2785	853	12264	10990	2270	958	0.27	0.07	0.19	0.09
97-08-11 16-20-54	76	N	49	0.3	F	12714	8641	985	1735	11410	8896	1042	1324	0.08	0.2	0.09	0.15
97-08-11 16-20-54	76	N	49	0.3	F	12100	9250	850	539	13680	9292	1072	379	0.07	0.06	0.08	0.04
97-08-11 16-20-54	76	N	49	0.3	F	10305	10363	1259	1719	11487	9599	998	1610	0.12	0.17	0.09	0.17
97-08-11 16-20-54	76	N	49	0.3	F	10429	10356	1565	336	12370	9835	1252	673	0.15	0.03	0.1	0.07
97-08-11 16-20-54	76	N	49	0.3	F	11834	8787	2514	2020	11515	11379	2208	1552	0.21	0.23	0.19	0.14
97-08-11 16-20-54	76	N	49	0.3	F	11240	7954	1302	454	10937	11758	1000	53	0.12	0.06	0.09	0
97-08-11 16-20-54	76	N	49	0.3	F	10918	8948	431	322	12006	10448	1549	1325	0.04	0.04	0.13	0.13
97-08-11 16-20-54	76	N	49	0.3	F	13102	9210	2003	-139	12415	9764	1554	502	0.15	-0.02	0.13	0.05
97-08-11 16-20-54	76	N	49.1	0.3	F	13442	10537	953	1604	11802	11028	914	1453	0.07	0.15	0.08	0.13
97-08-11 16-20-54	76	N	49.1	0.3	F	14650	7565	2798	957	14231	10068	2318	228	0.19	0.13	0.16	0.02
97-08-11 16-20-54	76	N	49.1	0.4	F	10259	13092	223	1648	12334	13523	671	1585	0.02	0.13	0.05	0.12
97-08-11 16-20-54	76	N	49.1	0.4	F	10697	12038	1747	122	12595	11592	1314	270	0.16	0.01	0.1	0.02
97-08-11 16-20-54	76	N	49.1	0.4	F	35458	31909	3606	4220	33604	32971	2312	4273	0.1	0.13	0.07	0.13
97-08-11 16-20-54	76	N	49.1	0.4	F	30984	34444	-32	14	33347	35049	1977	76	0	0	0.06	0
97-08-11 16-20-54	76	N	49.1	0.4	F	29793	32546	4126	4529	39777	36513	5152	3628	0.14	0.14	0.13	0.1
97-08-11 16-20-54	76	N	49.1	0.4	F	32809	38931	3519	-660	37643	32387	2207	50	0.11	-0.02	0.06	0
97-08-11 16-20-54	76	N	49.1	0.4	F	10341	8086	2309	1509	9275	9105	1870	1172	0.22	0.19	0.2	0.13
97-08-11 16-20-54	76	N	49.1	0.4	F	9372	7335	908	294	9377	8867	905	192	0.1	0.04	0.1	0.02
97-08-11 16-20-54	76	N	49.2	0.4	F	8838	8499	275	1638	9571	7300	757	1383	0.03	0.19	0.08	0.19
97-08-11 16-20-54	76	N	49.2	0.4	F	9255	9254	1393	186	10419	8645	984	497	0.15	0.02	0.09	0.06
97-08-11 16-20-54	76	N	49.2	0.4	F	15628	4869	2836	1322	9618	9178	609	1480	0.18	0.27	0.06	0.16
97-08-11 16-20-54	76	N	49.2	0.4	F	10752	6650	-75	1521	9651	8722	301	1243	-0.01	0.23	0.03	0.14
97-08-11 16-20-54	76	N	49.2	0.4	F	8372	13376	1247	556	11229	9945	2058	921	0.15	0.04	0.18	0.09
97-08-11 16-20-54	76	N	49.2	0.4	F	7889	13945	1551	-456	11308	12375	1962	65	0.2	-0.03	0.17	0.01
97-08-11 16-20-54	76	N	49.2	0.4	F	9646	7707	435	1222	9391	8568	622	1056	0.05	0.16	0.07	0.12
97-08-11 16-20-54	76	N	49.2	0.4	F	9607	6506	1291	58	10004	7275	959	56	0.13	0.01	0.1	0.01
97-08-11 16-20-54	76	N	49.3	0.4	F	8672	7999	1948	1588	8804	8396	1456	1399	0.22	0.2	0.17	0.17
97-08-11 16-20-54	76	N	49.3	0.4	F	8533	9216	1050	474	9120	10079	1098	162	0.12	0.05	0.12	0.02
97-08-11 16-20-54	76	N	49.3	0.4	F	11161	8235	3088	1665	9929	8840	2113	1361	0.28	0.2	0.21	0.15
97-08-11 16-20-54	76	N	49.3	0.4	F	9053	7479	1006	651	9453	8036	974	114	0.11	0.09	0.1	0.01
97-08-11 16-20-54	76	N	49.3	0.4	F	8036	8285	2225	1486	9219	8344	1822	1220	0.28	0.18	0.2	0.15
97-08-11 16-20-54	76	N	49.3	0.4	F	7789	10359	837	354	7632	8237	885	162	0.11	0.03	0.12	0.02
97-08-11 16-20-54	76	N	49.4	0.4	F	15584	13440	2821	1517	9370	6346	2264	1155	0.18	0.11	0.24	0.18
97-08-11 16-20-54	76	N	49.4	0.4	F	14226	9893	671	-70	12182	8702	648	294	0.05	-0.01	0.05	0.03
97-08-11 16-20-54	76	N	49.4	0.4	F	10133	13587	425	1321	11183	9943	631	1537	0.04	0.1	0.06	0.15
97-08-11 16-20-54	76	N	49.4	0.4	F	8562	8814	1348	225	11109	11301	962	247	0.16	0.03	0.09	0.02
97-08-11 16-20-54	76	N	49.4	0.4	F	9894	6673	2211	1495	9341	7507	1323	1275	0.22	0.22	0.14	0.17
97-08-11 16-20-54	76	N	49.4	0.4	F	8363	6425	934	761	10591	7132	1647	539	0.11	0.12	0.16	0.08
97-08-11 16-20-54	76	N	49.4	0.4	F	7386	10266	845	893	10309	7396	2460	1222	0.11	0.09	0.24	0.17
97-08-11 16-20-54	76	N	49.4	0.4	F	7894	10655	1647	-29	10426	7841	917	245	0.21	0	0.09	0.03
97-08-11 16-20-54	76	N	49.4	0.4	F	17410	10108	3387	2779	16015	12576	2479	1881	0.19	0.27	0.15	0.15
97-08-11 16-20-54	76	N	49.4	0.4	F	11077	8823	1983	2732	16272	11074	2932	1455	0.18	0.31	0.18	0.13
97-08-11 16-20-54	76	N	49.5	0.4	F	11606	15144	203	2219	14649	13237	2754	2237	0.02	0.15	0.19	0.17
97-08-11 16-20-54	76	N	49.5	0.4	F	12467	15979	1849	-371	15913	13507	1071	700	0.15	-0.02	0.07	0.05
97-08-11 16-20-54	76	N	49.5	0.4	F	9839	6923	2361	1534	10263	7097	1892	1227	0.24	0.22	0.18	0.17
97-08-11 16-20-54	76	N	49.5	0.4	F	9592	7605	1619	2026	10577	7078	709	1843	0.17	0.27	0.07	0.26
97-08-11 16-20-54	76	N	49.5	0.5	F	6756	9433	884	1222	8925	7412	1072	1092	0.13	0.13	0.12	0.15
97-08-11 16-20-54	76	N	49.5	0.5	F	7816	7789	1195	838	10422	8725	980	730	0.15	0.11	0.09	0.08
97-08-11 16-20-54	76	N	49.5	0.5	F	11593	9250	1353	1651	11508	9182	830	1440	0.12	0.18	0.07	0.16
97-08-11 16-20-54	76	N	49.6	0.5	F	10994	8937	1063	322	12075	8786	1072	552	0.1	0.04	0.09	0.06
97-08-11 16-20-54	76	N	49.6	0.5	F	10063	10842	644	1248	11018	10249	916	1388	0.06	0.12	0.08	0.14
97-08-11 16-20-54	76	N	49.6	0.5	F	10165	10678	1345	-82	12066	9182	889	445	0.13	-0.01	0.07	0.05
97-08-11 16-20-54	76	N	49.6	0.5	F	8911	7682	1102	1265	9316	8342	1828	1235	0.12	0.16	0.2	0.15

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-11 16-20-54	76	N	49.6	0.5	F	10139	7536	1114	-3	8998	8907	635	278	0.11	0	0.07	0.03
97-08-11 16-20-54	76	N	49.6	0.5	F	9017	7752	1128	1153	10185	7640	1013	1309	0.13	0.15	0.1	0.17
97-08-11 16-20-54	76	N	49.6	0.5	F	10020	7791	1578	142	9942	6911	1182	537	0.16	0.02	0.12	0.08
97-08-11 16-20-54	76	N	49.6	0.5	F	8941	6407	1566	1933	9785	8364	1334	1498	0.18	0.3	0.14	0.18
97-08-11 16-20-54	76	N	49.6	0.5	F	9344	6532	928	1070	9524	6901	648	685	0.1	0.16	0.07	0.1
97-08-11 16-20-54	76	N	49.7	0.5	F	9062	10555	1367	931	10332	7822	1682	1284	0.15	0.09	0.16	0.16
97-08-11 16-20-54	76	N	49.7	0.5	F	7318	9189	1417	-166	10248	7696	886	555	0.19	-0.02	0.09	0.07
97-08-11 16-20-54	76	N	49.7	0.5	F	9386	7227	393	1468	8888	7205	671	1352	0.04	0.2	0.08	0.19
97-08-11 16-20-54	76	N	49.7	0.5	F	9571	6241	1433	506	9828	7080	888	890	0.15	0.08	0.09	0.13
97-08-11 16-20-54	76	N	49.7	0.5	F	8127	8356	1889	1815	10389	6476	1363	1291	0.23	0.22	0.13	0.2
97-08-11 16-20-54	76	N	49.7	0.5	F	8144	8418	1133	563	9256	8024	577	1155	0.14	0.07	0.06	0.14
97-08-11 16-20-54	76	N	49.7	0.5	F	8208	5694	1662	1306	7639	6147	683	1105	0.2	0.23	0.09	0.18
97-08-11 16-20-54	76	N	49.7	0.5	F	7985	6919	769	1109	7779	7186	575	981	0.1	0.16	0.07	0.14
97-08-11 16-20-54	76	N	49.8	0.5	F	7579	6472	1479	1828	7499	6273	772	1272	0.2	0.28	0.1	0.2
97-08-11 16-20-54	76	N	49.8	0.5	F	6325	4721	1769	1291	7430	5537	1100	2002	0.28	0.27	0.15	0.36
97-08-12 10-29-08	34	N	36	-0.3	L	31733	36665	2764	562	30205	38288	10830	9238	0.09	0.02	0.36	0.24
97-08-12 10-29-08	34	N	36	-0.3	L	40205	33220	1486	526	38057	34295	4086	3119	0.04	0.02	0.11	0.09
97-08-12 10-29-08	34	N	36	-0.3	L	32044	33957	5721	4491	35407	33429	11297	8791	0.18	0.13	0.32	0.26
97-08-12 10-29-08	34	N	36	-0.3	L	37010	37566	1747	280	37605	34597	2766	823	0.05	0.01	0.07	0.02
97-08-12 10-29-08	34	N	36	-0.3	L	37802	30396	6570	5636	34638	33743	11081	9722	0.17	0.19	0.32	0.29
97-08-12 10-29-08	34	N	36	-0.3	L	35915	34561	1244	-90	35468	35926	3416	2490	0.03	0	0.1	0.07
97-08-12 10-29-08	34	N	36	-0.3	L	31242	34963	4734	5301	32946	32790	9542	9084	0.15	0.15	0.29	0.28
97-08-12 10-29-08	34	N	36	-0.3	L	34408	38669	1096	1068	35674	36933	2938	4952	0.03	0.03	0.08	0.13
97-08-12 10-29-08	34	N	36	-0.3	F	28488	19749	4515	3561	25423	21801	7311	5416	0.16	0.18	0.29	0.25
97-08-12 10-29-08	34	N	36	-0.3	F	25397	21015	2690	3719	23085	23406	5306	5849	0.11	0.18	0.23	0.25
97-08-12 10-29-08	34	N	36	-0.3	F	23057	22882	2652	2341	23080	21162	4530	4909	0.12	0.1	0.2	0.23
97-08-12 10-29-08	34	N	36	-0.3	F	20701	24536	1532	256	23990	23486	2644	1545	0.07	0.01	0.11	0.07
97-08-12 10-29-08	34	N	36	-0.3	F	11818	5164	1462	1375	11177	13602	2398	3219	0.12	0.27	0.21	0.24
97-08-12 10-29-08	34	N	35.9	-0.3	F	9207	8815	1008	2072	8160	9468	1037	2632	0.11	0.24	0.13	0.28
97-08-12 10-29-08	34	N	35.9	-0.3	F	6146	10509	1561	1102	7957	8766	3058	1396	0.25	0.1	0.38	0.16
97-08-12 10-29-08	34	N	35.9	-0.3	F	6520	9872	1684	406	8105	8211	3027	1839	0.26	0.04	0.37	0.22
97-08-12 10-29-08	34	N	35.9	-0.3	F	9288	7599	1142	1269	7696	8883	1345	2248	0.12	0.17	0.17	0.25
97-08-12 10-29-08	34	N	35.9	-0.3	F	7247	8524	471	786	7035	8481	1447	1160	0.06	0.09	0.21	0.14
97-08-12 10-29-08	34	N	35.9	-0.3	F	9014	8612	2093	1678	9471	7719	2842	1885	0.23	0.19	0.3	0.24
97-08-12 10-29-08	34	N	35.9	-0.3	F	7333	9673	745	512	8354	8213	1255	1381	0.1	0.05	0.15	0.17
97-08-12 10-29-08	34	N	35.9	-0.3	F	9052	7701	2280	1961	8272	9172	1732	3083	0.25	0.25	0.21	0.34
97-08-12 10-29-08	34	N	35.9	-0.3	F	7597	8320	510	843	7775	7095	1491	1023	0.07	0.1	0.19	0.14
97-08-12 10-29-08	34	N	35.9	-0.3	F	8856	10207	1150	805	7813	8278	1988	2141	0.13	0.08	0.25	0.26
97-08-12 10-29-08	34	N	35.9	-0.3	F	7382	10274	1444	599	7998	8352	787	1259	0.2	0.06	0.1	0.15
97-08-12 10-29-08	34	N	35.9	-0.3	F	11701	6605	1897	1186	9794	7408	2816	2327	0.16	0.18	0.29	0.31
97-08-12 10-29-08	34	N	35.9	-0.3	F	10839	6427	854	799	8372	7707	2799	2404	0.08	0.12	0.33	0.31
97-08-12 10-29-08	34	N	35.9	-0.3	F	6389	9767	1706	1788	7999	8015	3098	1928	0.28	0.18	0.39	0.24
97-08-12 10-29-08	34	N	35.8	-0.3	F	5818	10145	996	608	7341	7571	1711	1817	0.17	0.06	0.23	0.24
97-08-12 10-29-08	34	N	35.8	-0.3	F	8866	7151	887	1070	7352	8441	1485	2105	0.1	0.15	0.2	0.25
97-08-12 12-03-23	34	N	48.1	2.9	L	41193	27944	11012	5241	41447	30626	16343	8439	0.27	0.19	0.39	0.28
97-08-12 12-03-23	34	N	48	2.9	L	41296	31506	3024	2416	41620	30427	5902	3799	0.07	0.08	0.14	0.12
97-08-12 12-03-23	34	N	47.7	2.8	L	36658	26702	9095	4657	43103	25099	16075	7379	0.25	0.17	0.37	0.28
97-08-12 12-03-23	34	N	47.6	2.8	L	38215	35089	3662	473	40848	32097	10079	5325	0.1	0.01	0.25	0.17
97-08-12 12-03-23	34	N	47.5	2.7	F	25121	16406	6245	2640	24870	15573	11537	4901	0.25	0.16	0.46	0.31
97-08-12 12-03-23	34	N	47.4	2.7	F	21422	16909	1034	783	21079	18168	3087	1843	0.05	0.05	0.15	0.1
97-08-12 12-03-23	34	N	47	2.6	F	24446	18935	6301	3036	25329	17094	10109	5205	0.26	0.16	0.4	0.3
97-08-12 12-03-23	34	N	47	2.6	F	22752	19806	1633	595	23716	18544	2883	2041	0.07	0.03	0.12	0.11
97-08-12 12-03-23	34	N	46.9	2.5	F	33932	16013	6499	2660	24197	15079	9999	3894	0.19	0.17	0.41	0.26
97-08-12 12-03-23	34	N	46.8	2.5	F	22269	16247	1157	656	22978	17026	4952	2744	0.05	0.04	0.22	0.16
97-08-12 12-03-23	34	N	46.6	2.5	F	22091	17439	5211	2953	23433	15822	8561	4379	0.24	0.17	0.37	0.28
97-08-12 12-03-23	34	N	46.6	2.5	F	20362	19273	1524	163	21389	17033	2487	1028	0.07	0.01	0.12	0.06
97-08-12 12-03-23	34	N	46.5	2.4	F	24381	17862	6364	3161	23811	18109	9522	3964	0.26	0.18	0.4	0.22
97-08-12 12-03-23	34	N	46.5	2.4	F	23456	16886	1129	327	23744	17807	2484	1481	0.05	0.02	0.1	0.08
97-08-12 12-03-23	34	N	46.4	2.4	F	23385	16795	5183	2725	27198	15676	9435	4351	0.22	0.16	0.35	0.28
97-08-12 12-03-23	34	N	46.4	2.4	F	21279	18389	1648	1	22526	17418	3355	952	0.08	0	0.15	0.05
97-08-12 12-03-23	34	N	46.4	2.4	F	26106	15532	6569	2353	27584	15665	12040	4437	0.25	0.15	0.44	0.28
97-08-12 12-03-23	34	N	46.4	2.4	F	21318	20085	931	890	21166	19585	3430	3284	0.04	0.04	0.16	0.17
97-08-12 12-03-23	34	N	46.3	2.4	F	25501	18649	6026	2528	23970	16364	10694	4732	0.24	0.14	0.45	0.29
97-08-12 12-03-23	34	N	46.3	2.4	F	21501	19757	1249	202	24819	18849	2861	2273	0.06	0.01	0.12	0.12
97-08-12 12-03-23	34	N	46.3	2.4	F	22710	17652	4431	2322	22951	17142	10047	5360	0.2	0.13	0.44	0.31
97-08-12 12-03-23	34	N	46.3	2.4	F	22714	15846	1388	-54	22257	16734	3144	604	0.06	0	0.14	0.04
97-08-12 12-03-23	34	N	46.4	2.4	F	22323	19739	3709	2846	23900	17269	8393	4749	0.17	0.14	0.35	0.27
97-08-12 12-03-23	34	N	46.4	2.4	F	21044	21145	1517	97	23004	18627	3100	398	0.07	0	0.13	0.02
97-08-12 12-27-07	34	N	46.5	2.4	L	42246	26954	5740	459	41982	32199	11920	6093	0.14	0.02	0.28	0.19

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-12 12-27-07	34	N	46.4	2.4	L	40128	28811	3537	267	38840	29540	7439	1802	0.09	0.01	0.19	0.06
97-08-12 12-27-07	34	N	46.4	2.4	L	38482	32070	5610	2512	43177	27502	13050	7333	0.15	0.08	0.3	0.27
97-08-12 12-27-07	34	N	46.4	2.4	L	36139	31447	2936	-105	43226	28274	9497	2722	0.08	0	0.22	0.1
97-08-12 12-27-07	34	N	46.3	2.4	F	20123	10366	4546	1899	16901	11438	6846	2443	0.23	0.18	0.41	0.21
97-08-12 12-27-07	34	N	46.3	2.4	F	19691	11555	1615	1670	17201	13689	1648	2657	0.08	0.14	0.1	0.19
97-08-12 12-27-07	34	N	46.2	2.4	F	15638	13917	3688	1573	16826	13494	6307	1114	0.24	0.11	0.37	0.08
97-08-12 12-27-07	34	N	46.2	2.3	F	16656	14764	3761	33	17816	13160	5826	979	0.23	0	0.33	0.07
97-08-12 12-27-07	34	N	46.2	2.3	F	20137	9315	4290	1768	18084	12254	6059	2259	0.21	0.19	0.34	0.18
97-08-12 12-27-07	34	N	46.2	2.3	F	19709	11146	2075	1568	16508	13699	2862	2926	0.11	0.14	0.17	0.21
97-08-12 12-27-07	34	N	46.1	2.3	F	17094	14405	4035	2141	17179	12815	3855	2346	0.24	0.15	0.22	0.18
97-08-12 12-27-07	34	N	46.1	2.3	F	15515	15084	1827	121	17913	12440	2782	613	0.12	0.01	0.16	0.05
97-08-12 12-27-07	34	N	46	2.3	F	18519	9124	2994	1506	14950	12264	5491	2503	0.16	0.17	0.37	0.2
97-08-12 12-27-07	34	N	46	2.3	F	19714	11179	3487	2424	17039	15313	5972	4758	0.18	0.22	0.35	0.31
97-08-12 12-27-07	34	N	45.9	2.3	F	14788	14715	3814	1628	15766	13051	5934	595	0.26	0.11	0.38	0.05
97-08-12 12-27-07	34	N	45.9	2.3	F	15673	14966	3712	-48	17069	12858	5457	1099	0.24	0	0.32	0.09
97-08-12 12-27-07	34	N	45.9	2.2	F	17002	13572	804	145	14741	15055	3493	2541	0.05	0.01	0.24	0.17
97-08-12 12-27-07	34	N	45.9	2.2	F	17959	12765	2183	-126	14715	14851	2780	480	0.12	-0.01	0.19	0.03
97-08-12 12-27-07	34	N	45.8	2.2	F	14775	14671	885	132	15783	12413	4119	3189	0.06	0.01	0.26	0.26
97-08-12 12-27-07	34	N	45.8	2.2	F	13237	13655	2824	348	16152	12696	2538	581	0.21	0.03	0.16	0.05
97-08-12 15-49-56	34	N	32.8	-1	L	32781	37755	2585	596	29834	40211	3304	1709	0.08	0.02	0.11	0.04
97-08-12 15-49-56	34	N	32.8	-1	L	39370	31173	2138	1181	37130	32224	3659	723	0.05	0.04	0.1	0.02
97-08-12 15-49-56	34	N	32.8	-1	L	33580	36622	3349	551	33677	34366	9568	9336	0.1	0.02	0.28	0.27
97-08-12 15-49-56	34	N	32.7	-1	L	35078	36593	1975	716	35878	33982	2315	748	0.06	0.02	0.06	0.02
97-08-12 15-49-56	34	N	32.7	-1	L	36139	31414	6561	4531	35049	34843	12367	10913	0.18	0.14	0.35	0.31
97-08-12 15-49-56	34	N	32.7	-1	L	35638	38439	1303	472	33465	35203	2719	914	0.04	0.01	0.08	0.03
97-08-12 15-49-56	34	N	32.6	-1	L	30570	35898	2564	2165	33496	34050	10154	11015	0.08	0.06	0.3	0.32
97-08-12 15-49-56	34	N	32.6	-1	L	35939	39062	2180	1120	35185	35134	2123	1816	0.06	0.03	0.06	0.05
97-08-12 15-49-56	34	N	32.6	-1	F	38326	31715	4098	5591	34122	36566	8796	9367	0.11	0.18	0.26	0.26
97-08-12 15-49-56	34	N	32.6	-1	F	33561	34563	4843	6299	29861	38214	7420	12842	0.14	0.18	0.25	0.34
97-08-12 15-49-56	34	N	32.5	-1.1	F	34796	35549	1009	1545	38252	33112	7153	9496	0.03	0.04	0.19	0.29
97-08-12 15-49-56	34	N	32.5	-1.1	F	33689	34041	3210	201	36072	33493	3005	1583	0.1	0.01	0.08	0.05
97-08-12 15-49-56	34	N	32.4	-1.1	F	30627	24066	3493	3618	25368	28008	6126	7651	0.11	0.15	0.24	0.27
97-08-12 15-49-56	34	N	32.4	-1.1	F	27564	26783	2257	3093	24078	30769	3837	6615	0.08	0.12	0.16	0.21
97-08-12 15-49-56	34	N	32.3	-1.1	F	21998	35010	724	2684	24121	30482	1560	6473	0.03	0.08	0.06	0.21
97-08-12 15-49-56	34	N	32.3	-1.1	F	20803	36955	2197	144	24467	30578	3186	812	0.11	0	0.13	0.03
97-08-12 15-49-56	34	N	32.3	-1.1	F	7837	6579	1562	1232	7548	6718	2006	2006	0.2	0.19	0.27	0.3
97-08-12 15-49-56	34	N	32.3	-1.1	F	7021	7816	1607	1481	7406	7816	1552	1815	0.23	0.19	0.21	0.23
97-08-12 15-49-56	34	N	32.3	-1.1	F	7203	6845	1681	1213	7177	6142	1885	1382	0.23	0.18	0.26	0.22
97-08-12 15-49-56	34	N	32.3	-1.1	F	5737	7860	659	942	6932	7495	2001	1896	0.11	0.12	0.29	0.25
97-08-13 13-36-44	34	N	37.3	0	L	41383	28617	8068	4073	35222	33461	12856	11104	0.19	0.14	0.36	0.33
97-08-13 13-36-44	34	N	37.3	0	L	37321	35371	4857	4481	32249	36278	11925	14879	0.13	0.13	0.37	0.41
97-08-13 13-36-44	34	N	37.3	0	L	40187	37915	2068	1547	33549	37790	7807	8535	0.05	0.04	0.23	0.23
97-08-13 13-36-44	34	N	37.2	0	L	35052	31621	5896	4808	35491	30496	14627	13986	0.17	0.15	0.41	0.46
97-08-13 13-36-44	34	N	37.2	0	L	32550	32699	4154	3587	37963	34416	12027	11784	0.13	0.11	0.32	0.34
97-08-13 13-36-44	34	N	37.2	0	L	36443	36198	2115	1093	36278	34504	4324	4636	0.06	0.03	0.12	0.13
97-08-13 13-36-44	34	N	37.2	0	L	39920	30997	4783	4359	36742	32105	15478	13862	0.12	0.14	0.42	0.43
97-08-13 13-36-44	34	N	37.2	0	L	37749	35397	2646	1711	35828	36462	12911	13772	0.07	0.05	0.36	0.38
97-08-13 13-36-44	34	N	37.2	0	L	33971	33185	3088	-93	34029	33372	7078	4049	0.09	0	0.21	0.12
97-08-13 13-36-44	34	N	37.1	0	L	35584	35999	6691	5840	35298	32547	17673	16280	0.19	0.16	0.5	0.5
97-08-13 13-36-44	34	N	37.1	0	L	32901	33989	1088	532	34213	31606	5516	7470	0.03	0.02	0.16	0.24
97-08-13 13-36-44	34	N	37.1	0	L	36212	40675	2031	-149	38155	37324	4827	1458	0.06	0	0.13	0.04
97-08-13 13-36-44	34	N	37.1	0	F	8445	6489	2041	965	8620	7505	3131	3134	0.24	0.15	0.36	0.42
97-08-13 13-36-44	34	N	37.1	0	F	8979	7259	1053	599	6549	8319	2527	2489	0.12	0.08	0.39	0.3
97-08-13 13-36-44	34	N	37.1	-0.1	F	8222	7439	2216	1359	7085	7643	2669	2958	0.27	0.18	0.38	0.39
97-08-13 13-36-44	34	N	37.1	-0.1	F	7030	10106	727	485	8410	8478	1947	1074	0.1	0.05	0.23	0.13
97-08-13 13-36-44	34	N	37	-0.1	F	8921	7105	3113	1349	8219	6773	4250	2339	0.35	0.19	0.52	0.35
97-08-13 13-36-44	34	N	37	-0.1	F	7780	7166	582	866	5731	8968	1433	2668	0.07	0.12	0.25	0.3
97-08-13 13-36-44	34	N	37	-0.1	F	8024	9000	1210	253	7884	7797	2030	214	0.15	0.03	0.26	0.03
97-08-13 13-36-44	34	N	37	-0.1	F	7363	8204	2117	725	8112	7183	2021	802	0.29	0.09	0.25	0.11
97-08-13 13-36-44	34	N	37	-0.1	F	8639	7115	900	1213	7700	7753	2635	4148	0.1	0.17	0.34	0.54
97-08-13 13-36-44	34	N	37	-0.1	F	7568	7284	733	385	6756	7222	1203	990	0.1	0.05	0.18	0.14
97-08-13 13-36-44	34	N	36.9	-0.1	F	8332	7559	2110	1161	7396	7431	2672	2798	0.25	0.15	0.36	0.38
97-08-13 13-36-44	34	N	36.9	-0.1	F	6613	9234	657	545	6555	8927	1512	1676	0.1	0.06	0.23	0.19
97-08-13 13-36-44	34	N	36.9	-0.1	F	8898	6553	2014	765	8163	6711	3007	2182	0.23	0.12	0.37	0.33
97-08-13 13-36-44	34	N	36.9	-0.1	F	9855	8761	1027	644	8579	6597	2996	1811	0.1	0.07	0.35	0.27
97-08-13 13-36-44	34	N	36.9	-0.1	F	8524	10736	2145	1320	9078	8181	3445	4422	0.25	0.12	0.38	0.54
97-08-13 13-36-44	34	N	36.9	-0.1	F	8405	9449	1120	286	6872	7318	3630	3495	0.13	0.03	0.53	0.48
97-08-13 13-36-44	34	N	36.9	-0.1	F	9174	6872	2139	1506	8121	6544	4215	3359	0.23	0.22	0.52	0.51
97-08-13 13-36-44	34	N	36.8	-0.1	F	8573	6408	733	457	6294	7931	1125	1662	0.09	0.07	0.18	0.21

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 14-27-31	34	N	45.1	2	L	45043	33271	9991	6141	44146	34365	20997	16266	0.22	0.18	0.48	0.47
97-08-13 14-27-31	34	N	45.1	2	L	39644	30924	4529	1082	39314	33711	13064	11937	0.11	0.03	0.33	0.35
97-08-13 14-27-31	34	N	45.1	2	L	39560	30659	3819	59	38264	32860	5376	1639	0.1	0	0.14	0.05
97-08-13 14-27-31	34	N	45	2	L	37192	32173	6492	3629	38879	27260	16075	12947	0.17	0.11	0.41	0.47
97-08-13 14-27-31	34	N	45.1	2	L	36826	38235	1902	546	39139	35322	4085	905	0.05	0.01	0.1	0.03
97-08-13 14-27-31	34	N	45.1	2	L	38598	37922	3872	-229	43312	35036	5771	766	0.1	-0.01	0.13	0.02
97-08-13 14-27-31	34	N	45	2	L	43754	29468	8818	6898	43846	29443	16742	9942	0.2	0.23	0.38	0.34
97-08-13 14-27-31	34	N	45	2	L	40348	31838	4549	3898	42043	33075	12327	12133	0.11	0.12	0.29	0.37
97-08-13 14-27-31	34	N	45	2	L	37970	30812	8193	5229	39049	31775	13538	10873	0.22	0.17	0.35	0.34
97-08-13 14-27-31	34	N	45	2	L	35872	33230	2412	573	36688	29106	8970	4338	0.07	0.02	0.24	0.15
97-08-13 14-27-31	34	N	45	2	L	29634	29839	9332	4797	39535	32974	11912	11651	0.31	0.16	0.3	0.35
97-08-13 14-27-31	34	N	45	2	L	38078	38547	3129	-500	40262	34367	5889	926	0.08	-0.01	0.15	0.03
97-08-13 14-27-31	34	N	45	2	L	42997	32325	7250	4985	41649	32322	19936	15102	0.17	0.15	0.48	0.47
97-08-13 14-27-31	34	N	45	2	L	41346	33585	4792	1414	37913	35219	10689	8730	0.12	0.04	0.28	0.25
97-08-13 14-27-31	34	N	45	2	L	38963	35832	4113	-110	37614	30668	6771	1136	0.11	0	0.18	0.04
97-08-13 14-27-31	34	N	45	2	L	39491	31476	8297	4965	45998	33911	19972	15197	0.21	0.16	0.43	0.45
97-08-13 14-27-31	34	N	44.9	2	L	39109	36580	2535	121	40669	30368	8012	4160	0.06	0	0.2	0.14
97-08-13 14-27-31	34	N	44.9	2	L	38852	33462	3614	-291	42924	31854	5596	683	0.09	-0.01	0.13	0.02
97-08-13 14-27-31	34	N	44.9	2	L	41630	30544	3395	1075	42995	31905	13257	10848	0.08	0.04	0.31	0.34
97-08-13 14-27-31	34	N	44.9	2	L	41611	36031	4258	3609	40808	35476	10787	11623	0.1	0.1	0.26	0.33
97-08-13 14-27-31	34	N	44.9	2	L	35881	32991	5408	3175	36116	31504	10382	6435	0.15	0.1	0.29	0.2
97-08-13 14-27-31	34	N	44.9	2	L	37778	31952	11388	9894	40627	28149	17816	13246	0.3	0.31	0.44	0.47
97-08-13 14-27-31	34	N	44.9	2	L	40343	34329	5066	2382	42386	31377	11695	9909	0.13	0.07	0.28	0.32
97-08-13 14-27-31	34	N	44.9	2	L	38464	31046	2764	50	43243	30177	3780	1699	0.07	0	0.09	0.06
97-08-13 14-27-31	34	N	44.9	2	L	39467	28846	3696	526	38516	29362	16502	13293	0.09	0.02	0.43	0.45
97-08-13 14-27-31	34	N	44.9	2	L	36486	29370	2310	2929	36029	28656	8473	8627	0.06	0.1	0.24	0.3
97-08-13 14-27-31	34	N	44.9	2	L	35896	29166	4192	953	36603	28629	7315	3792	0.12	0.03	0.2	0.13
97-08-13 14-27-31	34	N	44.9	2	L	34129	29925	2204	1602	33401	24316	8923	8014	0.06	0.05	0.27	0.33
97-08-13 14-27-31	34	N	44.9	2	L	34276	29880	2726	1369	35331	27847	2673	2855	0.08	0.05	0.08	0.1
97-08-13 14-27-31	34	N	44.9	2	L	36571	31237	2411	1246	41007	28494	3332	1082	0.07	0.04	0.08	0.04
97-08-13 14-27-31	34	N	44.8	2	F	22493	12289	6128	3795	19007	13939	10286	7815	0.27	0.31	0.54	0.56
97-08-13 14-27-31	34	N	44.8	2	F	21417	13338	4143	2633	15693	16204	4988	4795	0.19	0.2	0.32	0.3
97-08-13 14-27-31	34	N	44.8	1.9	F	31162	24059	5298	4272	31900	26659	11071	12173	0.17	0.18	0.35	0.46
97-08-13 14-27-31	34	N	44.8	1.9	F	33021	28043	2325	416	30729	28485	2130	2996	0.07	0.01	0.07	0.11
97-08-13 14-27-31	34	N	44.8	1.9	F	33278	24775	6600	4370	34990	26036	16825	13222	0.2	0.18	0.48	0.51
97-08-13 14-27-31	34	N	44.7	1.9	F	34377	29375	3181	-10	33242	29243	8178	7976	0.09	0	0.25	0.27
97-08-13 14-27-31	34	N	44.7	1.9	F	35846	24869	1233	1953	37255	27960	4442	3012	0.03	0.08	0.12	0.11
97-08-13 14-27-31	34	N	44.7	1.9	F	37511	28552	2853	115	34353	30771	2143	521	0.08	0	0.06	0.02
97-08-13 14-27-31	34	N	44.7	1.9	F	37596	29436	5608	4597	38940	32599	11544	11826	0.15	0.16	0.3	0.36
97-08-13 14-27-31	34	N	44.7	1.9	F	37502	33584	2928	669	37367	31633	5503	6718	0.08	0.02	0.15	0.21
97-08-13 14-27-31	34	N	44.6	1.9	F	22034	17878	2899	1911	23529	15324	5090	2918	0.13	0.11	0.22	0.19
97-08-13 14-27-31	34	N	44.6	1.9	F	21302	20869	2218	37	22881	16834	2195	1900	0.1	0	0.1	0.11
97-08-13 14-27-31	34	N	44.6	1.9	F	13183	8278	715	696	11614	8915	2600	1151	0.05	0.08	0.22	0.13
97-08-13 14-27-31	34	N	44.6	1.9	F	11606	8878	1021	910	10659	10175	1818	2357	0.09	0.1	0.17	0.23
97-08-13 14-27-31	34	N	44.6	1.9	F	7295	13836	1339	2316	12225	8418	2591	-161	0.18	0.17	0.21	-0.02
97-08-13 14-27-31	34	N	44.6	1.9	F	8955	12818	2345	43	10020	11609	2784	1383	0.26	0	0.28	0.12
97-08-13 14-27-31	34	N	44.5	1.9	F	14721	11268	4204	3738	14238	8738	7754	7021	0.29	0.33	0.54	0.8
97-08-13 14-27-31	34	N	44.5	1.9	F	14150	11481	2867	3177	13421	11783	6639	6759	0.2	0.28	0.49	0.57
97-08-13 14-27-31	34	N	44.5	1.9	F	25463	19364	5720	3599	25237	18073	7868	3614	0.22	0.19	0.31	0.2
97-08-13 14-27-31	34	N	44.5	1.9	F	24521	20838	2070	2320	24847	20133	1754	3502	0.08	0.11	0.07	0.17
97-08-13 14-27-31	34	N	44.4	1.8	F	29972	18260	6253	3888	26201	20283	9242	4656	0.21	0.21	0.35	0.23
97-08-13 14-27-31	34	N	44.4	1.8	F	27767	21234	7397	7069	25608	22647	9334	12785	0.27	0.33	0.36	0.56
97-08-13 14-27-31	34	N	44.4	1.8	F	29215	20932	4627	2825	30233	25006	6559	4490	0.16	0.13	0.22	0.18
97-08-13 14-27-31	34	N	44.4	1.8	F	30090	28841	1715	126	33584	26027	8599	8216	0.06	0	0.26	0.32
97-08-13 14-27-31	34	N	44.3	1.8	F	35156	26119	1430	1588	33922	29320	6714	5552	0.04	0.06	0.2	0.19
97-08-13 14-27-31	34	N	44.3	1.8	F	38328	29624	3825	19	35487	29243	3982	3049	0.1	0	0.11	0.1
97-08-13 14-27-31	34	N	44.3	1.8	F	19366	17541	3825	2678	22285	17659	7920	7425	0.2	0.15	0.36	0.42
97-08-13 14-27-31	34	N	44.3	1.8	F	18307	22238	2296	135	20283	16244	1991	1450	0.13	0.01	0.1	0.09
97-08-13 14-27-31	34	N	44.2	1.8	F	19834	12702	3976	2405	18423	13754	6062	2594	0.2	0.19	0.33	0.19
97-08-13 14-27-31	34	N	44.3	1.8	F	19502	13834	975	1621	16952	15208	2129	2889	0.05	0.12	0.13	0.19
97-08-13 14-27-31	34	N	44.2	1.8	F	38548	26706	1669	1547	36850	26695	6987	5427	0.04	0.06	0.19	0.2
97-08-13 14-27-31	34	N	44.2	1.8	F	39224	28285	2793	1039	35066	29398	2442	3312	0.07	0.04	0.07	0.11
97-08-13 14-27-31	34	N	44.1	1.7	F	32187	27997	5369	2983	31751	29095	11428	10668	0.17	0.11	0.36	0.37
97-08-13 14-27-31	34	N	44.1	1.7	F	31142	32416	1837	199	30886	29534	2565	1018	0.06	0.01	0.08	0.03
97-08-13 14-27-31	34	N	44	1.7	F	32218	22920	7688	5279	32700	22141	8620	4061	0.24	0.23	0.26	0.18
97-08-13 14-27-31	34	N	44	1.7	F	30071	26177	2691	2277	30019	25387	6356	10254	0.09	0.09	0.21	0.4
97-08-13 14-27-31	34	N	44	1.7	F	38038	25791	10057	6712	35676	27168	19380	17095	0.26	0.26	0.54	0.63
97-08-13 14-27-31	34	N	44	1.7	F	36498	31869	7095	6059	35005	29389	14316	14909	0.19	0.19	0.41	0.51
97-08-13 14-27-31	34	N	43.9	1.7	F	14181	17516	3125	769	18755	13104	5103	2902	0.22	0.04	0.27	0.22

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 14-27-31	34	N	43.9	1.7	F	14975	18568	3004	248	17843	13278	1287	1608	0.2	0.01	0.07	0.12
97-08-13 14-27-31	34	N	43.9	1.7	F	24671	14731	5503	5286	23564	16730	10506	8297	0.22	0.36	0.45	0.5
97-08-13 14-27-31	34	N	43.9	1.7	F	23352	17828	3554	4379	20869	20042	4015	4502	0.15	0.25	0.19	0.22
97-08-13 14-27-31	34	N	43.8	1.7	F	31605	24919	2346	1881	34456	22167	10480	10184	0.07	0.08	0.3	0.46
97-08-13 14-27-31	34	N	43.8	1.7	F	33752	29320	3952	-67	35479	25907	2333	1953	0.12	0	0.07	0.08
97-08-13 14-27-31	34	N	43.7	1.6	F	31846	22979	2462	2230	32203	27537	8003	8706	0.08	0.1	0.25	0.32
97-08-13 14-27-31	34	N	43.7	1.6	F	34308	29066	3707	3	30042	29194	2608	1116	0.11	0	0.09	0.04
97-08-13 14-27-31	34	N	43.6	1.6	F	34025	23772	7836	4758	31940	23592	8255	4516	0.23	0.2	0.26	0.19
97-08-13 14-27-31	34	N	43.6	1.6	F	34501	28964	3883	1375	34503	25485	6457	4794	0.11	0.05	0.19	0.19
97-08-13 14-27-31	34	N	43.5	1.6	F	29809	31684	4682	862	32071	26468	4983	4348	0.16	0.03	0.16	0.16
97-08-13 14-27-31	34	N	43.5	1.6	F	27931	35049	4427	-246	32583	28014	3140	1784	0.16	-0.01	0.1	0.06
97-08-13 14-27-31	34	N	43.4	1.6	F	22729	18073	1217	1157	24163	14463	3102	1872	0.05	0.06	0.13	0.13
97-08-13 14-27-31	34	N	43.4	1.6	F	21064	19476	2643	188	23738	15060	2447	932	0.13	0.01	0.1	0.06
97-08-13 14-27-31	34	N	43.4	1.6	F	19589	12063	4712	3184	16694	14537	6002	5007	0.24	0.26	0.36	0.34
97-08-13 14-27-31	34	N	43.4	1.6	F	19676	14461	1073	725	17279	15254	2690	2188	0.05	0.05	0.16	0.14
97-08-13 14-27-31	34	N	43.3	1.5	F	33214	27816	5506	4475	35720	27298	14877	12888	0.17	0.16	0.42	0.47
97-08-13 14-27-31	34	N	43.3	1.5	F	35165	31504	2882	639	34761	28781	5947	7266	0.08	0.02	0.17	0.25
97-08-13 14-27-31	34	N	43.2	1.5	F	30430	21521	5761	4186	28185	22944	8128	5579	0.19	0.19	0.29	0.24
97-08-13 14-27-31	34	N	43.2	1.5	F	29035	24141	4025	3043	29303	24043	4898	5054	0.14	0.13	0.17	0.21
97-08-13 14-27-31	34	N	43.2	1.5	F	28349	23167	3042	3043	27151	24319	10548	10984	0.11	0.13	0.39	0.45
97-08-13 14-27-31	34	N	43.2	1.5	F	28040	25400	2802	110	27386	24022	2229	3997	0.1	0	0.08	0.17
97-08-13 14-27-31	34	N	43.1	1.5	F	33377	21793	9551	6408	29000	26368	14842	14043	0.29	0.29	0.51	0.53
97-08-13 14-27-31	34	N	43.1	1.5	F	31759	27225	5978	6292	30275	26383	5547	6603	0.19	0.23	0.18	0.25
97-08-13 14-27-31	34	N	43.1	1.5	F	15949	21483	7826	5843	19756	18978	11100	5929	0.49	0.27	0.56	0.31
97-08-13 14-27-31	34	N	43.1	1.5	F	17084	24849	3704	-132	19775	19021	4614	1029	0.22	-0.01	0.23	0.05
97-08-13 14-27-31	34	N	43.1	1.5	F	12746	8151	1922	1286	11227	8103	3675	2389	0.15	0.16	0.33	0.29
97-08-13 14-27-31	34	N	43.1	1.5	F	12222	8707	3138	2583	9733	10227	4848	6014	0.26	0.3	0.5	0.59
97-08-13 14-27-31	34	N	43.1	1.5	F	18763	14105	6477	5199	18140	13231	8739	6253	0.35	0.37	0.48	0.47
97-08-13 14-27-31	34	N	43.1	1.5	F	17316	15529	3103	3795	16599	15924	2793	4604	0.18	0.24	0.17	0.29
97-08-13 14-27-31	34	N	43	1.5	F	16820	15489	4189	3553	16490	15177	9504	9228	0.25	0.23	0.58	0.61
97-08-13 14-27-31	34	N	43	1.4	F	16531	16254	3171	1961	17714	15865	5743	6712	0.19	0.12	0.32	0.42
97-08-13 14-27-31	34	N	43	1.4	F	21370	15894	2513	2413	21411	13964	6157	3647	0.12	0.15	0.29	0.26
97-08-13 14-27-31	34	N	43	1.4	F	19784	17355	1717	482	20793	16340	4672	5565	0.09	0.03	0.22	0.34
97-08-13 14-27-31	34	N	42.9	1.4	F	25648	17608	7668	5797	23882	19834	13928	14310	0.3	0.33	0.58	0.72
97-08-13 14-27-31	34	N	42.9	1.4	F	25165	19934	5012	4797	23517	21045	7787	10692	0.2	0.24	0.33	0.51
97-08-13 14-27-31	34	N	42.8	1.4	F	12181	13056	808	393	15169	9850	3997	3686	0.07	0.03	0.26	0.37
97-08-13 14-27-31	34	N	42.8	1.4	F	11031	16236	1803	159	15152	11028	2074	1133	0.16	0.01	0.14	0.1
97-08-13 14-27-31	34	N	42.7	1.4	F	26744	14571	6990	4203	22834	17841	10841	8560	0.26	0.29	0.47	0.48
97-08-13 14-27-31	34	N	42.7	1.4	F	23926	16637	615	1049	21518	20263	2979	5517	0.03	0.06	0.14	0.27
97-08-13 14-27-31	34	N	42.7	1.4	F	33457	29010	3992	2676	31099	29764	11830	11698	0.12	0.09	0.38	0.39
97-08-13 14-27-31	34	N	42.7	1.4	F	31859	31783	4946	-174	33704	29640	4703	2497	0.16	-0.01	0.14	0.08
97-08-13 14-27-31	34	N	42.6	1.3	F	30406	28079	14771	9254	27093	29949	16914	12154	0.49	0.33	0.62	0.41
97-08-13 14-27-31	34	N	42.6	1.3	F	30759	30437	6899	39	30765	29282	7399	876	0.22	0	0.24	0.03
97-08-13 14-27-31	34	N	42.5	1.3	F	35855	24875	7041	4368	32149	27339	12368	12047	0.2	0.18	0.38	0.44
97-08-13 14-27-31	34	N	42.5	1.3	F	32884	28516	3294	153	30660	29165	3263	2864	0.1	0.01	0.11	0.1
97-08-13 14-27-31	34	N	42.4	1.3	F	40262	27499	5119	3789	38175	28789	10964	12113	0.13	0.14	0.29	0.42
97-08-13 14-27-31	34	N	42.4	1.3	F	39039	32413	3785	-135	36146	31478	3124	1911	0.1	0	0.09	0.06
97-08-13 14-27-31	34	N	42.3	1.3	F	19142	16458	995	669	21064	14916	2559	2813	0.05	0.04	0.12	0.19
97-08-13 14-27-31	34	N	42.3	1.3	F	17751	19489	3436	420	21081	15046	1992	1097	0.19	0.02	0.09	0.07
97-08-13 14-27-31	34	N	42.3	1.3	F	23554	13722	6423	4804	20024	17525	10527	10960	0.27	0.35	0.53	0.63
97-08-13 14-27-31	34	N	42.3	1.3	F	21410	15221	2524	3426	18987	18763	7969	9961	0.12	0.23	0.42	0.53
97-08-13 14-27-31	34	N	42.2	1.2	F	36989	29780	9312	6672	37250	29076	19878	16877	0.25	0.22	0.53	0.58
97-08-13 14-27-31	34	N	42.2	1.2	F	36301	34028	2125	1719	37105	30499	7971	11406	0.06	0.05	0.21	0.37
97-08-13 14-27-31	34	N	42.1	1.2	F	34657	25288	5477	4140	31501	28680	8748	6855	0.16	0.16	0.28	0.24
97-08-13 14-27-31	34	N	42.1	1.2	F	33880	30140	9398	9955	31308	29546	7230	10426	0.28	0.33	0.23	0.35
97-08-13 14-27-31	34	N	42.1	1.2	F	36482	24031	11370	8515	33761	28235	19436	17129	0.31	0.35	0.58	0.61
97-08-13 14-27-31	34	N	42	1.2	F	35016	28761	4248	5650	32206	29747	2736	6436	0.12	0.2	0.08	0.22
97-08-13 14-27-31	34	N	42	1.2	F	37874	23650	8920	4408	35013	27652	18483	15419	0.24	0.19	0.53	0.56
97-08-13 14-27-31	34	N	42	1.2	F	36242	27913	929	1607	31673	29875	4531	9345	0.03	0.06	0.14	0.31
97-08-13 14-27-31	34	N	41.9	1.2	F	18622	21602	2216	-387	21372	18466	1262	2264	0.12	-0.02	0.06	0.12
97-08-13 14-27-31	34	N	41.9	1.2	F	16680	25316	1259	70	22199	18107	2695	767	0.08	0	0.12	0.04
97-08-13 14-27-31	34	N	41.9	1.1	F	22719	11728	3404	1213	17881	14322	5230	2379	0.15	0.1	0.29	0.17
97-08-13 14-27-31	34	N	41.9	1.1	F	20786	13679	3398	3600	16824	17133	1905	3253	0.16	0.26	0.11	0.19
97-08-13 14-27-31	34	N	41.8	1.1	F	36456	31017	4048	322	35882	29362	11955	9948	0.11	0.01	0.33	0.34
97-08-13 14-27-31	34	N	41.8	1.1	F	33501	35198	3505	-396	33961	32533	2824	4883	0.1	-0.01	0.08	0.15
97-08-13 14-27-31	34	N	41.7	1.1	F	34935	24022	4117	2915	29631	26803	9421	10453	0.12	0.12	0.32	0.39
97-08-13 14-27-31	34	N	41.7	1.1	F	33627	25721	3563	-66	31315	28672	3121	2094	0.11	0	0.1	0.07
97-08-13 14-27-31	34	N	41.6	1.1	F	34766	25287	2112	2680	30122	26119	8935	9214	0.06	0.11	0.3	0.35
97-08-13 14-27-31	34	N	41.6	1.1	F	32377	27124	4044	-54	30598	29325	2951	1033	0.12	0	0.1	0.04

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 14-27-31	34	N	41.5	1.1	F	32172	27717	7488	5686	29506	26892	5971	5932	0.23	0.21	0.2	0.22
97-08-13 14-27-31	34	N	41.5	1.1	F	27613	34492	1776	-95	31084	31229	2528	491	0.06	0	0.08	0.02
97-08-13 14-27-31	34	N	41.4	1	F	17528	21802	8779	5876	19764	16957	8783	1953	0.5	0.27	0.44	0.12
97-08-13 14-27-31	34	N	41.4	1	F	17530	23737	4007	218	21675	19035	4389	733	0.23	0.01	0.2	0.04
97-08-13 14-27-31	34	N	41.4	1	F	24694	14809	3203	2954	21900	16361	7140	4127	0.13	0.2	0.33	0.25
97-08-13 14-27-31	34	N	41.4	1	F	24927	16042	653	1155	21299	18992	1326	2263	0.03	0.07	0.06	0.12
97-08-13 14-27-31	34	N	41.2	1	F	34514	26871	1468	2179	33013	28060	8243	8589	0.04	0.08	0.25	0.31
97-08-13 14-27-31	34	N	41.2	1	F	34103	29634	3782	-58	32714	28337	3455	698	0.11	0	0.11	0.02
97-08-13 14-27-31	34	N	41	0.9	F	34955	26317	1287	1490	34241	25332	10826	8886	0.04	0.06	0.32	0.35
97-08-13 14-27-31	34	N	41	0.9	F	34325	28136	3887	-104	36730	25050	6037	2557	0.11	0	0.16	0.1
97-08-13 14-27-31	34	N	40.9	0.9	F	36008	26025	5005	3281	34582	24524	7717	4076	0.14	0.13	0.22	0.17
97-08-13 14-27-31	34	N	40.9	0.9	F	33046	28592	3720	7	32962	27785	2766	863	0.11	0	0.08	0.03
97-08-13 14-27-31	34	N	40.8	0.9	F	32556	28407	882	1681	28832	28986	1854	3384	0.03	0.06	0.06	0.12
97-08-13 14-27-31	34	N	40.8	0.9	F	31918	31735	2587	555	32536	29034	2786	1394	0.08	0.02	0.09	0.05
97-08-13 14-27-31	34	N	40.6	0.8	F	20400	24887	9352	6331	19682	19214	12640	9745	0.46	0.25	0.64	0.51
97-08-13 14-27-31	34	N	40.6	0.8	F	19974	21483	3361	236	22422	19079	5088	1587	0.17	0.01	0.23	0.08
97-08-13 14-27-31	34	N	40.6	0.8	F	21858	16841	5102	4197	19220	18468	9290	9198	0.23	0.25	0.48	0.5
97-08-13 14-27-31	34	N	40.6	0.8	F	18512	18574	3665	3996	20251	18326	8097	7333	0.2	0.22	0.4	0.4
97-08-13 14-27-31	34	N	40.5	0.8	F	32597	22303	11425	8790	32616	24120	19464	14835	0.35	0.39	0.6	0.62
97-08-13 14-27-31	34	N	40.5	0.8	F	31084	26144	7185	8453	29725	27445	9328	13417	0.23	0.32	0.31	0.49
97-08-13 14-27-31	34	N	40.3	0.7	F	34858	22425	7656	4635	33978	23495	13035	6133	0.22	0.21	0.38	0.26
97-08-13 14-27-31	34	N	40.3	0.7	F	30062	26566	6955	7774	30298	25448	4222	5851	0.23	0.29	0.14	0.23
97-08-13 14-27-31	34	N	40.1	0.7	F	33387	24299	1815	2208	34569	24414	6877	3098	0.05	0.09	0.2	0.13
97-08-13 14-27-31	34	N	40.1	0.7	F	32453	26421	10239	8319	31744	28117	11118	15872	0.32	0.31	0.35	0.56
97-08-13 14-27-31	34	N	39.9	0.6	F	35239	28777	7004	5545	36713	27193	16467	14260	0.2	0.19	0.45	0.52
97-08-13 14-27-31	34	N	39.9	0.6	F	31672	33514	2664	2164	35208	28422	9932	12575	0.08	0.06	0.28	0.44
97-08-13 14-27-31	34	N	39.8	0.6	F	12437	19175	3052	1059	14562	15373	3810	437	0.25	0.06	0.26	0.03
97-08-13 14-27-31	34	N	39.8	0.6	F	12915	19315	2134	-63	16325	14501	3315	511	0.17	0	0.2	0.04
97-08-13 14-27-31	34	N	39.7	0.6	F	30265	16495	3171	1697	25565	20015	5669	3003	0.1	0.1	0.22	0.15
97-08-13 14-27-31	34	N	39.7	0.6	F	25252	18000	3531	5494	21135	20250	7467	9462	0.14	0.31	0.35	0.47
97-08-13 14-27-31	34	N	39.5	0.5	F	43104	33489	2361	3096	44184	30404	14375	11365	0.05	0.09	0.33	0.37
97-08-13 14-27-31	34	N	39.5	0.5	F	40700	36962	6136	-134	40406	31245	4291	3431	0.15	0	0.11	0.11
97-08-13 14-27-31	34	N	39.4	0.5	F	33827	34735	1365	1303	35129	28974	13042	11503	0.04	0.04	0.37	0.4
97-08-13 14-27-31	34	N	39.3	0.5	F	31602	35410	3535	-193	32824	32818	3726	2032	0.11	-0.01	0.11	0.06
97-08-13 14-27-31	34	N	39.1	0.4	F	33165	36845	16082	11030	33853	34085	14583	6292	0.48	0.3	0.43	0.18
97-08-13 14-27-31	34	N	39.1	0.4	F	31315	37473	13436	5361	32589	34257	13789	5748	0.43	0.14	0.42	0.17
97-08-13 14-27-31	34	N	38.9	0.4	F	42736	32017	2360	2891	42528	33392	7059	4916	0.06	0.09	0.17	0.15
97-08-13 14-27-31	34	N	38.9	0.4	F	42631	33329	4309	1810	39356	32421	2976	3944	0.1	0.05	0.08	0.12
97-08-13 14-27-31	34	N	38.7	0.3	F	22971	23489	1169	1382	25079	19242	1765	2509	0.05	0.06	0.07	0.13
97-08-13 14-27-31	34	N	38.7	0.3	F	20101	23824	2483	146	25706	17734	4652	1623	0.12	0.01	0.18	0.09
97-08-13 14-27-31	34	N	38.6	0.3	F	27513	17097	4565	3749	23385	20760	7732	8089	0.17	0.22	0.33	0.39
97-08-13 14-27-31	34	N	38.6	0.3	F	24014	19015	5290	5167	22880	20625	10316	10365	0.22	0.27	0.45	0.5
97-08-13 14-27-31	34	N	38.4	0.3	F	41778	32061	7024	5827	42285	30617	18457	15014	0.17	0.18	0.44	0.49
97-08-13 14-27-31	34	N	38.4	0.3	F	36011	34512	1508	786	40144	32023	3073	4450	0.04	0.02	0.08	0.14
97-08-13 14-27-31	34	N	38.2	0.2	F	38069	29440	4311	3446	37411	27864	9929	5009	0.11	0.12	0.27	0.18
97-08-13 14-27-31	34	N	38.2	0.2	F	31416	33266	2888	4220	34587	31307	3127	3891	0.09	0.13	0.09	0.12
97-08-13 14-27-31	34	N	37.9	0.1	F	38411	28671	6578	4149	38029	27752	8302	4499	0.17	0.14	0.22	0.16
97-08-13 14-27-31	34	N	37.8	0.1	F	32121	32681	728	2074	35843	29536	2212	2200	0.02	0.06	0.06	0.07
97-08-13 14-27-31	34	N	37.5	0	F	42456	32274	11526	6947	42796	30528	22414	17500	0.27	0.22	0.52	0.57
97-08-13 14-27-31	34	N	37.5	0	F	36092	37359	833	1213	38026	33553	1832	3480	0.02	0.03	0.05	0.1
97-08-13 14-27-31	34	N	37.1	0	F	19885	25454	4213	2755	25634	19153	6231	3426	0.21	0.11	0.24	0.18
97-08-13 14-27-31	34	N	37.1	0	F	16828	27448	1365	665	24229	20034	2458	1022	0.08	0.02	0.1	0.05
97-08-13 14-27-31	34	N	37	-0.1	F	15663	12037	4095	2053	13456	13145	2341	2113	0.26	0.17	0.17	0.16
97-08-13 14-27-31	34	N	37	-0.1	F	14325	12084	2707	2710	14542	12723	3995	3079	0.19	0.22	0.27	0.24
97-08-13 14-27-31	34	N	36.7	-0.1	F	24665	21472	7664	5822	24143	19585	14544	13745	0.31	0.27	0.6	0.7
97-08-13 14-27-31	34	N	36.7	-0.1	F	22276	24256	3888	3919	23961	22885	8003	9942	0.17	0.16	0.33	0.43
97-08-13 14-27-31	34	N	36.4	-0.2	F	25893	17996	5972	4078	26231	18213	12033	10478	0.23	0.23	0.46	0.58
97-08-13 14-27-31	34	N	36.4	-0.2	F	23686	20628	1023	877	25108	20103	1248	3246	0.04	0.04	0.05	0.16
97-08-13 14-27-31	34	N	36.1	-0.3	F	26272	20380	3666	2210	22833	22471	4294	4015	0.14	0.11	0.19	0.18
97-08-13 14-27-31	34	N	36	-0.3	F	23499	22480	1410	386	22986	23074	5937	4322	0.06	0.02	0.26	0.19
97-08-13 14-27-31	34	N	35.7	-0.4	F	27194	19976	6811	5505	25174	20148	12388	11610	0.25	0.28	0.49	0.58
97-08-13 14-27-31	34	N	35.6	-0.4	F	25347	22078	5305	5132	24895	22006	9464	11891	0.21	0.23	0.38	0.54
97-08-13 14-27-31	34	N	35.3	-0.4	F	12570	14112	2091	1823	15516	10427	5127	4264	0.17	0.13	0.33	0.41
97-08-13 14-27-31	34	N	35.3	-0.5	F	10797	16138	1531	484	15332	10843	2122	1324	0.14	0.03	0.14	0.12
97-08-13 14-27-31	34	N	35.2	-0.5	F	17239	10509	5822	4597	14479	12288	10116	10153	0.34	0.44	0.7	0.83
97-08-13 14-27-31	34	N	35.2	-0.5	F	16270	12213	3119	3854	12789	13321	1648	3247	0.19	0.32	0.13	0.24
97-08-13 14-27-31	34	N	34.9	-0.6	F	25434	22876	3558	3918	24939	23399	6279	5239	0.14	0.17	0.25	0.22
97-08-13 14-27-31	34	N	34.8	-0.6	F	23829	25502	978	1400	24118	25505	2147	5308	0.04	0.05	0.09	0.21
97-08-13 14-27-31	34	N	34.5	-0.6	F	28008	24818	4677	4399	27685	24288	7273	5224	0.17	0.18	0.26	0.22

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 14-27-31	34	N	34.4	-0.7	F	24837	27914	4187	4011	23604	27191	10168	14704	0.17	0.14	0.43	0.54
97-08-13 14-27-31	34	N	34.1	-0.7	F	28309	24074	8336	6973	27235	22578	10274	7599	0.29	0.29	0.38	0.34
97-08-13 14-27-31	34	N	34	-0.7	F	26037	26182	4403	3934	24709	24823	9830	14171	0.17	0.15	0.4	0.57
97-08-13 14-27-31	34	N	33.7	-0.8	F	30820	22422	6945	5136	29452	23530	8157	5877	0.23	0.23	0.28	0.25
97-08-13 14-27-31	34	N	33.6	-0.8	F	27554	27334	2840	5883	25544	27613	2154	7152	0.1	0.22	0.08	0.26
97-08-13 14-27-31	34	N	33.3	-0.9	F	14365	23254	5666	3994	21380	17105	7298	7259	0.39	0.17	0.34	0.42
97-08-13 14-27-31	34	N	33.3	-0.9	F	15729	22111	3379	-223	21322	16703	1705	2105	0.21	-0.01	0.08	0.13
97-08-13 14-27-31	34	N	33.2	-0.9	F	24758	16466	4920	3979	22175	20165	12015	12149	0.2	0.24	0.54	0.6
97-08-13 14-27-31	34	N	33.2	-0.9	F	26608	17118	857	1120	22402	24712	1838	4224	0.03	0.07	0.08	0.17
97-08-13 14-27-31	34	N	33	-1	F	36785	35772	9296	8621	36740	32182	9517	7191	0.25	0.24	0.26	0.22
97-08-13 14-27-31	34	N	33	-1	F	32126	41325	3939	4202	34412	37915	7527	9836	0.12	0.1	0.22	0.26
97-08-13 14-27-31	34	N	32.8	-1	F	32967	31541	7620	7536	33708	29862	13334	15149	0.23	0.24	0.4	0.51
97-08-13 14-27-31	34	N	32.8	-1	F	29980	35841	728	109	31424	33592	2454	3185	0.02	0	0.08	0.09
97-08-13 14-27-31	34	N	32.5	-1	F	33264	29327	9160	8206	35358	26054	12532	9857	0.28	0.28	0.35	0.38
97-08-13 14-27-31	34	N	32.5	-1	F	31122	33735	1226	4145	33707	30536	5750	9044	0.04	0.12	0.17	0.3
97-08-13 14-27-31	34	N	32.2	-1.1	F	34684	35693	706	3205	36674	33444	2389	4264	0.02	0.09	0.07	0.13
97-08-13 14-27-31	34	N	32.2	-1.1	F	34714	38608	2145	-107	35439	36102	2379	299	0.06	0	0.07	0.01
97-08-13 14-27-31	34	N	31.9	-1.2	F	17535	22414	2542	3315	22736	18730	3573	2348	0.14	0.15	0.16	0.13
97-08-13 14-27-31	34	N	31.8	-1.2	F	16090	26768	1057	361	20675	19686	1409	990	0.07	0.01	0.07	0.05
97-08-13 14-27-31	34	N	31.8	-1.2	F	13971	11157	4056	2896	10780	13418	7601	8111	0.29	0.26	0.71	0.6
97-08-13 14-27-31	34	N	31.8	-1.2	F	14025	10897	793	715	11542	14094	3541	3834	0.06	0.07	0.31	0.27
97-08-13 14-27-31	34	N	31.5	-1.2	F	21085	21701	5342	4503	23728	18586	10533	9868	0.25	0.21	0.44	0.53
97-08-13 14-27-31	34	N	31.5	-1.3	F	20716	21763	1376	72	21573	21990	2174	2819	0.07	0	0.1	0.13
97-08-13 14-27-31	34	N	31.2	-1.3	F	19460	23518	1183	2895	21985	20193	7823	9231	0.06	0.12	0.36	0.46
97-08-13 14-27-31	34	N	31.2	-1.3	F	20202	23141	1781	39	21654	21788	2234	1645	0.09	0	0.1	0.08
97-08-13 14-27-31	34	N	30.9	-1.4	F	23092	19740	4307	3675	24345	18365	10746	10395	0.19	0.19	0.44	0.57
97-08-13 14-27-31	34	N	30.8	-1.4	F	22325	20468	929	310	22008	20856	2835	4637	0.04	0.02	0.13	0.22
97-08-13 14-27-31	34	N	30.6	-1.4	F	19619	24139	3954	4383	21287	21052	8915	10378	0.2	0.18	0.42	0.49
97-08-13 14-27-31	34	N	30.5	-1.4	F	18425	24530	1225	-14	20251	22669	2044	2147	0.07	0	0.1	0.09
97-08-13 14-27-31	34	N	30.4	-1.5	F	10702	13432	853	1623	12778	11901	3859	5214	0.08	0.12	0.3	0.44
97-08-13 14-27-31	34	N	30.4	-1.5	F	10692	13452	1380	419	12618	11022	1410	1638	0.13	0.03	0.11	0.15
97-08-13 14-27-31	34	N	30.3	-1.5	F	24059	17067	6858	5138	18494	20481	12947	13368	0.29	0.3	0.7	0.65
97-08-13 14-27-31	34	N	30.3	-1.5	F	21652	17968	403	1347	16228	23298	629	4030	0.02	0.07	0.04	0.17
97-08-13 14-27-31	34	N	30.2	-1.5	F	29596	34772	569	3063	33414	32296	2833	5189	0.02	0.09	0.08	0.16
97-08-13 14-27-31	34	N	30.2	-1.5	F	29023	35523	1045	1137	33432	31420	2591	3268	0.04	0.03	0.08	0.1
97-08-13 14-27-31	34	N	30	-1.5	F	30389	30773	6436	7645	31584	27082	6910	6177	0.21	0.25	0.22	0.23
97-08-13 14-27-31	34	N	30	-1.5	F	36508	31854	5034	7299	29096	30596	6266	10643	0.14	0.23	0.22	0.35
97-08-13 14-27-31	34	N	29.9	-1.6	F	29593	31516	2682	5439	29449	30736	11902	14958	0.09	0.17	0.4	0.49
97-08-13 14-27-31	34	N	29.9	-1.6	F	28746	31962	3106	166	27598	32307	3668	3539	0.11	0.01	0.13	0.11
97-08-13 14-27-31	34	N	29.8	-1.6	F	32852	35135	4073	5729	33684	32439	13556	16663	0.12	0.16	0.4	0.51
97-08-13 14-27-31	34	N	29.8	-1.6	F	31457	51519	2648	753	29939	35878	2278	5164	0.08	0.01	0.08	0.14
97-08-13 14-27-31	34	N	29.8	-1.6	F	18577	20831	461	1673	20219	19184	792	2337	0.02	0.08	0.04	0.12
97-08-13 14-27-31	34	N	29.7	-1.6	F	18512	22184	1911	452	20063	19291	1745	1384	0.1	0.02	0.09	0.07
97-08-13 14-27-31	34	N	29.7	-1.6	F	17330	10376	5942	4853	15013	13492	6726	4855	0.34	0.47	0.45	0.36
97-08-13 14-27-31	34	N	29.7	-1.6	F	14025	11206	1558	3183	12137	13565	1873	3702	0.11	0.28	0.15	0.27
97-08-13 14-27-31	34	N	29.7	-1.6	F	22879	25667	707	1804	22277	27072	750	3492	0.03	0.07	0.03	0.13
97-08-13 14-27-31	34	N	29.6	-1.6	F	21334	24778	922	688	19940	25246	1531	1381	0.04	0.03	0.08	0.05
97-08-13 14-27-31	34	N	29.6	-1.6	F	23047	25356	4973	5368	25237	23156	11521	13427	0.22	0.21	0.46	0.58
97-08-13 14-27-31	34	N	29.6	-1.6	F	21241	24908	750	942	21709	22280	5243	6663	0.04	0.04	0.24	0.3
97-08-13 14-27-31	34	N	29.5	-1.6	F	26522	22132	1449	2751	26615	21284	5124	4130	0.05	0.12	0.19	0.19
97-08-13 14-27-31	34	N	29.5	-1.6	F	24287	22707	652	2161	24446	23045	598	3069	0.03	0.1	0.02	0.13
97-08-13 14-27-31	34	N	29.5	-1.6	F	26901	28725	5634	5251	29074	27463	13645	15565	0.21	0.18	0.47	0.57
97-08-13 14-27-31	34	N	29.5	-1.6	F	26049	44516	2483	260	33261	28320	2068	3415	0.1	0.01	0.06	0.12
97-08-13 14-27-31	34	N	29.6	-1.6	F	13771	19421	3147	3359	18640	14838	3542	1881	0.23	0.17	0.19	0.13
97-08-13 14-27-31	34	N	29.6	-1.6	F	11856	22452	945	342	17309	16639	1777	2320	0.08	0.02	0.1	0.14
97-08-13 14-27-31	34	N	29.6	-1.6	F	13395	7862	5107	4007	10232	11629	7069	7413	0.38	0.51	0.69	0.64
97-08-13 14-27-31	34	N	29.6	-1.6	F	12085	9360	2487	3845	9068	11246	4230	6204	0.21	0.41	0.47	0.55
97-08-13 14-27-31	34	N	29.5	-1.6	F	10172	11588	2213	2139	11922	8738	3217	3523	0.22	0.18	0.27	0.4
97-08-13 14-27-31	34	N	29.5	-1.6	F	8793	12880	1567	67	10667	10343	1265	1291	0.18	0.01	0.12	0.12
97-08-13 14-27-31	34	N	29.5	-1.6	F	15852	11206	4153	3957	13731	14500	6425	7048	0.26	0.35	0.47	0.49
97-08-13 14-27-31	34	N	29.5	-1.6	F	14485	13250	1787	3901	11535	15332	3261	6942	0.12	0.29	0.28	0.45
97-08-13 14-27-31	34	N	29.4	-1.7	F	10394	17378	1499	3072	15836	11492	6042	6287	0.14	0.18	0.38	0.55
97-08-13 14-27-31	34	N	29.4	-1.7	F	9829	17062	1120	7	14328	13088	1182	2041	0.11	0	0.08	0.16
97-08-13 14-27-31	34	N	29.4	-1.7	F	17718	11919	4514	3718	15082	14226	7631	6761	0.25	0.31	0.51	0.48
97-08-13 14-27-31	34	N	29.4	-1.7	F	14227	13248	1480	3946	12175	16300	3007	7395	0.1	0.3	0.25	0.45
97-08-13 14-27-31	34	N	29.3	-1.7	F	10782	17551	2051	2847	15629	12682	6232	6308	0.19	0.16	0.4	0.5
97-08-13 14-27-31	34	N	29.3	-1.7	F	10415	19359	1168	27	14458	13774	1633	1853	0.11	0	0.11	0.13
97-08-13 16-15-34	34	N	43.9	1.7	L	46152	25553	10615	7418	41734	27631	20842	14697	0.23	0.29	0.5	0.53
97-08-13 16-15-34	34	N	43.9	1.7	L	37187	29954	6636	7958	36350	33224	10069	12207	0.18	0.27	0.28	0.37

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 16-15-34	34	N	43.9	1.7	L	36383	30513	3505	3683	33980	31523	5560	6324	0.1	0.12	0.16	0.2
97-08-13 16-15-34	34	N	43.8	1.7	L	41436	40443	8483	7804	39185	31784	13985	14974	0.2	0.19	0.36	0.47
97-08-13 16-15-34	34	N	43.8	1.7	L	36799	34772	5057	5826	37774	33931	9271	14504	0.14	0.17	0.25	0.43
97-08-13 16-15-34	34	N	43.8	1.7	L	32227	27915	2888	14	41997	29664	6427	1335	0.09	0	0.15	0.05
97-08-13 16-15-34	34	N	43.7	1.6	L	39413	26787	6471	4211	38068	29173	14851	12855	0.16	0.16	0.39	0.44
97-08-13 16-15-34	34	N	43.7	1.6	L	39001	35050	3301	0	36179	29198	6732	6458	0.08	0	0.19	0.22
97-08-13 16-15-34	34	N	43.7	1.6	L	40396	30110	2193	-106	39580	32664	3508	1253	0.05	0	0.09	0.04
97-08-13 16-15-34	34	N	43.6	1.6	L	37048	32745	1468	859	37900	29879	8221	9762	0.04	0.03	0.22	0.33
97-08-13 16-15-34	34	N	43.6	1.6	L	34589	34886	2477	510	35748	31864	1885	1411	0.07	0.01	0.05	0.04
97-08-13 16-15-34	34	N	43.6	1.6	L	35447	34587	3408	455	42556	32276	4714	1150	0.1	0.01	0.11	0.04
97-08-13 16-15-34	34	N	43.6	1.6	L	40922	27611	8306	5656	40988	28971	14592	9845	0.2	0.2	0.36	0.34
97-08-13 16-15-34	34	N	43.6	1.6	L	39183	37046	3570	6634	37106	35573	6176	12371	0.09	0.18	0.17	0.35
97-08-13 16-15-34	34	N	43.6	1.6	L	41940	28745	2274	198	36962	32388	3900	2629	0.05	0.01	0.11	0.08
97-08-13 16-15-34	34	N	43.5	1.6	L	35801	33086	1690	661	36467	32072	6919	8564	0.05	0.02	0.19	0.27
97-08-13 16-15-34	34	N	43.5	1.6	L	36071	34968	1731	616	36825	33043	1800	1391	0.05	0.02	0.05	0.04
97-08-13 16-15-34	34	N	43.5	1.6	L	33710	33000	3792	32	39129	29381	5732	192	0.11	0	0.15	0.01
97-08-13 18-36-41	34	N	36	-0.3	L	34769	30298	8802	9298	34679	33624	15228	17829	0.25	0.31	0.44	0.53
97-08-13 18-36-41	34	N	36	-0.3	L	33671	38822	3659	3906	34908	36358	9837	15218	0.11	0.1	0.28	0.42
97-08-13 18-36-41	34	N	36.1	-0.3	L	31183	33864	7181	7840	33394	32478	13735	17232	0.23	0.23	0.41	0.53
97-08-13 18-36-41	34	N	36.1	-0.3	L	30538	41302	1726	2310	33425	37178	6906	10228	0.06	0.06	0.21	0.28
97-08-13 18-36-41	34	N	36.1	-0.3	F	10204	8028	2922	1492	8926	8702	3831	3187	0.29	0.19	0.43	0.37
97-08-13 18-36-41	34	N	36.1	-0.3	F	8930	8950	826	1194	8127	8992	1710	2924	0.09	0.13	0.21	0.33
97-08-13 18-36-41	34	N	36.1	-0.3	F	8620	8763	770	414	8709	8038	1922	1314	0.09	0.05	0.22	0.16
97-08-13 18-36-41	34	N	36.1	-0.3	F	7726	9487	972	425	7921	8273	1045	924	0.13	0.04	0.13	0.11
97-08-13 18-36-41	34	N	36.1	-0.3	F	8765	7673	1069	1166	7881	8406	1259	1518	0.12	0.15	0.16	0.18
97-08-13 18-36-41	34	N	36.1	-0.3	F	8139	7637	642	687	8319	8351	1278	934	0.08	0.09	0.15	0.11
97-08-13 18-36-41	34	N	36.1	-0.3	F	7972	8907	658	850	8143	7831	1480	1531	0.08	0.1	0.18	0.2
97-08-13 18-36-41	34	N	36.1	-0.3	F	7359	9264	1877	443	7871	8609	906	1532	0.26	0.05	0.12	0.18
97-08-13 18-36-41	34	N	36.1	-0.3	F	34105	31123	4569	4996	33354	33900	9052	7395	0.13	0.16	0.27	0.22
97-08-13 18-36-41	34	N	36.1	-0.3	F	34619	31707	2186	4409	31156	37133	3226	8037	0.06	0.14	0.1	0.22
97-08-13 18-36-41	34	N	36.1	-0.3	F	36235	40310	1166	2679	40633	28675	5738	5514	0.03	0.07	0.14	0.19
97-08-13 18-36-41	34	N	36.1	-0.3	F	31234	37925	5811	215	39408	43828	4895	1320	0.19	0.01	0.12	0.03
97-08-13 18-36-41	34	N	36.1	-0.3	F	30355	20783	4951	3310	26825	23872	6814	5679	0.16	0.16	0.25	0.24
97-08-13 18-36-41	34	N	36.1	-0.3	F	28547	23488	1645	2138	25602	25299	1467	3751	0.06	0.09	0.06	0.15
97-08-13 18-36-41	34	N	36.2	-0.3	F	25412	28176	5212	4380	25585	26461	5796	6159	0.21	0.16	0.23	0.23
97-08-13 18-36-41	34	N	36.2	-0.3	F	25332	29093	2126	270	26019	27242	1553	1707	0.08	0.01	0.06	0.06
97-08-13 18-36-41	34	N	36.2	-0.3	F	11910	9889	1467	1171	9707	11471	2608	2703	0.12	0.12	0.27	0.24
97-08-13 18-36-41	34	N	36.2	-0.3	F	10282	10167	714	511	9459	11198	1244	944	0.07	0.05	0.13	0.08
97-08-13 18-36-41	34	N	36.2	-0.3	F	9129	13726	646	1104	10890	11027	1507	2225	0.07	0.08	0.14	0.2
97-08-13 18-36-41	34	N	36.2	-0.3	F	9478	12258	1605	367	10296	11896	1330	1558	0.17	0.03	0.13	0.13
97-08-13 18-36-41	34	N	36.2	-0.3	F	14143	9677	2363	1161	11984	11187	2510	1900	0.17	0.12	0.21	0.17
97-08-13 18-36-41	34	N	36.2	-0.3	F	12019	10233	900	281	12204	11454	1204	1227	0.07	0.03	0.1	0.11
97-08-13 18-36-41	34	N	36.2	-0.2	F	11420	10755	730	774	10839	10858	1258	1862	0.06	0.07	0.12	0.17
97-08-13 18-36-41	34	N	36.2	-0.2	F	9949	11577	2418	464	14710	12158	2991	1108	0.24	0.04	0.2	0.09
97-08-13 18-36-41	34	N	36.2	-0.3	F	19449	12603	3348	2303	15616	14135	4631	2786	0.17	0.18	0.3	0.2
97-08-13 18-36-41	34	N	36.2	-0.3	F	17015	12400	1002	2209	12744	14462	2607	3455	0.06	0.18	0.2	0.24
97-08-13 18-36-41	34	N	36.2	-0.3	F	12494	18443	1152	769	14788	14429	2251	2767	0.09	0.04	0.15	0.19
97-08-13 18-36-41	34	N	36.2	-0.3	F	11195	18420	4396	1934	13882	14311	5245	2430	0.39	0.11	0.38	0.17
97-08-13 18-36-41	34	N	36.2	-0.3	F	28854	23293	4594	3263	25030	24939	7280	6025	0.16	0.14	0.29	0.24
97-08-13 18-36-41	34	N	36.2	-0.3	F	24794	25100	771	910	28598	24285	3734	4944	0.03	0.04	0.13	0.2
97-08-13 18-36-41	34	N	36.1	-0.3	F	25557	24078	3241	2699	24854	23044	6325	6301	0.13	0.11	0.25	0.27
97-08-13 18-36-41	34	N	36.1	-0.3	F	24250	24772	2808	262	25411	22840	2308	1247	0.12	0.01	0.09	0.05
97-08-13 18-36-41	34	N	36.1	-0.3	F	34878	27229	6840	5149	32687	30749	12221	10758	0.2	0.19	0.37	0.35
97-08-13 18-36-41	34	N	36.1	-0.3	F	34820	30366	5424	5036	31389	33083	8188	11526	0.16	0.17	0.26	0.35
97-08-13 18-36-41	34	N	36	-0.3	F	28740	35925	835	990	32092	34614	3558	6935	0.03	0.03	0.11	0.2
97-08-13 18-36-41	34	N	36	-0.3	F	28298	35039	3194	153	30359	33018	4038	839	0.11	0	0.13	0.03
97-08-13 18-36-41	34	N	35.9	-0.3	F	28616	23191	4447	3055	26382	26901	9926	10224	0.16	0.13	0.38	0.38
97-08-13 18-36-41	34	N	35.9	-0.3	F	25899	24595	869	682	24281	26749	5091	6680	0.03	0.03	0.21	0.25
97-08-13 18-36-41	34	N	35.8	-0.4	F	23435	26489	2178	2978	24865	25326	6602	8225	0.09	0.11	0.27	0.32
97-08-13 18-36-41	34	N	35.7	-0.4	F	21905	26146	2241	48	24358	24165	1893	1327	0.1	0	0.08	0.05
97-08-13 18-36-41	34	N	35.7	-0.4	F	35054	24264	7670	4727	35773	28199	15140	11270	0.22	0.19	0.42	0.4
97-08-13 18-36-41	34	N	35.6	-0.4	F	33639	26242	2567	5166	28967	32394	7106	13188	0.08	0.2	0.25	0.41
97-08-13 18-36-41	34	N	35.4	-0.4	F	26351	35069	801	1581	32754	30332	4403	7102	0.03	0.05	0.13	0.23
97-08-13 18-36-41	34	N	35.4	-0.4	F	27649	32359	3308	168	30120	31693	3202	1778	0.12	0.01	0.11	0.06
97-08-13 18-36-41	34	N	35.3	-0.5	F	40016	21227	5382	3076	33784	32386	12794	8719	0.13	0.14	0.38	0.27
97-08-13 18-36-41	34	N	35.2	-0.5	F	37242	24566	1777	4355	34616	43687	5597	13294	0.05	0.18	0.16	0.3
97-08-13 18-36-41	34	N	35	-0.5	F	24580	36216	832	1886	29803	29533	6848	8749	0.03	0.05	0.23	0.3
97-08-13 18-36-41	34	N	34.9	-0.5	F	26811	36228	4301	132	32030	29936	3355	1587	0.16	0	0.1	0.05
97-08-13 18-36-41	34	N	34.8	-0.6	F	8687	6474	1368	901	7344	6939	2014	2281	0.16	0.14	0.27	0.33

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 18-36-41	34	N	34.8	-0.6	F	6980	7317	1045	979	7476	7508	1495	1766	0.15	0.13	0.2	0.24
97-08-13 18-36-41	34	N	34.6	-0.6	F	7953	6652	1275	895	7821	6010	2153	1202	0.16	0.13	0.28	0.2
97-08-13 18-36-41	34	N	34.6	-0.6	F	6235	7633	1050	1371	6608	6625	1647	2113	0.17	0.18	0.25	0.32
97-08-13 18-59-04	34	N	40.7	0.8	L	37181	26938	2683	1241	37460	29992	8142	5880	0.07	0.05	0.22	0.2
97-08-13 18-59-04	34	N	40.7	0.8	L	37176	33198	1173	1412	35237	33751	4260	6826	0.03	0.04	0.12	0.2
97-08-13 18-59-04	34	N	40.7	0.8	L	37122	32769	1416	1217	39217	37793	3958	1742	0.04	0.04	0.1	0.05
97-08-13 18-59-04	34	N	40.6	0.8	L	33684	34405	3608	2257	36759	32427	9510	7979	0.11	0.07	0.26	0.25
97-08-13 18-59-04	34	N	40.6	0.8	L	33553	35956	1527	756	37526	34345	6383	5011	0.05	0.02	0.17	0.15
97-08-13 18-59-04	34	N	40.6	0.8	L	34226	34031	3667	529	37623	32366	5872	1085	0.11	0.02	0.16	0.03
97-08-13 18-59-04	34	N	40.5	0.8	L	40247	25920	8320	3784	37937	28087	13798	7190	0.21	0.15	0.36	0.26
97-08-13 18-59-04	34	N	40.5	0.8	L	35743	31085	4039	2915	32556	32275	8438	7686	0.11	0.09	0.26	0.24
97-08-13 18-59-04	34	N	40.5	0.8	L	37281	30720	2047	286	34564	29975	3845	1538	0.05	0.01	0.11	0.05
97-08-13 18-59-04	34	N	40.5	0.8	L	36391	34311	8255	5474	34330	31471	10872	8896	0.23	0.16	0.32	0.28
97-08-13 18-59-04	34	N	40.5	0.8	L	33438	35919	1660	1155	34702	34731	2824	3414	0.05	0.03	0.08	0.1
97-08-13 18-59-04	34	N	40.4	0.8	L	33349	33882	2586	660	41697	33422	5682	1630	0.08	0.02	0.14	0.05
97-08-13 18-59-04	34	N	40.5	0.8	F	32482	20373	4124	1979	29233	24346	8154	3484	0.13	0.1	0.28	0.14
97-08-13 18-59-04	34	N	40.4	0.8	F	30910	25948	2141	2743	25624	28263	3828	4716	0.07	0.11	0.15	0.17
97-08-13 18-59-04	34	N	40.4	0.8	F	27676	31600	7266	3126	30233	29771	6967	2771	0.26	0.1	0.23	0.09
97-08-13 18-59-04	34	N	40.4	0.8	F	45447	33311	8509	6	32523	29219	7279	826	0.19	0	0.22	0.03
97-08-13 18-59-04	34	N	40.4	0.8	F	41194	26615	7492	3382	36960	29873	11877	4284	0.18	0.13	0.32	0.14
97-08-13 18-59-04	34	N	40.3	0.7	F	36492	28227	3105	3264	34182	31436	2777	5013	0.09	0.12	0.08	0.16
97-08-13 18-59-04	34	N	40.3	0.7	F	36427	30682	4372	2842	33676	28631	5390	4691	0.12	0.09	0.16	0.16
97-08-13 18-59-04	34	N	40.3	0.7	F	35032	30696	3698	367	34862	31342	3227	2033	0.11	0.01	0.09	0.06
97-08-13 18-59-04	34	N	40.3	0.7	F	41371	25401	6658	3214	37722	27412	9155	5070	0.16	0.13	0.24	0.18
97-08-13 18-59-04	34	N	40.3	0.7	F	37984	28945	1102	3448	34052	32063	3134	4608	0.03	0.12	0.09	0.14
97-08-13 18-59-04	34	N	40.2	0.7	F	32034	32169	5211	173	33775	28992	6071	363	0.16	0.01	0.18	0.01
97-08-13 18-59-04	34	N	40.2	0.7	F	29044	33594	5837	1104	30861	33355	6790	4383	0.2	0.03	0.22	0.13
97-08-13 18-59-04	34	N	40.2	0.7	F	40093	24761	7204	3615	37242	30988	9736	4364	0.18	0.15	0.26	0.14
97-08-13 18-59-04	34	N	40.2	0.7	F	34509	34912	2963	4812	33198	34218	2730	4384	0.09	0.14	0.08	0.13
97-08-13 18-59-04	34	N	40.2	0.7	F	30739	37713	1659	4064	34650	32429	6366	4423	0.05	0.11	0.18	0.14
97-08-13 18-59-04	34	N	40.2	0.7	F	31261	35425	2988	285	33830	31928	4285	1531	0.1	0.01	0.13	0.05
97-08-13 18-59-04	34	N	40.1	0.7	F	38126	27456	6811	4308	35537	32819	9548	6158	0.18	0.16	0.27	0.19
97-08-13 18-59-04	34	N	40.1	0.7	F	35533	31869	1745	2907	33689	32226	3328	4121	0.05	0.09	0.1	0.13
97-08-13 18-59-04	34	N	40.1	0.7	F	30971	34447	936	3203	38148	30664	5402	3932	0.03	0.09	0.14	0.13
97-08-13 18-59-04	34	N	40.1	0.7	F	32062	36750	3433	205	34302	30874	4612	1367	0.11	0.01	0.13	0.04
97-08-13 18-59-04	34	N	40.1	0.7	F	36768	30203	5586	4494	36862	31158	11198	6036	0.15	0.15	0.3	0.19
97-08-13 18-59-04	34	N	40.1	0.7	F	34626	34848	690	2530	33540	33810	4057	6176	0.02	0.07	0.12	0.18
97-08-13 18-59-04	34	N	40	0.7	F	32585	33064	3342	2889	34071	30877	7753	6059	0.1	0.09	0.23	0.2
97-08-13 18-59-04	34	N	40	0.7	F	33062	33908	3019	317	34201	31733	3225	1760	0.09	0.01	0.09	0.06
97-08-13 18-59-04	34	N	40	0.7	F	50073	33963	2671	2283	48242	33387	10370	6478	0.05	0.07	0.21	0.19
97-08-13 18-59-04	34	N	40	0.7	F	45571	35391	3369	147	46788	35556	6601	2701	0.07	0	0.14	0.08
97-08-13 18-59-04	34	N	40	0.7	F	30137	23237	2068	1980	30334	20615	5886	4419	0.07	0.09	0.19	0.21
97-08-13 18-59-04	34	N	40	0.7	F	32460	21986	4037	1222	31868	24373	2898	2744	0.12	0.06	0.09	0.11
97-08-13 18-59-04	34	N	40	0.7	F	37968	24413	6710	3419	36105	27501	10318	3782	0.18	0.14	0.29	0.14
97-08-13 18-59-04	34	N	40	0.6	F	37585	26621	1700	2031	33196	30556	985	2501	0.05	0.08	0.03	0.08
97-08-13 18-59-04	34	N	39.9	0.6	F	27632	29921	5359	3517	27436	27493	6134	4271	0.19	0.12	0.22	0.16
97-08-13 18-59-04	34	N	39.9	0.6	F	30417	28429	6720	-107	32711	27213	6881	899	0.22	0	0.21	0.03
97-08-13 18-59-04	34	N	40	0.7	F	26356	30858	4276	4786	32781	24547	12981	5132	0.16	0.16	0.4	0.21
97-08-13 18-59-04	34	N	40	0.6	F	31194	27173	4083	3614	27178	29009	4681	6462	0.13	0.13	0.17	0.22
97-08-13 18-59-04	34	N	39.9	0.6	F	30877	32566	1200	421	30282	28186	5365	5433	0.04	0.01	0.18	0.19
97-08-13 18-59-04	34	N	39.9	0.6	F	31364	28467	5175	64	29995	29338	3748	1001	0.17	0	0.12	0.03
97-08-13 18-50-04	34	N	39.9	0.6	F	28180	19675	4488	2378	28040	24445	7681	2320	0.16	0.12	0.27	0.09
97-08-13 18-59-04	34	N	39.9	0.6	F	28520	30526	3514	2747	25436	26422	3057	2318	0.12	0.09	0.12	0.09
97-08-13 18-59-04	34	N	39.9	0.6	F	25139	26511	4728	3068	27664	23834	7453	5268	0.19	0.12	0.27	0.22
97-08-13 18-59-04	34	N	39.9	0.6	F	25729	28440	1596	486	27951	25620	1451	1751	0.06	0.02	0.05	0.07
97-08-13 18-59-04	34	N	39.8	0.6	F	28875	26073	1783	1812	27648	28626	3858	2312	0.06	0.07	0.14	0.08
97-08-13 18-59-04	34	N	39.8	0.6	F	29811	27902	1704	1419	25887	29996	898	2320	0.06	0.05	0.03	0.08
97-08-13 18-59-04	34	N	39.8	0.6	F	34050	33298	971	1220	33794	39670	1983	2871	0.03	0.04	0.06	0.07
97-08-13 18-59-04	34	N	39.8	0.6	F	27062	36086	3040	61	29201	31641	3300	1008	0.11	0	0.11	0.03
97-08-13 18-59-04	34	N	39.8	0.6	F	31449	22789	2732	1573	30042	26105	5151	2588	0.09	0.07	0.17	0.1
97-08-13 18-59-04	34	N	39.8	0.6	F	30601	27245	2988	1298	27907	28766	5876	4150	0.1	0.05	0.21	0.14
97-08-13 18-59-04	34	N	39.7	0.6	F	21786	27596	1169	862	23870	24203	3108	1644	0.05	0.03	0.13	0.07
97-08-13 18-59-04	34	N	39.7	0.6	F	22447	29401	3353	110	23748	26285	3880	620	0.15	0	0.16	0.02
97-08-13 18-59-04	34	N	39.7	0.6	F	35816	30699	7218	2544	33347	31399	9497	2837	0.2	0.08	0.28	0.09
97-08-13 18-59-04	34	N	39.7	0.6	F	31966	31662	475	2433	31991	36799	1925	2673	0.01	0.08	0.06	0.07
97-08-13 18-59-04	34	N	39.7	0.6	F	26517	46278	4153	3570	35207	39352	7368	2265	0.16	0.08	0.21	0.06
97-08-13 18-59-04	34	N	39.7	0.6	F	30089	45655	6253	-354	34424	37122	7818	-106	0.21	-0.01	0.23	0
97-08-13 18-59-04	34	N	39.6	0.6	F	34539	21325	5960	3018	32585	25835	9607	6395	0.17	0.14	0.29	0.25
97-08-13 18-59-04	34	N	39.6	0.6	F	35993	22789	1234	1265	30673	25077	1458	2376	0.03	0.06	0.05	0.09

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 18-59-04	34	N	39.6	0.6	F	27995	25721	1587	1694	29576	25116	6242	7128	0.06	0.07	0.21	0.28
97-08-13 18-59-04	34	N	39.6	0.6	F	28476	26609	3262	242	31635	25375	4519	1447	0.11	0.01	0.14	0.06
97-08-13 18-59-04	34	N	39.6	0.6	F	27442	23382	1850	1854	25455	22066	4121	2042	0.07	0.08	0.16	0.09
97-08-13 18-59-04	34	N	39.6	0.6	F	24324	23054	839	1297	24103	24018	2525	2010	0.03	0.06	0.1	0.08
97-08-13 18-59-04	34	N	39.6	0.5	F	21473	26720	1303	425	23800	24696	665	2312	0.06	0.02	0.03	0.09
97-08-13 18-59-04	34	N	39.6	0.5	F	20301	27922	2287	691	24312	23684	2352	1465	0.11	0.02	0.1	0.06
97-08-13 18-59-04	34	N	39.5	0.5	F	29850	26823	5161	4038	29059	23762	8010	3185	0.17	0.15	0.28	0.13
97-08-13 18-59-04	34	N	39.5	0.5	F	27226	21269	4412	1671	25191	25712	3201	1275	0.16	0.08	0.13	0.05
97-08-13 18-59-04	34	N	39.5	0.5	F	26207	30953	900	3076	30561	26206	4976	4950	0.03	0.1	0.16	0.19
97-08-13 18-59-04	34	N	39.5	0.5	F	35982	32442	3993	185	33960	26305	6825	1539	0.11	0.01	0.2	0.06
97-08-13 18-59-04	34	N	39.4	0.5	F	11285	6273	1407	980	9121	7648	5190	1911	0.12	0.16	0.57	0.25
97-08-13 18-59-04	34	N	39.4	0.5	F	10074	6691	1626	694	6382	9507	1267	2395	0.16	0.1	0.2	0.25
97-08-13 18-59-04	34	N	39.4	0.5	F	7506	10500	780	678	9900	7852	2288	1186	0.1	0.06	0.23	0.15
97-08-13 18-59-04	34	N	39.4	0.5	F	7323	11247	1718	242	9216	8625	2127	750	0.23	0.02	0.23	0.09
97-08-13 18-59-04	34	N	39.4	0.5	F	10022	8860	930	882	9924	8127	2329	976	0.09	0.1	0.23	0.12
97-08-13 18-59-04	34	N	39.4	0.5	F	8701	8407	1962	1017	7022	9495	2199	2100	0.23	0.12	0.31	0.22
97-08-13 18-59-04	34	N	39.3	0.5	F	7722	9278	821	339	8205	8071	1154	1120	0.11	0.04	0.14	0.14
97-08-13 18-59-04	34	N	39.3	0.5	F	6848	9454	979	269	8509	9183	2494	1094	0.14	0.03	0.29	0.12
97-08-13 18-59-04	34	N	39.3	0.5	F	33446	26558	6993	4588	30162	27767	12215	7848	0.21	0.17	0.4	0.28
97-08-13 18-59-04	34	N	39.3	0.5	F	35252	27134	3603	2292	32581	30038	3981	3795	0.1	0.08	0.12	0.13
97-08-13 18-59-04	34	N	39.2	0.5	F	28657	29259	1756	2590	29661	27118	3494	3308	0.06	0.09	0.12	0.12
97-08-13 18-59-04	34	N	39.2	0.5	F	27905	29762	4206	54	28107	29024	4248	1189	0.15	0	0.15	0.04
97-08-13 18-59-04	34	N	39.2	0.5	F	24561	19303	3253	1721	23716	20550	5220	1924	0.13	0.09	0.22	0.09
97-08-13 18-59-04	34	N	39.2	0.5	F	21954	21047	615	1453	20879	21372	1268	2382	0.03	0.07	0.06	0.11
97-08-13 18-59-04	34	N	39.1	0.4	F	20584	23722	1865	249	20376	22085	4442	290	0.09	0.01	0.22	0.01
97-08-13 18-59-04	34	N	39.1	0.4	F	18782	25317	3674	809	20418	22701	5305	2858	0.2	0.03	0.26	0.13
97-08-13 18-59-04	34	N	39.1	0.4	F	37783	26667	6864	2955	38515	33215	11222	5290	0.18	0.11	0.29	0.16
97-08-13 18-59-04	34	N	39.1	0.4	F	37652	33157	2199	3707	35531	33224	5764	4993	0.06	0.11	0.16	0.15
97-08-13 18-59-04	34	N	39.1	0.4	F	35130	31841	4072	2893	37040	33118	7979	5902	0.12	0.09	0.22	0.18
97-08-13 18-59-04	34	N	39	0.4	F	32830	39738	3284	323	32852	30843	3630	1219	0.1	0.01	0.11	0.04
97-08-13 18-59-04	34	N	39	0.4	F	46770	30877	6412	4095	34109	37101	9257	7710	0.14	0.13	0.27	0.21
97-08-13 18-59-04	34	N	39	0.4	F	39222	29615	4281	1542	32886	43779	4518	5476	0.11	0.05	0.14	0.13
97-08-13 18-59-04	34	N	39	0.4	F	36764	33178	6698	3313	38120	33374	8656	6151	0.18	0.1	0.23	0.18
97-08-13 18-59-04	34	N	38.9	0.4	F	38516	33544	4573	458	37622	33939	4294	4688	0.12	0.01	0.11	0.14
97-08-13 18-59-04	34	N	38.9	0.4	F	43734	28328	8693	3650	37198	32554	8520	4195	0.2	0.13	0.23	0.13
97-08-13 18-59-04	34	N	38.9	0.4	F	39142	37921	2952	2723	33868	36474	2978	3609	0.08	0.07	0.09	0.1
97-08-13 18-59-04	34	N	38.9	0.4	F	30859	36152	6721	2654	36314	33602	2765	3734	0.22	0.07	0.08	0.11
97-08-13 18-59-04	34	N	38.8	0.4	F	31188	37923	7630	171	36737	32203	3769	1221	0.24	0	0.1	0.04
97-08-13 18-59-04	34	N	38.8	0.4	F	36946	30651	6406	3889	36060	36557	9315	5055	0.17	0.13	0.26	0.14
97-08-13 18-59-04	34	N	38.8	0.4	F	36359	32968	4646	3458	33687	36149	6696	4819	0.13	0.1	0.2	0.13
97-08-13 18-59-04	34	N	38.8	0.4	F	38629	29806	4980	3176	35733	30784	5670	4545	0.13	0.11	0.16	0.15
97-08-13 18-59-04	34	N	38.8	0.4	F	36205	41974	3054	560	35011	31936	2901	1512	0.08	0.01	0.08	0.05
97-08-13 18-59-04	34	N	38.7	0.3	F	37997	27554	6039	3050	35834	30825	8760	2577	0.16	0.11	0.24	0.08
97-08-13 18-59-04	34	N	38.7	0.3	F	33956	31126	398	1358	31873	36179	506	2523	0.01	0.04	0.02	0.07
97-08-13 18-59-04	34	N	38.7	0.3	F	34844	32625	3851	2440	34181	31365	4304	1947	0.11	0.07	0.13	0.06
97-08-13 18-59-04	34	N	38.7	0.3	F	32357	35354	3736	312	33833	33119	2850	1591	0.12	0.01	0.08	0.05
97-08-13 18-59-04	34	N	38.7	0.3	F	33798	25403	5328	2626	29183	27915	6649	2515	0.16	0.1	0.23	0.09
97-08-13 18-59-04	34	N	38.7	0.3	F	29196	27271	526	1909	27325	29805	1359	2512	0.02	0.07	0.05	0.08
97-08-13 18-59-04	34	N	38.6	0.3	F	28754	28552	1483	473	29013	26299	2873	2632	0.05	0.02	0.1	0.1
97-08-13 18-59-04	34	N	38.6	0.3	F	26395	31012	4273	83	28025	28551	4218	1271	0.16	0	0.15	0.04
97-08-13 18-59-04	34	N	38.6	0.3	F	25571	18048	4604	2482	22377	21403	5000	2016	0.18	0.14	0.22	0.09
97-08-13 18-59-04	34	N	38.6	0.3	F	21600	22104	1968	1863	21835	20256	3065	2886	0.09	0.08	0.14	0.14
97-08-13 18-59-04	34	N	38.5	0.3	F	22222	22950	1795	2761	24643	19938	1895	2080	0.08	0.12	0.08	0.1
97-08-13 18-59-04	34	N	38.5	0.3	F	26011	26030	3417	181	25762	20908	4882	958	0.13	0.01	0.19	0.05
97-08-13 18-59-04	34	N	38.5	0.3	F	9614	5620	2234	859	8327	7207	3139	1423	0.23	0.15	0.38	0.2
97-08-13 18-59-04	34	N	38.5	0.3	F	8003	7540	612	504	7439	8145	1157	1407	0.08	0.07	0.16	0.17
97-08-13 18-59-04	34	N	38.4	0.3	F	7848	8531	512	367	8439	7962	1050	835	0.07	0.04	0.12	0.1
97-08-13 18-59-04	34	N	38.4	0.3	F	8094	10147	1390	121	9352	8601	1481	1108	0.17	0.01	0.16	0.13
97-08-13 18-59-04	34	N	38.3	0.3	F	37000	28936	3209	2733	36067	30978	7742	2835	0.09	0.09	0.21	0.09
97-08-13 18-59-04	34	N	38.3	0.3	F	37843	31659	2245	354	32686	33602	2630	3008	0.06	0.01	0.08	0.09
97-08-13 18-59-04	34	N	38.3	0.2	F	36017	36310	1026	1246	37385	34130	1442	3389	0.03	0.03	0.04	0.1
97-08-13 18-59-04	34	N	38.3	0.2	F	36700	38493	5812	-25	38083	34712	5878	717	0.16	0	0.15	0.02
97-08-13 18-59-04	34	N	38.3	0.2	F	28087	25737	2015	1273	25535	26968	4236	3035	0.07	0.05	0.17	0.11
97-08-13 18-59-04	34	N	38.2	0.2	F	27722	24880	2172	-33	24421	26498	5138	3109	0.08	0	0.21	0.12
97-08-13 18-59-04	34	N	38.2	0.2	F	23071	26881	972	1054	23298	25241	2197	2849	0.04	0.04	0.09	0.11
97-08-13 18-59-04	34	N	38.2	0.2	F	23121	26324	2896	146	23721	25504	2867	1144	0.13	0.01	0.12	0.04
97-08-13 18-59-04	34	N	38.2	0.2	F	29059	24506	6696	4221	26702	25468	10169	5051	0.23	0.17	0.38	0.2
97-08-13 18-59-04	34	N	38.2	0.2	F	27132	27323	2673	2543	25442	29254	1677	3128	0.1	0.09	0.07	0.11
97-08-13 18-59-04	34	N	38.1	0.2	F	27508	28361	5660	3138	27587	26355	7489	5836	0.21	0.11	0.27	0.22

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/	Spiral Low Rail L/	Body High Rail L/	Body Low Rail L/
97-08-13 18-59-04	34	N	38.1	0.2	F	25537	30642	2505	48	26227	27896	3095	992	0.1	0	0.12	0.04
97-08-13 18-59-04	34	N	38.1	0.2	F	11614	11520	762	770	11061	11836	1024	1514	0.07	0.07	0.09	0.13
97-08-13 18-59-04	34	N	38.1	0.2	F	12565	10512	1784	830	10713	10970	1781	1380	0.14	0.08	0.17	0.13
97-08-13 18-59-04	34	N	38	0.2	F	11056	12097	625	1223	12902	9605	1996	1135	0.06	0.1	0.15	0.12
97-08-13 18-59-04	34	N	38	0.2	F	10261	11409	1281	285	11291	11308	1817	1939	0.12	0.02	0.16	0.17
97-08-13 18-59-04	34	N	37.9	0.1	F	36089	25642	3093	2190	34432	26594	6864	2792	0.09	0.09	0.2	0.1
97-08-13 18-59-04	34	N	37.9	0.1	F	33102	27807	1275	2897	30555	28594	2375	4035	0.04	0.1	0.08	0.14
97-08-13 18-59-04	34	N	37.8	0.1	F	33341	35922	2761	2445	37455	29264	7797	5427	0.08	0.07	0.21	0.19
97-08-13 18-59-04	34	N	37.8	0.1	F	28552	37910	6083	633	34677	32856	5749	1132	0.21	0.02	0.17	0.03
97-08-13 18-59-04	34	N	37.7	0.1	F	28937	19360	2906	1081	26733	22377	5497	1959	0.1	0.06	0.21	0.09
97-08-13 18-59-04	34	N	37.7	0.1	F	25620	21820	419	990	21655	24690	621	2349	0.02	0.05	0.03	0.1
97-08-13 18-59-04	34	N	37.7	0.1	F	24112	24957	1525	335	24710	24053	1173	2609	0.06	0.01	0.05	0.11
97-08-13 18-59-04	34	N	37.6	0.1	F	23589	25144	2627	193	27179	24067	2575	1420	0.11	0.01	0.09	0.06
97-08-13 18-59-04	34	N	37.6	0.1	F	31207	24604	5225	2159	26102	26142	6484	2801	0.17	0.09	0.25	0.11
97-08-13 18-59-04	34	N	37.6	0.1	F	27299	26727	579	1315	24942	28164	1168	3080	0.02	0.05	0.05	0.11
97-08-13 18-59-04	34	N	37.6	0.1	F	22813	29685	939	1706	24753	28681	2773	4380	0.04	0.06	0.11	0.15
97-08-13 18-59-04	34	N	37.6	0.1	F	22593	30121	4759	8	23438	28194	3335	917	0.21	0	0.14	0.03
97-08-13 18-59-04	34	N	37.5	0.1	F	29805	21452	2987	1891	25994	23315	4409	2987	0.1	0.09	0.17	0.13
97-08-13 18-59-04	34	N	37.5	0.1	F	27097	23835	839	1089	25143	26077	2287	2736	0.03	0.05	0.09	0.1
97-08-13 18-59-04	34	N	37.5	0	F	25055	28151	1101	1101	26425	25299	3932	3921	0.04	0.04	0.15	0.15
97-08-13 18-59-04	34	N	37.5	0	F	26133	28640	4349	111	24941	26120	3733	1154	0.17	0	0.15	0.04
97-08-13 18-59-04	34	N	37.4	0	F	26672	21296	3104	1612	22172	25382	4154	2484	0.12	0.08	0.19	0.1
97-08-13 18-59-04	34	N	37.4	0	F	23301	24133	1107	1461	20816	25945	1237	2688	0.05	0.06	0.06	0.1
97-08-13 18-59-04	34	N	37.4	0	F	25630	22929	2291	1474	27028	21427	4700	2685	0.09	0.06	0.17	0.13
97-08-13 18-59-04	34	N	37.4	0	F	26325	22099	2930	336	24541	21210	1952	1679	0.11	0.02	0.08	-0.08
97-08-13 18-59-04	34	N	37.4	0	F	30458	21910	5848	3578	29030	23951	8206	3625	0.19	0.16	0.28	0.15
97-08-13 18-59-04	34	N	37.4	0	F	28885	23208	1382	1742	26089	24064	1252	2077	0.05	0.08	0.05	0.09
97-08-13 18-59-04	34	N	37.3	0	F	25376	34212	2366	1644	24119	23520	3351	3108	0.09	0.05	0.14	0.13
97-08-13 18-59-04	34	N	37.3	0	F	24838	26236	2623	103	24416	24281	2446	1436	0.11	0	0.1	0.06
97-08-13 18-59-04	34	N	37.3	0	F	9713	7667	755	256	7016	6932	1067	801	0.08	0.03	0.15	0.12
97-08-13 18-59-04	34	N	37.3	0	F	8015	6836	975	117	9577	8127	1544	1024	0.12	0.02	0.16	0.13
97-08-13 18-59-04	34	N	37.2	0	F	8631	8829	786	696	7714	6200	1442	977	0.09	0.08	0.19	0.16
97-08-13 18-59-04	34	N	37.2	0	F	12049	13796	917	367	7173	7101	1436	994	0.08	0.03	0.2	0.14
97-08-13 18-59-04	34	N	37.2	0	F	29588	25650	5856	3862	27599	28952	7900	4594	0.2	0.15	0.29	0.16
97-08-13 18-59-04	34	N	37.2	0	F	28977	26746	3339	3246	25594	30009	4197	3705	0.12	0.12	0.16	0.12
97-08-13 18-59-04	34	N	37.1	0	F	29197	31489	1445	1287	28262	28338	4176	4283	0.05	0.04	0.15	0.15
97-08-13 18-59-04	34	N	37.1	0	F	27807	30022	2927	43	30683	29798	3835	1266	0.11	0	0.13	0.04
97-08-13 18-59-04	34	N	37.1	-0.1	F	38025	29482	3915	2749	34532	33502	6349	4417	0.1	0.09	0.18	0.13
97-08-13 18-59-04	34	N	37.1	-0.1	F	33852	33146	626	1893	30911	35089	875	4585	0.02	0.06	0.03	0.13
97-08-13 18-59-04	34	N	37	-0.1	F	30416	35026	850	2633	34931	31120	4724	4302	0.03	0.08	0.14	0.14
97-08-13 18-59-04	34	N	37	-0.1	F	31474	34625	3836	100	34374	30784	3863	1399	0.12	0	0.11	0.05
97-08-13 18-59-04	34	N	37	-0.1	F	28947	19706	3892	2629	28316	23489	5365	3230	0.13	0.13	0.19	0.14
97-08-13 18-59-04	34	N	37	-0.1	F	30025	24752	2052	1542	28000	26771	3068	3327	0.07	0.06	0.11	0.12
97-08-13 18-59-04	34	N	36.9	-0.1	F	21974	24757	4139	3112	22047	21723	4683	3236	0.19	0.13	0.21	0.15
97-08-13 18-59-04	34	N	36.9	-0.1	F	21242	24632	1236	368	23180	23555	1549	1586	0.06	0.01	0.07	0.07
97-08-13 18-59-04	34	N	36.9	-0.1	F	28147	26450	6049	4085	25359	28633	10008	5881	0.21	0.15	0.39	0.21
97-08-13 18-59-04	34	N	36.9	-0.1	F	27356	27182	2496	3293	22519	31400	2679	3996	0.09	0.12	0.12	0.13
97-08-13 18-59-04	34	N	36.8	-0.1	F	25392	29461	2424	58	29759	22868	1017	1861	0.1	0	0.03	0.08
97-08-13 18-59-04	34	N	36.8	-0.1	F	21528	32318	2203	76	31611	23733	4642	929	0.1	0	0.15	0.04
97-08-13 18-59-04	34	N	36.7	-0.1	F	34811	22184	8512	3956	31722	24791	10805	4637	0.24	0.18	0.34	0.19
97-08-13 18-59-04	34	N	36.7	-0.1	F	32383	24393	2360	3761	28608	27428	3639	5728	0.07	0.15	0.13	0.21
97-08-13 18-59-04	34	N	36.7	-0.1	F	30707	32409	2445	1859	30519	27056	6568	5907	0.08	0.06	0.22	0.22
97-08-13 18-59-04	34	N	36.7	-0.1	F	27167	32331	3100	-294	30857	26805	4126	529	0.11	-0.01	0.13	0.02
97-08-13 18-59-04	34	N	36.6	-0.2	F	27223	29394	3098	2860	28810	28241	8690	4129	0.11	0.1	0.3	0.15
97-08-13 18-59-04	34	N	36.6	-0.2	F	29089	29889	2498	3747	28352	29959	3635	2915	0.09	0.13	0.13	0.1
97-08-13 18-59-04	34	N	36.6	-0.2	F	26388	30273	3503	2649	29708	27325	5291	2298	0.13	0.09	0.18	0.08
97-08-13 18-59-04	34	N	36.6	-0.2	F	21749	33504	3446	876	25267	27879	4657	2200	0.16	0.03	0.18	0.08
97-08-13 18-59-04	34	N	36.5	-0.2	F	32717	30071	2339	3219	35033	27763	8084	3458	0.07	0.11	0.23	0.12
97-08-13 18-59-04	34	N	36.5	-0.2	F	35713	28604	1508	975	31643	30811	817	1495	0.04	0.03	0.03	0.05
97-08-13 18-59-04	34	N	36.5	-0.2	F	36037	41336	1253	3246	40262	35655	2819	4187	0.03	0.08	0.07	0.12
97-08-13 18-59-04	34	N	36.5	-0.2	F	34629	39229	3300	734	36966	36904	5078	1906	0.1	0.02	0.14	0.05
97-08-13 18-59-04	34	N	36.5	-0.2	F	28385	37610	8684	5725	29243	36023	13531	7662	0.31	0.15	0.46	0.21
97-08-13 18-59-04	34	N	36.5	-0.2	F	25116	42148	979	684	26042	39693	3102	1530	0.04	0.02	0.12	0.04
97-08-13 18-59-04	34	N	36.4	-0.2	F	21263	37816	1414	2526	22621	36263	5783	7955	0.07	0.07	0.26	0.22
97-08-13 18-59-04	34	N	36.4	-0.2	F	23903	36820	3341	-281	25023	36577	4026	769	0.14	-0.01	0.16	0.02
97-08-13 18-59-04	34	N	36.4	-0.2	F	32160	22332	4472	2142	29329	27029	5706	3296	0.14	0.1	0.19	0.12
97-08-13 18-59-04	34	N	36.4	-0.2	F	29915	24396	1638	1896	26620	27773	1319	2698	0.05	0.08	0.05	0.1
97-08-13 18-59-04	34	N	36.3	-0.2	F	23070	28186	3129	3788	23194	26769	2365	3068	0.14	0.13	0.1	0.11
97-08-13 18-59-04	34	N	36.3	-0.2	F	23043	27873	2469	253	23958	26173	2997	991	0.11	0.01	0.13	0.04

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 18-59-04	34	N	36.3	-0.2	F	13214	12032	677	1272	14435	11111	2082	1688	0.05	0.11	0.14	0.15
97-08-13 18-59-04	34	N	36.3	-0.2	F	14493	9806	3266	1663	15168	9648	4641	820	0.23	0.17	0.31	0.09
97-08-13 18-59-04	34	N	36.2	-0.2	F	12804	12242	801	1181	13177	10409	1952	1126	0.06	0.1	0.15	0.11
97-08-13 18-59-04	34	N	36.2	-0.2	F	12241	10997	1492	232	13051	10553	1876	773	0.12	0.02	0.14	0.07
97-08-13 18-59-04	34	N	36.2	-0.3	F	30143	30743	6803	4662	27807	33464	9826	5797	0.23	0.15	0.35	0.17
97-08-13 18-59-04	34	N	36.2	-0.3	F	30060	32547	2859	2187	26276	34482	6175	5889	0.1	0.07	0.24	0.17
97-08-13 18-59-04	34	N	36.1	-0.3	F	25007	33940	1410	2730	26530	33365	947	5166	0.06	0.08	0.04	0.15
97-08-13 18-59-04	34	N	36.1	-0.3	F	26181	34683	3647	184	26295	30629	5180	856	0.14	0.01	0.2	0.03
97-08-13 18-59-04	34	N	36.1	-0.3	F	35116	27068	4843	3405	34792	27588	8335	3816	0.14	0.13	0.24	0.14
97-08-13 18-59-04	34	N	36.1	-0.3	F	34457	29541	3230	2872	36156	29815	5546	2210	0.09	0.1	0.15	0.07
97-08-13 18-59-04	34	N	36	-0.3	F	28938	27058	3612	2145	29030	27820	4982	4666	0.12	0.08	0.17	0.17
97-08-13 18-59-04	34	N	36	-0.3	F	26471	30650	3796	1044	28357	28451	3930	2359	0.14	0.03	0.14	0.08
97-08-13 18-59-04	34	N	36	-0.3	F	37813	27247	5452	3588	33633	30395	7564	4116	0.14	0.13	0.22	0.14
97-08-13 18-59-04	34	N	36	-0.3	F	32666	30265	1238	4155	30574	36191	3016	6787	0.04	0.14	0.1	0.19
97-08-13 18-59-04	34	N	35.9	-0.3	F	25497	32103	1296	3965	27603	30166	2994	5665	0.05	0.12	0.11	0.19
97-08-13 18-59-04	34	N	35.9	-0.3	F	24459	37926	3005	487	26771	30903	4698	1292	0.12	0.01	0.18	0.04
97-08-13 18-59-04	34	N	35.9	-0.3	F	38261	29496	6869	4561	34061	31039	9780	4777	0.18	0.15	0.29	0.15
97-08-13 18-59-04	34	N	35.9	-0.3	F	31864	31661	1766	3172	30344	34899	3112	4746	0.06	0.1	0.1	0.14
97-08-13 18-59-04	34	N	35.8	-0.3	F	25876	32509	2294	2512	28703	29991	4301	4772	0.09	0.08	0.15	0.16
97-08-13 18-59-04	34	N	35.8	-0.3	F	29165	29871	4367	359	32036	26084	6435	881	0.15	0.01	0.2	0.03
97-08-13 18-59-04	34	N	35.8	-0.4	F	36469	27215	7000	4611	33513	30763	10011	6743	0.19	0.17	0.3	0.22
97-08-13 18-59-04	34	N	35.7	-0.4	F	34403	31266	4420	1432	32869	30050	9495	1598	0.13	0.05	0.29	0.05
97-08-13 18-59-04	34	N	35.7	-0.4	F	29183	31342	5089	3019	29033	27896	6632	4467	0.17	0.1	0.23	0.16
97-08-13 18-59-04	34	N	35.7	-0.4	F	26027	31644	1649	2278	28702	30049	2861	3644	0.06	0.07	0.1	0.12
97-08-13 18-59-04	34	N	35.7	-0.4	F	31862	24748	3530	2259	30030	27229	8289	2741	0.11	0.09	0.28	0.1
97-08-13 18-59-04	34	N	35.7	-0.4	F	31770	28262	1717	2827	29103	31511	2202	4340	0.05	0.1	0.08	0.14
97-08-13 18-59-04	34	N	35.6	-0.4	F	30878	29806	2577	2638	28279	30307	3544	3982	0.08	0.09	0.13	0.13
97-08-13 18-59-04	34	N	35.6	-0.4	F	31393	30061	5550	-160	31490	29075	6422	825	0.18	-0.01	0.2	0.03
97-08-13 18-59-04	34	N	35.6	-0.4	F	7423	6559	3004	1524	5961	6590	5209	1360	0.4	0.23	0.87	0.21
97-08-13 18-59-04	34	N	35.6	-0.4	F	8058	7452	1041	406	7785	8037	1438	1565	0.13	0.05	0.18	0.19
97-08-13 18-59-04	34	N	35.5	-0.4	F	8636	7839	1290	762	8317	7900	1213	1183	0.15	0.1	0.15	0.15
97-08-13 18-59-04	34	N	35.5	-0.4	F	7874	9096	441	645	9017	8791	1195	1301	0.06	0.07	0.13	0.15
97-08-13 18-59-04	34	N	35.5	-0.4	F	18875	22053	2028	3514	21221	18925	7250	3692	0.11	0.16	0.34	0.2
97-08-13 18-59-04	34	N	35.5	-0.4	F	16648	21740	1858	3292	19005	22652	6021	5046	0.11	0.15	0.32	0.22
97-08-13 18-59-04	34	N	35.4	-0.4	F	18770	18677	6049	3360	18048	18780	3857	5408	0.32	0.18	0.21	0.29
97-08-13 18-59-04	34	N	35.4	-0.4	F	18389	19746	1752	852	19714	17656	4129	2088	0.1	0.04	0.21	0.12
97-08-13 18-59-04	34	N	35.4	-0.4	F	33653	17233	3094	1405	31298	20839	5132	2486	0.09	0.08	0.16	0.12
97-08-13 18-59-04	34	N	35.4	-0.4	F	31556	19869	1149	1144	27448	22716	1453	2399	0.04	0.06	0.05	0.11
97-08-13 18-59-04	34	N	35.3	-0.5	F	27449	26981	1136	1264	28784	25044	1481	2976	0.04	0.05	0.05	0.12
97-08-13 18-59-04	34	N	35.3	-0.5	F	29001	28368	3536	105	29789	25685	3533	1339	0.12	0	0.12	0.05
97-08-13 18-59-04	34	N	35.3	-0.5	F	30288	21505	6264	3655	26035	25660	8838	5667	0.21	0.17	0.34	0.22
97-08-13 18-59-04	34	N	35.3	-0.5	F	28078	23270	570	1611	25108	27514	874	3685	0.02	0.07	0.03	0.13
97-08-13 18-59-04	34	N	35.2	-0.5	F	27559	27361	1978	2059	25707	26241	3745	5289	0.07	0.08	0.15	0.2
97-08-13 18-59-04	34	N	35.2	-0.5	F	29028	26891	2879	87	27718	26361	2672	951	0.1	0	0.1	0.04
97-08-13 19-26-53	34	N	35.1	-0.5	L	35577	29016	4956	4999	33809	31854	9911	8775	0.14	0.17	0.29	0.28
97-08-13 19-26-53	34	N	35.1	-0.5	L	35437	40254	2247	2037	34891	37804	4430	5458	0.06	0.05	0.13	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	L	27063	36367	5952	4924	28435	34239	9113	7556	0.22	0.14	0.32	0.22
97-08-13 19-26-53	34	N	35.1	-0.5	L	30162	42281	1776	15	31667	39448	2629	978	0.06	0	0.08	0.02
97-08-13 19-26-53	34	N	35.1	-0.5	L	34860	31589	1490	2431	34271	37642	4455	4459	0.04	0.08	0.13	0.12
97-08-13 19-26-53	34	N	35.1	-0.5	L	33634	34524	1113	1377	32262	35966	6401	5897	0.03	0.04	0.2	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	L	34304	38469	2042	1357	29306	37960	3522	2354	0.06	0.04	0.12	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	L	31876	33441	2498	3469	32991	31420	4603	3911	0.08	0.1	0.14	0.12
97-08-13 19-26-53	34	N	35.1	-0.5	L	30818	35451	1849	3013	34348	32055	2284	3883	0.06	0.08	0.07	0.12
97-08-13 19-26-53	34	N	35.1	-0.5	L	34894	40543	3295	1282	34700	36895	3846	2334	0.09	0.03	0.11	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	L	38796	29803	1733	1813	35270	32724	5267	2726	0.04	0.06	0.15	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	L	33631	34372	779	1423	30088	35248	3793	6803	0.02	0.04	0.13	0.19
97-08-13 19-26-53	34	N	35.1	-0.5	L	40329	40451	2760	26	39015	41173	5631	403	0.07	0	0.14	0.01
97-08-13 19-26-53	34	N	35.1	-0.5	L	32541	35346	4433	4109	37403	33288	9461	6421	0.14	0.12	0.25	0.19
97-08-13 19-26-53	34	N	35.1	-0.5	L	30248	40711	2185	1981	31313	40709	4436	7345	0.07	0.05	0.14	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	L	33382	37702	2565	504	34449	37267	3998	640	0.08	0.01	0.12	0.02
97-08-13 19-26-53	34	N	35.1	-0.5	F	9982	7166	2190	1005	7822	7693	2311	1241	0.22	0.14	0.3	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	7771	7956	1015	1049	7369	8744	1429	1790	0.13	0.13	0.19	0.2
97-08-13 19-26-53	34	N	35.1	-0.5	F	8074	9229	743	358	8399	7734	2389	1389	0.09	0.04	0.28	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	6846	9696	1313	643	7593	9016	816	876	0.19	0.07	0.11	0.1
97-08-13 19-26-53	34	N	35.2	-0.5	F	10936	5825	1137	973	10131	6739	2006	739	0.1	0.17	0.2	0.11
97-08-13 19-26-53	34	N	35.2	-0.5	F	10247	7083	664	911	8293	9020	1236	1308	0.06	0.13	0.15	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	6630	9929	853	230	7149	9668	1222	355	0.13	0.02	0.17	0.04
97-08-13 19-26-53	34	N	35.1	-0.5	F	5461	10872	1528	343	6112	9329	1753	475	0.28	0.03	0.29	0.05
97-08-13 19-26-53	34	N	35.1	-0.5	F	9597	7407	775	734	8051	7952	936	1121	0.08	0.1	0.12	0.14

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 19-26-53	34	N	35.1	-0.5	F	7659	7955	463	909	6927	8184	1182	1246	0.06	0.11	0.17	0.15
97-08-13 19-26-53	34	N	35.2	-0.5	F	7797	9571	1815	354	7298	7809	930	570	0.23	0.04	0.13	0.07
97-08-13 19-26-53	34	N	35.1	-0.5	F	7485	10049	2168	625	8261	9571	863	845	0.29	0.06	0.1	0.09
97-08-13 19-26-53	34	N	35.2	-0.5	F	10077	11000	703	1255	8794	7018	1878	1129	0.07	0.11	0.21	0.16
97-08-13 19-26-53	34	N	35.2	-0.5	F	8365	8317	522	911	7048	8295	1631	1288	0.06	0.11	0.23	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	7904	9065	788	917	8256	7883	1026	865	0.1	0.1	0.12	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	8492	9219	1340	362	7759	8762	1162	491	0.16	0.04	0.15	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	9131	8215	870	862	8373	8194	862	850	0.1	0.1	0.1	0.1
97-08-13 19-26-53	34	N	35.1	-0.5	F	8702	8128	812	919	8583	8642	1436	808	0.09	0.11	0.17	0.09
97-08-13 19-26-53	34	N	35.1	-0.5	F	8349	8420	627	408	7743	8000	983	1024	0.08	0.05	0.12	0.13
97-08-13 19-26-53	34	N	35.1	-0.5	F	6615	9284	1262	476	6173	8825	1019	865	0.19	0.05	0.17	0.1
97-08-13 19-26-53	34	N	35.1	-0.5	F	9836	8163	2469	937	7906	7543	2732	1173	0.25	0.11	0.35	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	9056	7495	942	1097	8193	8838	1918	1411	0.1	0.15	0.23	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	9393	9063	1079	602	8498	8051	1110	901	0.11	0.07	0.13	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	6356	11380	1694	807	8399	8262	1426	304	0.27	0.07	0.17	0.04
97-08-13 19-26-53	34	N	35.1	-0.5	F	9031	7051	912	1377	7237	8483	2098	1305	0.1	0.2	0.29	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	10539	8226	532	1068	7679	9332	1820	1554	0.05	0.13	0.24	0.17
97-08-13 19-26-53	34	N	35.2	-0.5	F	11604	10985	1080	294	8588	8152	1594	1103	0.09	0.03	0.19	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	6500	12688	1703	645	7828	7645	984	431	0.26	0.05	0.13	0.06
97-08-13 19-26-53	34	N	35.2	-0.5	F	9695	7939	1282	1078	8424	7872	2372	1142	0.13	0.14	0.28	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	8666	8789	904	1091	8686	8850	1514	1338	0.1	0.12	0.17	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	7667	8692	671	335	8438	7768	1462	873	0.09	0.04	0.17	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	7070	9297	1648	353	7727	8666	1319	411	0.23	0.04	0.17	0.05
97-08-13 19-26-53	34	N	35.1	-0.5	F	9184	7851	1107	1109	7606	8524	1266	1394	0.12	0.14	0.17	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	8676	8605	609	820	8160	8350	872	639	0.07	0.1	0.11	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	7646	7920	638	622	7607	8086	1317	1159	0.08	0.08	0.17	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	6403	11028	1137	675	7300	8212	1047	749	0.18	0.06	0.14	0.09
97-08-13 19-26-53	34	N	35.1	-0.5	F	11354	9802	1162	1011	8129	8660	2188	1785	0.1	0.1	0.27	0.21
97-08-13 19-26-53	34	N	35.1	-0.5	F	8400	9998	431	761	6741	9497	1922	2771	0.05	0.08	0.29	0.29
97-08-13 19-26-53	34	N	35.1	-0.5	F	8959	9142	1710	800	9754	7408	3367	1374	0.19	0.09	0.35	0.19
97-08-13 19-26-53	34	N	35.1	-0.5	F	7250	9374	1459	16	8823	6690	1154	560	0.2	0	0.13	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	10044	7340	1079	915	8456	7690	1445	1338	0.11	0.12	0.17	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	9315	8027	640	754	6854	9815	995	2024	0.07	0.09	0.15	0.21
97-08-13 19-26-53	34	N	35.1	-0.5	F	6574	10105	674	322	7955	7705	1443	974	0.1	0.03	0.18	0.13
97-08-13 19-26-53	34	N	35.1	-0.5	F	5588	10667	1292	667	8156	8464	1439	1001	0.23	0.06	0.18	0.12
97-08-13 19-26-53	34	N	35.1	-0.5	F	9693	6193	893	967	9548	7115	1819	1145	0.09	0.16	0.19	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	8525	8058	580	724	8130	9629	1750	1584	0.07	0.09	0.22	0.16
97-08-13 19-26-53	34	N	35.2	-0.5	F	8309	9561	1416	345	8253	8746	1558	1091	0.17	0.04	0.19	0.12
97-08-13 19-26-53	34	N	35.2	-0.5	F	8919	11487	1343	376	11191	13447	1909	1926	0.15	0.03	0.17	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	10907	7291	898	1056	8872	8179	2114	1191	0.08	0.14	0.24	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	9348	8941	440	791	7699	8782	1382	1365	0.05	0.09	0.18	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	6077	9600	616	555	8061	7909	1540	1039	0.1	0.06	0.19	0.13
97-08-13 19-26-53	34	N	35.1	-0.5	F	4918	9636	1228	532	6809	9274	1524	396	0.25	0.06	0.22	0.04
97-08-13 19-26-53	34	N	35.1	-0.5	F	9055	8197	1243	923	8120	8049	1553	1394	0.14	0.11	0.19	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	8744	7870	563	475	8204	7863	1367	358	0.06	0.06	0.17	0.05
97-08-13 19-26-53	34	N	35.1	-0.5	F	9019	10094	1026	155	9405	7565	1796	1251	0.11	0.02	0.19	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	7918	10391	1690	316	8740	9557	1682	619	0.21	0.03	0.19	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	11264	6410	911	849	9562	7707	888	1402	0.08	0.13	0.09	0.18
97-08-13 19-26-53	34	N	35.2	-0.5	F	9602	6225	713	207	9890	7528	1037	1472	0.07	0.03	0.1	0.2
97-08-13 19-26-53	34	N	35.1	-0.5	F	6319	9901	583	430	6500	8508	1380	472	0.09	0.04	0.21	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	4591	10387	1114	409	5602	8686	1396	183	0.24	0.04	0.25	0.02
97-08-13 19-26-53	34	N	35.1	-0.5	F	11199	6474	1866	1040	9217	7630	2249	1205	0.17	0.16	0.24	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	11758	9810	1103	987	9345	9181	1033	1499	0.09	0.1	0.11	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	5898	10327	883	487	8237	8908	1655	-258	0.15	0.05	0.2	-0.03
97-08-13 19-26-53	34	N	35.1	-0.5	F	5500	10387	1116	584	6880	8231	1982	500	0.2	0.06	0.29	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	10221	7237	926	1271	8234	8148	2559	1223	0.09	0.18	0.31	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	9411	6730	519	775	6476	9245	836	1692	0.06	0.12	0.13	0.18
97-08-13 19-26-53	34	N	35.2	-0.5	F	6642	9028	1329	300	9122	7300	1770	1145	0.2	0.03	0.19	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	5934	11079	1475	444	6931	7941	899	1160	0.25	0.04	0.13	0.15
97-08-13 19-26-53	34	N	35.2	-0.5	F	10138	8690	880	1308	8142	7902	3159	1157	0.09	0.15	0.39	0.15
97-08-13 19-26-53	34	N	35.2	-0.5	F	8683	7999	649	946	7758	9035	1191	1771	0.07	0.12	0.15	0.2
97-08-13 19-26-53	34	N	35.2	-0.5	F	7530	9729	1140	366	8626	7769	2809	1079	0.15	0.04	0.33	0.14
97-08-13 19-26-53	34	N	35.2	-0.5	F	6369	10074	1453	265	7498	8206	1490	463	0.23	0.03	0.2	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	10721	7303	772	1120	8180	8601	1488	1766	0.07	0.15	0.18	0.21
97-08-13 19-26-53	34	N	35.1	-0.5	F	8358	8208	657	990	7300	8891	1202	1777	0.08	0.12	0.16	0.2
97-08-13 19-26-53	34	N	35.1	-0.5	F	8359	8473	2311	1078	7505	7775	2013	1041	0.28	0.13	0.27	0.13
97-08-13 19-26-53	34	N	35.1	-0.5	F	7667	9763	983	445	7407	8855	1414	540	0.13	0.05	0.19	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	9584	7044	1236	1050	7751	7815	2567	1220	0.13	0.15	0.33	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	7891	7522	591	941	6749	8538	1302	1476	0.07	0.13	0.19	0.17

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 19-26-53	34	N	35.1	-0.5	F	8881	11439	2069	792	8838	7046	1986	1068	0.23	0.07	0.22	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	6734	10160	907	137	8746	8790	1456	521	0.13	0.01	0.17	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	8332	9691	817	815	7692	9133	2427	1539	0.1	0.08	0.32	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	8556	8538	474	700	6070	9896	1342	1825	0.06	0.08	0.22	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	8478	8615	802	394	9273	7256	1333	821	0.09	0.05	0.14	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	8353	9310	1762	392	9817	6906	1843	695	0.21	0.04	0.19	0.1
97-08-13 19-26-53	34	N	35.1	-0.5	F	10033	7388	1458	884	7672	7066	1979	1285	0.15	0.12	0.26	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	7251	8536	532	1018	7173	8316	1488	1332	0.07	0.12	0.21	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	7495	10102	1695	1182	7586	7667	1811	1305	0.23	0.12	0.24	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	7088	9474	1517	218	6924	8568	1415	1359	0.21	0.02	0.2	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	9522	6908	1415	910	7775	7741	1726	1280	0.15	0.13	0.22	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	8011	8075	546	712	7629	9808	1245	1999	0.07	0.09	0.16	0.2
97-08-13 19-26-53	34	N	35.2	-0.5	F	9931	8870	1946	643	9175	7838	1761	1105	0.2	0.07	0.19	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	6752	10952	1843	434	7814	8818	1202	803	0.27	0.04	0.15	0.09
97-08-13 19-26-53	34	N	35.2	-0.5	F	9753	6665	635	1025	8107	7925	2294	1381	0.07	0.15	0.28	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	9193	7681	504	753	7098	9574	1684	1779	0.05	0.1	0.24	0.19
97-08-13 19-26-53	34	N	35.1	-0.5	F	6459	9272	603	480	8992	7448	1605	897	0.09	0.05	0.18	0.12
97-08-13 19-26-53	34	N	35.1	-0.5	F	5529	9579	899	336	7333	7353	1347	365	0.16	0.04	0.18	0.05
97-08-13 19-26-53	34	N	35.1	-0.5	F	9946	8361	1242	1175	8677	8576	2088	1424	0.12	0.14	0.24	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	8487	8390	602	803	7884	8850	1158	1530	0.07	0.1	0.15	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	7057	9440	1477	612	7797	8002	1731	-337	0.21	0.06	0.22	-0.04
97-08-13 19-26-53	34	N	35.1	-0.5	F	7167	8532	1808	176	7112	8700	1649	204	0.25	0.02	0.23	0.02
97-08-13 19-26-53	34	N	35.1	-0.5	F	9855	7683	743	1016	8609	7558	1222	1266	0.08	0.13	0.14	0.17
97-08-13 19-26-53	34	N	35.1	-0.5	F	8235	8701	482	933	9314	8401	1647	1544	0.06	0.11	0.18	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	7020	9793	1758	216	6525	7042	2763	-597	0.25	0.02	0.42	-0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	6823	9025	1466	327	6604	8762	2032	980	0.21	0.04	0.31	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	11611	6278	880	812	9097	7223	2595	807	0.08	0.13	0.29	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	9056	7620	745	795	7283	9242	919	1210	0.08	0.1	0.13	0.13
97-08-13 19-26-53	34	N	35.1	-0.5	F	6646	10190	1065	214	7835	9010	2253	-144	0.16	0.02	0.29	-0.02
97-08-13 19-26-53	34	N	35.1	-0.5	F	5177	10677	1032	287	6791	8494	2054	253	0.2	0.03	0.3	0.03
97-08-13 19-26-53	34	N	35.1	-0.5	F	10913	7051	1241	995	7982	7888	1563	1233	0.11	0.14	0.2	0.16
97-08-13 19-26-53	34	N	35.1	-0.5	F	8440	7733	674	834	6933	8631	1183	1217	0.08	0.11	0.17	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	6349	10245	1264	334	7678	7848	2226	2	0.2	0.03	0.29	0
97-08-13 19-26-53	34	N	35.1	-0.5	F	6745	10513	1632	282	7263	8748	1847	678	0.24	0.03	0.25	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	13058	9619	1069	912	10900	11569	1360	945	0.08	0.09	0.12	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	10753	10602	520	1117	10186	11341	1195	1638	0.05	0.11	0.12	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	10940	11374	856	880	10496	11275	1059	774	0.08	0.08	0.1	0.07
97-08-13 19-26-53	34	N	35.1	-0.5	F	10073	11647	1057	335	11067	10832	1540	1146	0.1	0.03	0.14	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	12136	10394	1702	1206	9936	12379	1123	1737	0.14	0.12	0.11	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	10312	10777	1037	996	9968	10661	1647	50	0.1	0.09	0.17	0
97-08-13 19-26-53	34	N	35.1	-0.5	F	10193	11263	679	516	11241	9480	2258	1130	0.07	0.05	0.2	0.12
97-08-13 19-26-53	34	N	35.1	-0.5	F	9988	11871	1573	387	10639	10305	1193	488	0.16	0.03	0.11	0.05
97-08-13 19-26-53	34	N	35.1	-0.5	F	15540	11367	1508	1509	13529	13622	3329	2448	0.1	0.13	0.25	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	12674	13012	756	1362	10902	13606	1092	1416	0.06	0.1	0.1	0.1
97-08-13 19-26-53	34	N	35.1	-0.5	F	10870	17060	2246	1092	12301	14036	2321	4	0.21	0.06	0.19	0
97-08-13 19-26-53	34	N	35.1	-0.5	F	8688	18133	1053	202	11028	14018	2032	1345	0.22	0.01	0.25	0.1
97-08-13 19-26-53	34	N	35.1	-0.5	F	9573	7078	635	554	8033	8418	1046	668	0.07	0.07	0.24	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	8589	8224	569	642	7453	8612	1108	1591	0.07	0.08	0.15	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	7446	9095	711	638	8088	7208	876	993	0.1	0.07	0.11	0.14
97-08-13 19-26-53	34	N	35.1	-0.5	F	7824	9168	1694	399	9613	8055	1276	466	0.22	0.04	0.13	0.06
97-08-13 19-26-53	34	N	35.1	-0.5	F	38057	26632	5247	3263	39355	33906	5819	3709	0.14	0.12	0.15	0.11
97-08-13 19-26-53	34	N	35.1	-0.5	F	31270	34173	488	3551	30019	33346	4078	6205	0.02	0.1	0.14	0.19
97-08-13 19-26-53	34	N	35.1	-0.5	F	32318	34024	1181	2038	34021	31280	5963	6361	0.04	0.06	0.18	0.2
97-08-13 19-26-53	34	N	35.1	-0.5	F	32523	34608	5749	21	35297	31613	5857	481	0.18	0	0.17	0.02
97-08-13 19-26-53	34	N	35.1	-0.5	F	37083	25228	5312	2955	35203	28228	10463	5200	0.14	0.12	0.3	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	34830	31346	1392	3223	32365	33038	2846	5996	0.04	0.1	0.09	0.18
97-08-13 19-26-53	34	N	35.1	-0.5	F	31084	34497	6456	3475	30212	32122	7567	2309	0.21	0.1	0.25	0.07
97-08-13 19-26-53	34	N	35.1	-0.5	F	29387	32853	6108	-43	32448	29454	8997	2085	0.21	0	0.28	0.07
97-08-13 19-26-53	34	N	35.1	-0.5	F	34267	25148	3896	3116	33174	28279	8835	4192	0.11	0.12	0.27	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	31612	30044	527	3178	27451	31295	1568	5815	0.02	0.11	0.06	0.19
97-08-13 19-26-53	34	N	35.1	-0.5	F	27562	30254	5827	4240	28999	29004	7322	2290	0.21	0.14	0.25	0.08
97-08-13 19-26-53	34	N	35.1	-0.5	F	28348	31342	6040	-74	33661	28836	9179	764	0.21	0	0.27	0.03
97-08-13 19-26-53	34	N	35.1	-0.5	F	36087	26718	5646	3160	36649	31245	11956	5358	0.16	0.12	0.33	0.17
97-08-13 19-26-53	34	N	35	-0.5	F	30856	31602	1099	3532	27654	31491	2119	5289	0.04	0.11	0.08	0.17
97-08-13 19-26-53	34	N	35	-0.5	F	26451	38965	5467	4184	27594	34816	7940	5388	0.21	0.11	0.29	0.15
97-08-13 19-26-53	34	N	35.1	-0.5	F	28630	35671	6261	-93	31322	33109	9188	3225	0.22	0	0.29	0.1
97-08-13 19-26-53	34	N	35	-0.5	F	17048	13176	3239	1479	13178	15167	3988	2681	0.19	0.11	0.3	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	14404	13592	842	367	12234	14801	1821	1822	0.06	0.03	0.15	0.12
97-08-13 19-26-53	34	N	35	-0.5	F	12185	14794	717	1069	13851	12554	2888	2118	0.06	0.07	0.21	0.17

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 19-26-53	34	N	35	-0.5	F	12868	15767	1662	256	15767	13233	1468	566	0.13	0.02	0.09	0.04
97-08-13 19-26-53	34	N	35	-0.5	F	16352	13553	2867	1516	15522	13740	4992	2297	0.18	0.11	0.32	0.17
97-08-13 19-26-53	34	N	35	-0.5	F	13883	14942	886	1528	13384	14881	2280	2958	0.06	0.1	0.17	0.2
97-08-13 19-26-53	34	N	35	-0.5	F	11301	17353	2515	2114	13556	13065	2984	-84	0.22	0.12	0.22	-0.01
97-08-13 19-26-53	34	N	35	-0.5	F	11352	17612	2606	72	14293	14535	3624	1355	0.23	0	0.25	0.09
97-08-13 19-26-53	34	N	35	-0.5	F	16772	13445	1642	1219	14219	15403	3624	2840	0.1	0.09	0.25	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	14783	13760	621	550	13973	14687	2934	2057	0.04	0.04	0.21	0.14
97-08-13 19-26-53	34	N	35	-0.5	F	14510	16470	1979	1978	13807	15509	3194	2800	0.14	0.12	0.23	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	13549	16775	1760	281	14358	16599	1328	632	0.13	0.02	0.09	0.04
97-08-13 19-26-53	34	N	35	-0.5	F	15770	10656	2015	1241	14685	12387	2769	1831	0.13	0.12	0.19	0.15
97-08-13 19-26-53	34	N	35	-0.5	F	12764	13853	625	1460	12765	14066	1702	2472	0.05	0.11	0.13	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	11824	15274	2422	1306	14018	12075	2642	2013	0.2	0.09	0.19	0.17
97-08-13 19-26-53	34	N	35	-0.5	F	10833	17422	2138	277	16112	13949	1649	754	0.2	0.02	0.1	0.05
97-08-13 19-26-53	34	N	35	-0.5	F	15561	12830	932	1229	22369	13023	2337	3014	0.06	0.1	0.1	0.23
97-08-13 19-26-53	34	N	35	-0.5	F	14242	12131	738	1094	13678	13743	2710	2325	0.05	0.09	0.2	0.17
97-08-13 19-26-53	34	N	35	-0.5	F	12246	14756	1570	1666	12660	13168	2126	2412	0.13	0.11	0.17	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	10823	15549	1418	360	12667	13517	1677	266	0.13	0.02	0.13	0.02
97-08-13 19-26-53	34	N	35	-0.5	F	10097	9242	1448	1082	8635	9525	1862	1341	0.14	0.12	0.22	0.14
97-08-13 19-26-53	34	N	35	-0.5	F	8941	9337	583	853	7812	9815	1301	1878	0.07	0.09	0.17	0.19
97-08-13 19-26-53	34	N	35	-0.5	F	10063	15345	1772	1346	9820	9536	2103	543	0.18	0.09	0.21	0.06
97-08-13 19-26-53	34	N	35	-0.5	F	8408	12230	1751	440	10676	9717	2362	1089	0.21	0.04	0.22	0.11
97-08-13 19-26-53	34	N	35	-0.5	F	33801	27133	3283	3540	36505	24822	9125	3853	0.1	0.13	0.25	0.16
97-08-13 19-26-53	34	N	35	-0.5	F	35990	26593	5330	2959	35594	26211	8912	3528	0.15	0.11	0.25	0.13
97-08-13 19-26-53	34	N	35	-0.5	F	37797	36550	4678	3548	37912	35384	7822	6456	0.12	0.1	0.21	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	36613	35863	1759	479	37287	34227	2650	1082	0.05	0.01	0.07	0.03
97-08-13 19-26-53	34	N	35	-0.5	F	10560	6809	1406	528	10231	6698	2786	1016	0.13	0.08	0.27	0.15
97-08-13 19-26-53	34	N	35	-0.5	F	9561	7087	468	207	7834	8521	1420	1110	0.05	0.03	0.18	0.13
97-08-13 19-26-53	34	N	35	-0.5	F	7058	9824	752	1028	8344	7188	2187	952	0.11	0.1	0.26	0.13
97-08-13 19-26-53	34	N	35	-0.5	F	6561	10509	1208	-96	7365	10289	1233	1140	0.18	-0.01	0.17	0.11
97-08-13 19-26-53	34	N	35	-0.5	F	10772	8320	2088	877	8582	10113	3080	1882	0.19	0.11	0.36	0.19
97-08-13 19-26-53	34	N	35	-0.5	F	9083	8032	481	715	7775	11238	1686	2133	0.05	0.09	0.22	0.19
97-08-13 19-26-53	34	N	35	-0.5	F	7738	11364	1923	1392	9764	7809	2052	1049	0.25	0.12	0.21	0.13
97-08-13 19-26-53	34	N	35	-0.5	F	8062	11040	1867	504	9537	7929	1520	484	0.23	0.05	0.16	0.06
97-08-13 19-26-53	34	N	35	-0.5	F	10871	7187	1591	875	8531	9127	2896	1450	0.15	0.12	0.34	0.16
97-08-13 19-26-53	34	N	35	-0.5	F	9250	9106	482	857	7469	10041	1327	1868	0.05	0.09	0.18	0.19
97-08-13 19-26-53	34	N	35	-0.5	F	7235	12002	1111	885	8668	8749	1793	246	0.15	0.07	0.21	0.03
97-08-13 19-26-53	34	N	35	-0.5	F	7332	12174	1650	476	9030	8879	2188	358	0.23	0.04	0.24	0.04
97-08-13 19-26-53	34	N	35	-0.5	F	10454	8403	1325	737	9335	9003	4402	1041	0.13	0.09	0.47	0.12
97-08-13 19-26-53	34	N	35	-0.5	F	8598	9217	683	648	7096	10842	560	2035	0.08	0.07	0.08	0.19
97-08-13 19-26-53	34	N	35	-0.5	F	7754	11771	2138	844	9287	8060	2912	428	0.28	0.07	0.31	0.05
97-08-13 19-26-53	34	N	35	-0.5	F	9287	9867	2308	4	9181	8336	2803	977	0.25	0	0.31	0.12
97-08-13 19-26-53	34	N	35	-0.5	F	13482	9920	1700	1118	12036	9991	2340	1675	0.13	0.11	0.19	0.17
97-08-13 19-26-53	34	N	35	-0.5	F	11174	11810	689	989	10927	11992	2014	2135	0.06	0.08	0.18	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	11197	13818	2086	622	11459	12563	1886	1627	0.19	0.05	0.16	0.13
97-08-13 19-26-53	34	N	35	-0.5	F	8898	14059	2246	19	10734	12279	1145	2219	0.25	0	0.11	0.18
97-08-13 19-26-53	34	N	35	-0.5	F	8546	9687	591	591	6980	9694	1311	1521	0.07	0.06	0.19	0.16
97-08-13 19-26-53	34	N	35	-0.5	F	7637	9923	819	216	7368	9220	1543	242	0.11	0.02	0.21	0.03
97-08-13 19-26-53	34	N	35	-0.5	F	9016	8313	743	864	8490	7813	860	1101	0.08	0.1	0.1	0.14
97-08-13 19-26-53	34	N	35	-0.5	F	8705	7647	1344	147	10286	8489	1317	408	0.15	0.02	0.13	0.05
97-08-13 19-26-53	34	N	34.9	-0.5	F	7811	9024	963	989	9048	7133	3320	610	0.12	0.11	0.37	0.09
97-08-13 19-26-53	34	N	34.9	-0.5	F	9274	7737	629	811	6161	9544	1496	1312	0.07	0.1	0.24	0.14
97-08-13 19-26-53	34	N	35	-0.5	F	5640	13222	1302	2289	9246	8397	3091	1082	0.23	0.17	0.33	0.13
97-08-13 19-26-53	34	N	35	-0.5	F	9123	9668	1801	-218	7990	9660	2806	170	0.2	-0.02	0.35	0.02
97-08-13 19-26-53	34	N	34.9	-0.5	F	7683	9335	663	884	9381	7338	2513	1042	0.09	0.09	0.27	0.14
97-08-13 19-26-53	34	N	34.9	-0.5	F	9593	7053	964	737	6738	9170	1148	1244	0.1	0.1	0.17	0.14
97-08-13 19-26-53	34	N	34.9	-0.5	F	7491	11771	1550	1541	9184	9361	3435	1803	0.21	0.13	0.37	0.19
97-08-13 19-26-53	34	N	35	-0.5	F	9596	8524	2033	-272	7114	10573	2233	1304	0.21	-0.03	0.31	0.12
97-08-13 19-26-53	34	N	34.9	-0.5	F	9077	8946	510	669	7981	9632	1224	1431	0.06	0.07	0.15	0.15
97-08-13 19-26-53	34	N	34.9	-0.5	F	8246	8353	676	550	7221	10018	1462	1945	0.08	0.07	0.2	0.19
97-08-13 19-26-53	34	N	34.9	-0.5	F	8204	9912	1807	1149	9288	8207	2649	718	0.22	0.12	0.29	0.09
97-08-13 19-26-53	34	N	34.9	-0.5	F	8109	8825	1690	303	8853	8405	1134	656	0.21	0.03	0.13	0.08
97-08-13 19-26-53	34	N	34.9	-0.5	F	11553	9356	1122	996	9630	10447	2481	1527	0.1	0.11	0.26	0.15
97-08-13 19-26-53	34	N	34.9	-0.5	F	10536	10850	752	814	8956	11117	895	1244	0.07	0.08	0.1	0.11
97-08-13 19-26-53	34	N	34.9	-0.5	F	8805	11597	1364	1107	10433	9522	2165	1245	0.15	0.1	0.21	0.13
97-08-13 19-26-53	34	N	34.9	-0.5	F	8557	12477	1249	322	11691	10356	1903	436	0.15	0.03	0.16	0.04
97-08-13 19-26-53	34	N	34.9	-0.5	F	8966	7269	1156	782	7886	7215	1575	697	0.13	0.11	0.2	0.1
97-08-13 19-26-53	34	N	34.9	-0.5	F	9143	7732	1008	671	8598	8281	1625	1595	0.11	0.09	0.19	0.19
97-08-13 19-26-53	34	N	34.9	-0.5	F	7679	8924	737	692	7938	8204	1492	1515	0.1	0.08	0.19	0.18
97-08-13 19-26-53	34	N	34.9	-0.5	F	6974	9528	1801	811	7486	8428	635	703	0.26	0.09	0.08	0.08

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 19-26-53	34	N	34.9	-0.5	F	12161	12033	925	1116	11259	11993	2431	1492	0.08	0.09	0.22	0.12
97-08-13 19-26-53	34	N	34.9	-0.5	F	10655	10711	880	559	10646	12014	1881	1019	0.08	0.05	0.18	0.08
97-08-13 19-26-53	34	N	34.9	-0.6	F	9624	11995	748	919	10040	9854	2679	957	0.08	0.08	0.27	0.1
97-08-13 19-26-53	34	N	34.9	-0.6	F	10646	12310	1697	243	10866	11617	1657	44	0.16	0.02	0.15	0
97-08-13 19-26-53	34	N	34.9	-0.6	F	11104	9205	1565	1067	9393	9833	2430	1185	0.14	0.12	0.26	0.12
97-08-13 19-26-53	34	N	34.9	-0.6	F	10974	9931	878	1053	8743	11507	1159	1220	0.08	0.11	0.13	0.11
97-08-13 19-26-53	34	N	34.8	-0.6	F	8787	11966	984	449	9994	11103	2371	-29	0.11	0.04	0.24	0
97-08-13 19-26-53	34	N	34.8	-0.6	F	8750	12780	1807	814	9347	10281	2737	656	0.21	0.06	0.29	0.06
97-08-13 19-26-53	34	N	34.8	-0.6	F	9389	7685	1553	814	8109	7656	1836	985	0.17	0.11	0.23	0.13
97-08-13 19-26-53	34	N	34.8	-0.6	F	8124	9005	1093	1025	7962	8567	1635	1062	0.13	0.11	0.21	0.12
97-08-13 19-26-53	34	N	34.8	-0.6	F	7530	8096	673	441	7886	7583	1440	884	0.09	0.05	0.18	0.12
97-08-13 19-26-53	34	N	34.8	-0.6	F	6738	8822	1464	633	7729	7998	1089	367	0.22	0.07	0.14	0.05
97-08-13 19-26-53	34	N	34.8	-0.6	F	16661	14490	2179	1764	14360	14658	3327	2368	0.13	0.12	0.23	0.16
97-08-13 19-26-53	34	N	34.8	-0.6	F	14243	14184	853	1168	11733	14621	2107	2867	0.06	0.08	0.18	0.2
97-08-13 19-26-53	34	N	34.8	-0.6	F	12811	14706	707	1801	13395	12996	1682	2180	0.06	0.12	0.13	0.17
97-08-13 19-26-53	34	N	34.8	-0.6	F	13313	17186	2009	747	16679	14172	1361	1275	0.15	0.04	0.08	0.09
97-08-13 19-26-53	34	N	34.8	-0.6	F	14990	14783	2587	1512	17250	12375	4271	2153	0.17	0.1	0.25	0.17
97-08-13 19-26-53	34	N	34.8	-0.6	F	10857	14256	1159	1288	13226	12285	1884	2283	0.11	0.09	0.14	0.19
97-08-13 19-26-53	34	N	34.8	-0.6	F	12731	15039	1970	1406	13941	12485	4035	1476	0.15	0.09	0.29	0.12
97-08-13 19-26-53	34	N	34.7	-0.6	F	11750	16690	1627	254	13288	13223	1477	311	0.14	0.02	0.11	0.02
97-08-13 19-26-53	34	N	34.7	-0.6	F	11128	7800	1303	838	8464	9093	1222	1242	0.12	0.11	0.14	0.14
97-08-13 19-26-53	34	N	34.8	-0.6	F	8285	8233	723	827	8916	8751	1340	1312	0.09	0.1	0.15	0.15
97-08-13 19-26-53	34	N	34.7	-0.6	F	7985	9989	1423	447	7032	9356	2013	821	0.18	0.04	0.29	0.09
97-08-13 19-26-53	34	N	34.7	-0.6	F	5719	10119	1314	265	6749	7871	1078	303	0.23	0.03	0.16	0.04
97-08-13 19-26-53	34	N	34.7	-0.6	F	9698	8381	857	772	9521	7352	1241	882	0.09	0.09	0.13	0.12
97-08-13 19-26-53	34	N	34.7	-0.6	F	10689	9762	1221	617	8806	10296	1507	1434	0.11	0.06	0.17	0.14
97-08-13 19-26-53	34	N	34.7	-0.6	F	7848	9372	2052	1136	8042	8135	2106	626	0.26	0.12	0.26	0.08
97-08-13 19-26-53	34	N	34.7	-0.6	F	7191	9486	944	506	8405	9313	1577	633	0.13	0.05	0.19	0.07
97-08-13 19-26-53	34	N	34.7	-0.6	F	9601	8083	2069	989	8500	8135	1683	1483	0.22	0.12	0.2	0.18
97-08-13 19-26-53	34	N	34.7	-0.6	F	9011	7881	906	666	9108	8113	1516	63	0.1	0.08	0.17	0.01
97-08-13 19-26-53	34	N	34.7	-0.6	F	8572	8027	1958	872	8054	8822	2159	1343	0.23	0.11	0.27	0.15
97-08-13 19-26-53	34	N	34.7	-0.6	F	7670	9046	892	451	8127	8638	1838	1507	0.12	0.05	0.23	0.17
97-08-13 19-26-53	34	N	34.7	-0.6	F	10041	7393	868	766	8499	8414	1841	1208	0.09	0.1	0.22	0.14
97-08-13 19-26-53	34	N	34.6	-0.6	F	8852	8641	874	566	7683	9588	1985	1184	0.1	0.07	0.26	0.12
97-08-13 19-26-53	34	N	34.6	-0.6	F	7876	10287	692	847	9128	8915	1165	1179	0.09	0.08	0.13	0.13
97-08-13 19-26-53	34	N	34.6	-0.6	F	7251	9119	1517	419	8469	8992	2185	211	0.21	0.05	0.26	0.02
97-08-13 19-26-53	34	N	34.6	-0.6	F	9447	8340	1570	1012	8308	8911	1065	1169	0.17	0.12	0.13	0.13
97-08-13 19-26-53	34	N	34.6	-0.6	F	9780	8017	1687	839	9214	7814	3030	669	0.17	0.1	0.33	0.09
97-08-13 19-26-53	34	N	34.5	-0.6	F	7779	9185	770	546	7724	8808	1052	925	0.1	0.06	0.14	0.11
97-08-13 19-26-53	34	N	34.5	-0.6	F	7990	9425	1645	168	8317	9256	1226	464	0.21	0.02	0.15	0.05
97-08-13 19-26-53	34	N	34.5	-0.6	F	9669	8288	1845	936	9770	7635	2635	900	0.19	0.11	0.27	0.12
97-08-13 19-26-53	34	N	34.5	-0.6	F	9304	8505	694	855	8091	11824	1467	2186	0.07	0.1	0.18	0.18
97-08-13 19-26-53	34	N	34.5	-0.6	F	6413	11611	1187	1038	8983	7679	2004	-144	0.19	0.09	0.22	-0.02
97-08-13 19-26-53	34	N	34.4	-0.6	F	8285	10334	1924	113	7107	9919	2009	331	0.23	0.01	0.28	0.03
97-08-13 19-26-53	34	N	34.4	-0.6	F	10881	9062	1490	1023	11128	10324	2317	1249	0.14	0.11	0.21	0.12
97-08-13 19-26-53	34	N	34.4	-0.6	F	10500	9944	703	1112	9775	10661	1966	1630	0.07	0.11	0.2	0.15
97-08-13 19-26-53	34	N	34.4	-0.6	F	8527	14059	1781	1694	11427	9752	3336	1042	0.21	0.12	0.29	0.11
97-08-13 19-26-53	34	N	34.4	-0.7	F	8322	13006	2071	265	9720	12241	1315	522	0.25	0.02	0.14	0.04
97-08-13 19-26-53	34	N	34.4	-0.7	F	9905	8128	1331	934	10020	8232	2945	856	0.13	0.11	0.29	0.1
97-08-13 19-26-53	34	N	34.4	-0.7	F	8869	8175	712	748	8075	8561	1177	915	0.08	0.09	0.15	0.11
97-08-13 19-26-53	34	N	34.4	-0.7	F	8345	8688	776	642	9197	9489	1443	1089	0.09	0.07	0.16	0.11
97-08-13 19-26-53	34	N	34.4	-0.7	F	7905	9592	1172	352	8413	8801	1261	351	0.15	0.04	0.15	0.04
97-08-13 19-26-53	34	N	34.4	-0.7	F	10536	8331	971	811	9059	9331	1323	1406	0.09	0.1	0.15	0.15
97-08-13 19-26-53	34	N	34.3	-0.7	F	9790	8309	935	516	8511	9153	1414	256	0.1	0.06	0.17	0.03
97-08-13 19-26-53	34	N	34.3	-0.7	F	8503	10878	1142	1160	9761	8899	1299	1155	0.13	0.11	0.13	0.13
97-08-13 19-26-53	34	N	34.3	-0.7	F	10267	12436	970	436	9549	9287	1004	418	0.09	0.04	0.11	0.04
97-08-13 19-26-53	34	N	34.3	-0.7	F	9670	8654	1370	1066	9222	10069	2303	1291	0.14	0.12	0.25	0.13
97-08-13 19-26-53	34	N	34.3	-0.7	F	9628	8877	729	976	9599	9534	2391	1684	0.08	0.11	0.25	0.18
97-08-13 19-26-53	34	N	34.2	-0.7	F	8839	8811	1071	760	10001	8556	2654	1406	0.12	0.09	0.27	0.16
97-08-13 19-26-53	34	N	34.2	-0.7	F	6974	9298	1659	602	9281	8454	1171	562	0.24	0.06	0.13	0.07
97-08-13 19-26-53	34	N	34.2	-0.7	F	9067	9415	1630	1339	9562	7771	3613	1265	0.18	0.14	0.38	0.16
97-08-13 19-26-53	34	N	34.2	-0.7	F	9080	8377	636	634	7323	9581	927	1254	0.07	0.08	0.13	0.13
97-08-13 19-26-53	34	N	34.2	-0.7	F	6989	10989	490	1194	9739	9267	1468	1261	0.07	0.11	0.15	0.14
97-08-13 19-26-53	34	N	34.2	-0.7	F	10249	8758	2642	689	8610	9954	1887	1022	0.26	0.08	0.22	0.1
97-08-13 19-26-53	34	N	34.2	-0.7	F	8498	7507	1254	751	8830	8039	2091	875	0.15	0.1	0.24	0.11
97-08-13 19-26-53	34	N	34.2	-0.7	F	8127	7668	718	713	8136	8039	1219	543	0.09	0.09	0.15	0.07
97-08-13 19-26-53	34	N	34.1	-0.7	F	8172	9547	788	741	8514	8310	1049	1389	0.1	0.08	0.12	0.17
97-08-13 19-26-53	34	N	34.1	-0.7	F	6794	9735	1496	469	7905	8265	1492	1062	0.22	0.05	0.19	0.13
97-08-13 19-26-53	34	N	34.1	-0.7	F	12995	8824	2179	807	10335	11928	1985	1541	0.17	0.09	0.19	0.13

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 19-26-53	34	N	34.1	-0.7	F	9952	9894	699	620	9300	12128	1132	792	0.07	0.06	0.12	0.07
97-08-13 19-26-53	34	N	34.1	-0.7	F	10629	10863	2134	1064	9536	10314	1640	1198	0.2	0.1	0.17	0.12
97-08-13 19-26-53	34	N	34.1	-0.7	F	9200	11843	1112	669	10455	10883	1261	485	0.12	0.06	0.12	0.04
97-08-13 19-26-53	34	N	34.1	-0.7	F	12026	9742	2392	1103	10508	9844	2838	1132	0.2	0.11	0.27	0.12
97-08-13 19-26-53	34	N	34.1	-0.7	F	10674	10177	933	1062	10202	10642	1619	1299	0.09	0.1	0.16	0.12
97-08-13 19-26-53	34	N	34	-0.7	F	10398	12378	1323	979	10319	10327	2150	1092	0.13	0.08	0.21	0.11
97-08-13 19-26-53	34	N	34	-0.7	F	9676	12182	1547	429	10648	10805	1320	688	0.16	0.04	0.12	0.06
97-08-13 19-26-53	34	N	34	-0.7	F	11382	9178	1730	944	9917	9264	1911	1408	0.15	0.1	0.19	0.15
97-08-13 19-26-53	34	N	34	-0.7	F	9528	9718	826	921	9353	9390	1807	1374	0.09	0.09	0.19	0.15
97-08-13 19-26-53	34	N	34	-0.7	F	9604	9969	841	1063	9478	9832	1200	1523	0.09	0.11	0.13	0.15
97-08-13 19-26-53	34	N	34	-0.7	F	10062	11495	1920	80	11892	10855	1962	711	0.19	0.01	0.16	0.07
97-08-13 19-26-53	34	N	34	-0.7	F	11355	9624	1844	835	9375	10581	2592	1221	0.16	0.09	0.28	0.12
97-08-13 19-26-53	34	N	34	-0.7	F	9511	10620	617	605	9611	11139	2213	905	0.06	0.06	0.23	0.08
97-08-13 19-26-53	34	N	33.9	-0.8	F	9654	10478	2181	1147	9119	9774	2143	1043	0.23	0.11	0.23	0.11
97-08-13 19-26-53	34	N	33.9	-0.8	F	8603	11609	955	460	9593	11302	1391	319	0.11	0.04	0.15	0.03
97-08-13 19-26-53	34	N	33.9	-0.8	F	11712	9161	1261	933	8993	9762	2199	1727	0.11	0.1	0.24	0.18
97-08-13 19-26-53	34	N	33.9	-0.8	F	10008	9576	702	963	9404	10860	2602	1755	0.07	0.1	0.28	0.16
97-08-13 19-26-53	34	N	33.9	-0.8	F	9211	11735	813	860	9519	9948	1641	1626	0.09	0.07	0.17	0.16
97-08-13 19-26-53	34	N	33.9	-0.8	F	8822	11914	1642	273	9318	10245	2098	369	0.19	0.02	0.23	0.04
97-08-13 19-26-53	34	N	33.9	-0.8	F	12450	10039	1936	1005	10386	9717	2614	1537	0.16	0.1	0.25	0.16
97-08-13 19-26-53	34	N	33.9	-0.8	F	10323	10876	723	262	9662	11189	1817	1506	0.07	0.02	0.19	0.13
97-08-13 19-26-53	34	N	33.8	-0.8	F	9820	10168	2786	1047	9816	8864	2679	608	0.28	0.1	0.27	0.07
97-08-13 19-26-53	34	N	33.8	-0.8	F	9525	12929	996	430	11353	11056	1431	401	0.1	0.03	0.13	0.04
97-08-13 19-26-53	34	N	33.8	-0.8	F	27688	21256	3257	2588	25012	24069	7167	4458	0.12	0.12	0.29	0.19
97-08-13 19-26-53	34	N	33.8	-0.8	F	24311	23865	859	2422	22428	25127	3621	5254	0.04	0.1	0.16	0.21
97-08-13 19-26-53	34	N	33.8	-0.8	F	22427	25977	794	1421	24798	24238	2980	4937	0.04	0.05	0.12	0.2
97-08-13 19-26-53	34	N	33.8	-0.8	F	23842	27056	3786	431	24297	23941	3021	778	0.16	0.02	0.12	0.03
97-08-13 19-26-53	34	N	33.8	-0.8	F	11409	9919	2190	1030	9927	10772	2392	1982	0.19	0.1	0.24	0.18
97-08-13 19-26-53	34	N	33.8	-0.8	F	12312	11716	711	1081	9975	10918	1618	1623	0.06	0.09	0.16	0.15
97-08-13 19-26-53	34	N	33.7	-0.8	F	8047	11486	1604	1290	8932	9762	1666	1622	0.2	0.11	0.19	0.17
97-08-13 19-26-53	34	N	33.7	-0.8	F	8399	12726	2041	578	12127	10076	1296	602	0.24	0.05	0.11	0.06
97-08-13 19-26-53	34	N	33.7	-0.8	F	9835	8429	1156	942	8407	8226	847	-32	0.12	0.11	0.1	0
97-08-13 19-26-53	34	N	33.7	-0.8	F	8868	8877	1169	1028	8783	8899	1127	1133	0.13	0.12	0.13	0.13
97-08-13 19-26-53	34	N	33.7	-0.8	F	7012	9451	547	1029	7722	7801	1176	655	0.08	0.11	0.15	0.08
97-08-13 19-26-53	34	N	33.7	-0.8	F	7398	9825	1786	576	8378	7887	1261	685	0.24	0.06	0.15	0.09
97-08-13 19-26-53	34	N	33.7	-0.8	F	10293	6636	801	625	9130	7234	1266	363	0.08	0.09	0.14	0.05
97-08-13 19-26-53	34	N	33.7	-0.8	F	9403	7177	819	404	7335	8760	1884	575	0.09	0.06	0.26	0.07
97-08-13 19-26-53	34	N	33.6	-0.8	F	6215	10364	604	941	8584	7280	1512	385	0.1	0.09	0.18	0.05
97-08-13 19-26-53	34	N	33.6	-0.8	F	6319	10869	992	448	8281	8599	1012	458	0.16	0.04	0.12	0.05
97-08-13 19-26-53	34	N	33.6	-0.8	F	36462	27317	6149	3355	32496	32778	9784	6769	0.17	0.12	0.3	0.21
97-08-13 19-26-53	34	N	33.6	-0.8	F	29984	30970	482	3146	27091	32214	973	4288	0.02	0.1	0.04	0.13
97-08-13 19-26-53	34	N	33.6	-0.8	F	28750	35501	1113	2061	31291	31492	4795	6149	0.04	0.06	0.15	0.2
97-08-13 19-26-53	34	N	33.6	-0.8	F	28117	35526	3343	433	31459	30322	2871	1664	0.12	0.01	0.09	0.05
97-08-13 19-26-53	34	N	33.6	-0.8	F	17170	12268	3241	1371	14326	13755	4006	2766	0.19	0.11	0.28	0.2
97-08-13 19-26-53	34	N	33.6	-0.8	F	12747	14501	694	1298	13226	14329	1952	2749	0.05	0.09	0.15	0.19
97-08-13 19-26-53	34	N	33.6	-0.8	F	10745	18133	2182	2114	14412	14253	3396	2492	0.2	0.12	0.24	0.17
97-08-13 19-26-53	34	N	33.6	-0.8	F	11320	17313	2300	112	14325	15091	1648	479	0.2	0.01	0.12	0.03
97-08-13 19-26-53	34	N	33.5	-0.8	F	12820	8716	2470	866	10627	9681	1871	1046	0.19	0.1	0.18	0.11
97-08-13 19-26-53	34	N	33.5	-0.8	F	9448	9924	708	744	10212	9312	1519	370	0.07	0.07	0.15	0.04
97-08-13 19-26-53	34	N	33.5	-0.8	F	8802	10095	2113	1099	9142	10010	2414	1784	0.24	0.11	0.26	0.18
97-08-13 19-26-53	34	N	33.5	-0.8	F	8649	11731	918	557	9671	10882	1098	563	0.11	0.05	0.11	0.05
97-08-13 19-26-53	34	N	33.5	-0.8	F	8398	8274	872	777	7322	8566	911	1024	0.1	0.09	0.12	0.12
97-08-13 19-26-53	34	N	33.5	-0.8	F	7993	8293	1044	519	7497	8406	1329	173	0.13	0.06	0.18	0.02
97-08-13 19-26-53	34	N	33.4	-0.9	F	7686	9698	525	1088	8310	7551	1380	670	0.07	0.11	0.17	0.09
97-08-13 19-26-53	34	N	33.4	-0.9	F	7196	9885	1331	532	8538	8102	1165	801	0.19	0.05	0.14	0.1
97-08-13 19-26-53	34	N	33.4	-0.9	F	36619	31595	5928	3912	32015	33561	9491	6615	0.16	0.12	0.3	0.2
97-08-13 19-26-53	34	N	33.4	-0.9	F	31268	34965	638	3835	29567	36859	3783	7256	0.02	0.11	0.13	0.2
97-08-13 19-26-53	34	N	33.4	-0.9	F	31242	37992	804	3781	32664	35885	3312	7032	0.03	0.1	0.1	0.2
97-08-13 19-26-53	34	N	33.4	-0.9	F	30983	37506	4379	284	31547	34410	3591	972	0.14	0.01	0.11	0.03
97-08-13 19-26-53	34	N	33.4	-0.9	F	37515	31685	4770	3149	34802	35961	9828	6220	0.13	0.1	0.28	0.17
97-08-13 19-26-53	34	N	33.4	-0.9	F	33835	34287	1432	920	30611	36262	3933	3372	0.04	0.03	0.13	0.09
97-08-13 19-26-53	34	N	33.4	-0.9	F	31077	37263	6045	4459	32705	35685	7999	6253	0.19	0.12	0.24	0.18
97-08-13 19-26-53	34	N	33.4	-0.9	F	30270	37340	1885	633	31646	36063	2617	1435	0.06	0.02	0.08	0.04
97-08-13 19-26-53	34	N	33.3	-0.9	F	38748	25465	4757	3105	32039	29540	8874	5622	0.12	0.12	0.28	0.19
97-08-13 19-26-53	34	N	33.3	-0.9	F	32665	31125	1421	3135	31279	31501	6295	6336	0.04	0.1	0.2	0.2
97-08-13 19-26-53	34	N	33.3	-0.9	F	25054	37418	5018	4134	28413	34815	6759	2550	0.2	0.11	0.24	0.07
97-08-13 19-26-53	34	N	33.3	-0.9	F	25330	40096	4721	916	28277	34304	7189	3849	0.19	0.02	0.25	0.11
97-08-13 19-26-53	34	N	33.3	-0.9	F	33786	27389	5721	2872	27833	33805	8012	5766	0.17	0.1	0.29	0.17
97-08-13 19-26-53	34	N	33.3	-0.9	F	29835	32261	721	1100	27288	33978	1925	1222	0.02	0.03	0.07	0.04

Regular Traffic Raw Data

Date/Time	Curve	Dir.	Speed	Cant Def.	Axle	Spiral High Rail Ve	Spiral Low Rail Ve	Spiral High Rail La	Spiral Low Rail La	Body High Rail Ver	Body Low Rail Ver	Body High Rail La	Body Low Rail La	Spiral High Rail L/V	Spiral Low Rail L/V	Body High Rail L/V	Body Low Rail L/V
97-08-13 19-26-53	34	N	33.3	-0.9	F	24734	38888	1504	3628	29863	33961	6675	5704	0.06	0.09	0.22	0.17
97-08-13 19-26-53	34	N	33.3	-0.9	F	26061	35919	2003	287	29125	32286	3157	1355	0.08	0.01	0.11	0.04
97-08-13 19-26-53	34	N	33.3	-0.9	F	34159	26380	6798	3181	32250	29325	9516	5872	0.2	0.12	0.3	0.2
97-08-13 19-26-53	34	N	33.3	-0.9	F	30718	30473	539	3390	27490	32988	610	5135	0.02	0.11	0.02	0.16
97-08-13 19-26-53	34	N	33.2	-0.9	F	23906	39878	4345	3183	25147	34815	5306	1697	0.18	0.08	0.21	0.05
97-08-13 19-26-53	34	N	33.2	-0.9	F	21967	39198	4736	1189	25124	35233	7329	2207	0.22	0.03	0.29	0.06
97-08-13 19-26-53	34	N	33.2	-0.9	F	32071	28316	3799	3424	27464	29476	7042	4337	0.12	0.12	0.26	0.15
97-08-13 19-26-53	34	N	33.2	-0.9	F	28527	28702	704	2911	26128	32273	2235	5675	0.02	0.1	0.09	0.18
97-08-13 19-26-53	34	N	33.2	-0.9	F	26502	31231	1789	3686	26564	29152	5234	5773	0.07	0.12	0.2	0.2
97-08-13 19-26-53	34	N	33.2	-0.9	F	26829	31688	6410	3420	26907	30903	6990	5414	0.24	0.11	0.26	0.18
97-08-13 19-26-53	34	N	33.2	-0.9	F	11575	6832	2906	605	8592	9131	2566	623	0.25	0.09	0.3	0.07
97-08-13 19-26-53	34	N	33.2	-0.9	F	9189	9134	679	788	7992	9906	1565	1104	0.07	0.09	0.2	0.11
97-08-13 19-26-53	34	N	33.1	-0.9	F	6323	12070	1633	1748	8563	8481	2565	532	0.26	0.14	0.3	0.06
97-08-13 19-26-53	34	N	33.1	-0.9	F	7350	11368	1819	110	9171	9852	2442	1355	0.25	0.01	0.27	0.14
97-08-13 19-26-53	34	N	33.1	-0.9	F	14678	10716	2283	983	13372	11073	3988	1779	0.16	0.09	0.3	0.16
97-08-13 19-26-53	34	N	33.1	-0.9	F	13270	12783	1265	1437	13258	12881	3139	2104	0.1	0.11	0.24	0.16
97-08-13 19-26-53	34	N	33.1	-0.9	F	9444	16219	1955	1773	12264	13016	3148	159	0.21	0.11	0.26	0.01
97-08-13 19-26-53	34	N	33.1	-0.9	F	9144	16689	2090	370	10402	13873	2927	2152	0.23	0.02	0.28	0.16
97-08-13 19-26-53	34	N	33.1	-0.9	F	15143	10689	2451	1105	14010	10725	3203	2102	0.16	0.1	0.23	0.2
97-08-13 19-26-53	34	N	33	-0.9	F	10998	12089	723	943	12973	11366	1683	2267	0.07	0.08	0.13	0.2
97-08-13 19-26-53	34	N	33	-0.9	F	7320	15834	1576	1514	10686	13047	2864	557	0.22	0.1	0.27	0.04
97-08-13 19-26-53	34	N	33	-0.9	F	8712	16020	2110	73	9278	14724	2446	1650	0.24	0	0.26	0.11
97-08-13 19-26-53	34	N	33	-0.9	F	12403	9300	2213	968	9863	10373	2474	1511	0.18	0.1	0.25	0.15
97-08-13 19-26-53	34	N	33	-0.9	F	9596	10355	690	475	9704	11727	1517	515	0.07	0.05	0.16	0.04
97-08-13 19-26-53	34	N	33	-1	F	10029	11095	1224	1316	9970	10858	2011	2117	0.12	0.12	0.2	0.19
97-08-13 19-26-53	34	N	33	-1	F	8365	12764	773	549	10522	11549	1137	945	0.09	0.04	0.11	0.08
97-08-13 19-26-53	34	N	33	-1	F	35916	34348	5528	4265	34191	36882	11578	7702	0.15	0.12	0.34	0.21
97-08-13 19-26-53	34	N	33	-1	F	31553	34949	773	3958	29752	37752	5246	7683	0.02	0.11	0.18	0.2
97-08-13 19-26-53	34	N	32.9	-1	F	28361	39005	1193	2378	31851	34038	5968	7402	0.04	0.06	0.19	0.22
97-08-13 19-26-53	34	N	32.9	-1	F	34133	40264	5448	-117	36664	38787	5293	327	0.16	0	0.14	0.01
97-08-13 19-26-53	34	N	32.9	-1	F	10964	8746	1174	764	9771	8137	3118	1132	0.11	0.09	0.32	0.14
97-08-13 19-26-53	34	N	32.9	-1	F	9473	9483	492	555	7881	10626	1034	1333	0.05	0.06	0.13	0.13
97-08-13 19-26-53	34	N	32.9	-1	F	8106	10996	947	472	9179	8680	1188	1051	0.12	0.04	0.13	0.12
97-08-13 19-26-53	34	N	32.9	-1	F	8495	11046	1685	270	10018	8968	1656	506	0.2	0.02	0.17	0.06
97-08-13 19-26-53	34	N	32.9	-1	F	11814	8855	2910	1044	10232	8594	4390	1410	0.25	0.12	0.43	0.16
97-08-13 19-26-53	34	N	32.8	-1	F	9840	9056	604	927	7769	11056	1108	1532	0.06	0.1	0.14	0.14
97-08-13 19-26-53	34	N	32.8	-1	F	7271	11110	681	1030	8616	8617	1380	1000	0.09	0.09	0.16	0.12
97-08-13 19-26-53	34	N	32.8	-1	F	8161	11761	1646	242	9870	8714	1924	110	0.2	0.02	0.19	0.01
97-08-13 19-26-53	34	N	32.8	-1	F	11581	8321	2410	1001	10083	9098	2331	1826	0.21	0.12	0.23	0.2
97-08-13 19-26-53	34	N	32.8	-1	F	9633	9818	740	1196	9645	9970	922	1048	0.08	0.12	0.1	0.11
97-08-13 19-26-53	34	N	32.7	-1	F	8392	10974	748	906	9494	9614	1923	1756	0.09	0.08	0.2	0.18
97-08-13 19-26-53	34	N	32.7	-1	F	8392	11367	1911	302	9407	10290	1550	486	0.23	0.03	0.16	0.05
97-08-13 19-26-53	34	N	32.7	-1	F	16843	12665	3688	1736	13951	14548	3592	1889	0.22	0.14	0.26	0.13
97-08-13 19-26-53	34	N	32.7	-1	F	15194	13669	709	1439	14630	14644	2651	2632	0.05	0.11	0.18	0.18
97-08-13 19-26-53	34	N	32.7	-1	F	13014	17205	3209	1641	14157	14524	3966	443	0.25	0.1	0.28	0.03
97-08-13 19-26-53	34	N	32.7	-1	F	12273	17782	2962	827	14186	15424	4305	2385	0.24	0.05	0.3	0.15
97-08-13 19-26-53	34	N	32.7	-1	F	17097	11402	3519	1391	14866	13028	4293	2418	0.21	0.12	0.29	0.19
97-08-13 19-26-53	34	N	32.7	-1	F	14176	12936	922	1366	14664	13769	2470	2501	0.07	0.11	0.17	0.18
97-08-13 19-26-53	34	N	32.6	-1	F	11181	17297	2905	2855	13687	14940	4006	2000	0.26	0.17	0.29	0.13
97-08-13 19-26-53	34	N	32.6	-1	F	11460	18477	2659	28	14322	17838	4754	2783	0.23	0	0.33	0.16
97-08-13 19-26-53	34	N	32.6	-1	F	10373	9249	1438	1409	9391	10204	2311	2615	0.14	0.15	0.25	0.26
97-08-13 19-26-53	34	N	32.6	-1	F	8616	8994	792	537	7726	8785	1118	833	0.09	0.06	0.14	0.09
97-08-13 19-26-53	34	N	32.5	-1	F	8059	9346	693	634	8594	8945	589	1296	0.09	0.07	0.07	0.14
97-08-13 19-26-53	34	N	32.6	-1	F	8786	9586	1921	263	9453	8177	1562	121	0.22	0.03	0.17	0.01
97-08-13 19-26-53	34	N	32.5	-1	F	17311	10928	3309	1404	14280	13607	5284	2101	0.19	0.13	0.37	0.15
97-08-13 19-26-53	34	N	32.5	-1	F	13855	13129	997	1440	13162	14362	1508	3054	0.07	0.11	0.11	0.21
97-08-13 19-26-53	34	N	32.5	-1.1	F	11002	15591	992	767	15178	12254	4004	1956	0.09	0.05	0.26	0.16
97-08-13 19-26-53	34	N	32.5	-1.1	F	10661	17558	2358	493	13165	13106	1574	777	0.22	0.03	0.12	0.06
97-08-13 19-26-53	34	N	32.5	-1.1	F	8697	9493	760	635	7282	11773	1434	1683	0.09	0.07	0.2	0.14
97-08-13 19-26-53	34	N	32.5	-1.1	F	9706	10302	1165	404	7631	9569	1759	490	0.12	0.04	0.23	0.05
97-08-13 19-26-53	34	N	32.4	-1.1	F	10519	8835	882	756	9832	8375	1465	1089	0.08	0.09	0.15	0.13
97-08-13 19-26-53	34	N	32.4	-1.1	F	9599	11254	1308	456	9945	8475	954	521	0.14	0.04	0.1	0.06
97-08-13 19-26-53	34	N	32.4	-1.1	F	10486	8859	1940	951	9243	9452	1597	998	0.19	0.11	0.17	0.11
97-08-13 19-26-53	34	N	32.4	-1.1	F	9099	8199	760	247	11681	10030	2408	1130	0.08	0.03	0.21	0.11
97-08-13 19-26-53	34	N	32.4	-1.1	F	8032	9580	1769	1226	10428	8555	3344	942	0.22	0.13	0.32	0.11
97-08-13 19-26-53	34	N	32.3	-1.1	F	9073	10911	1106	474	8329	9940	1980	1196	0.12	0.04	0.24	0.12

Appendix D: Summary of Run Codes for Test Identification

Appendix D. Summary of Run Codes for Test Identification.

Test identification run code consists of a full run description as follows:

- Train type
- Test Site location
- Train Speed, mph
- Cant Deficiency Level, in.

For example, the following run codes, which contain a corresponding detailed description, were used:

T3V46C24

T6V74C80

F4V60C30,

with the descriptive fields as follows:

T, F, A, L - Talgo, Freight and Amtrak trains, or Locomotive only

V74 = Speed, mph

C30 = Cant Deficiency (x10), i.e. 3.0 in

Appendix E: Threshold Levels

Threshold Levels

- Adjustable threshold levels defined for Lateral (L) and Lateral/Vertical (L/V) parameters

- Four threshold levels to be defined

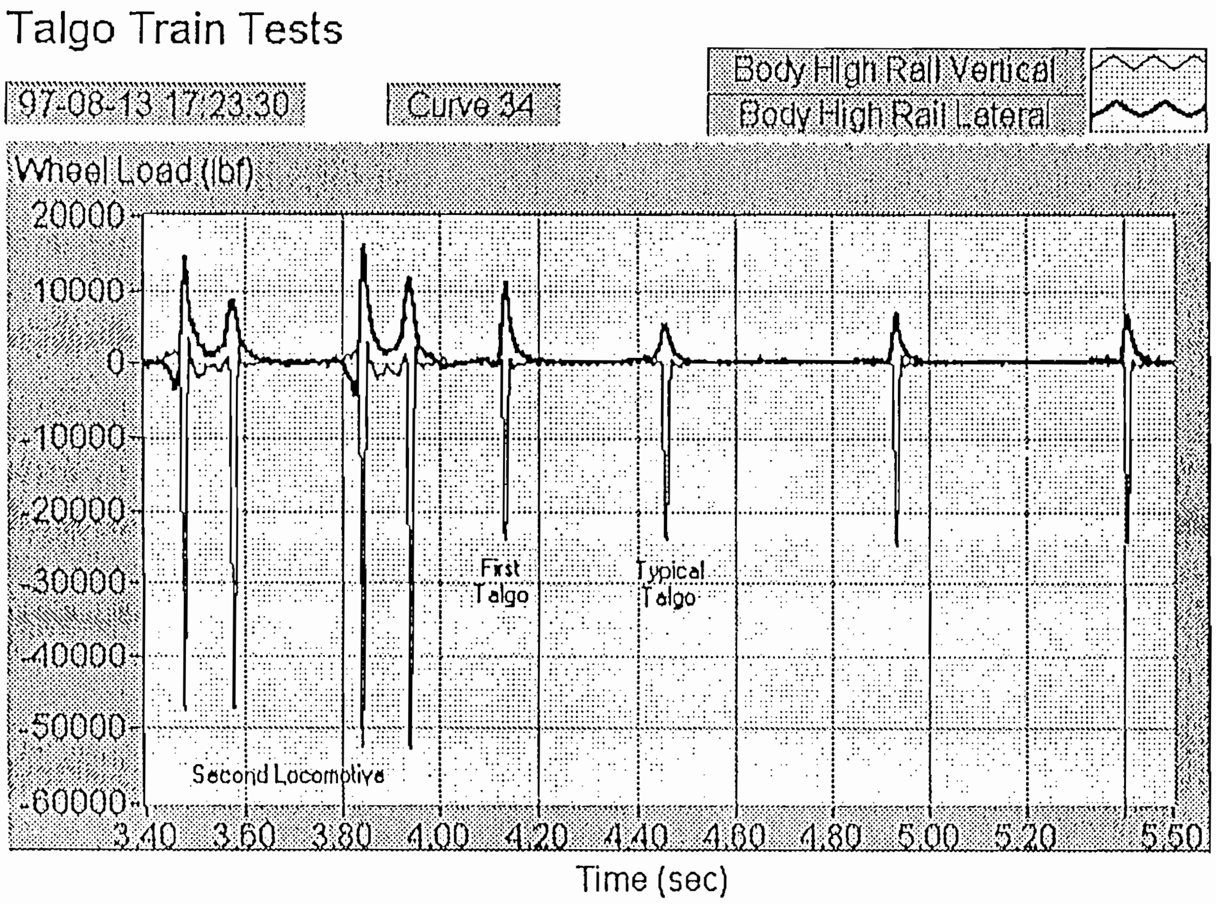
- Preliminary recommendations:

Threshold	L	and	L/V
1	5000		0.4
2	10000		0.6*
3	20000		0.8**
4	30000		1.0

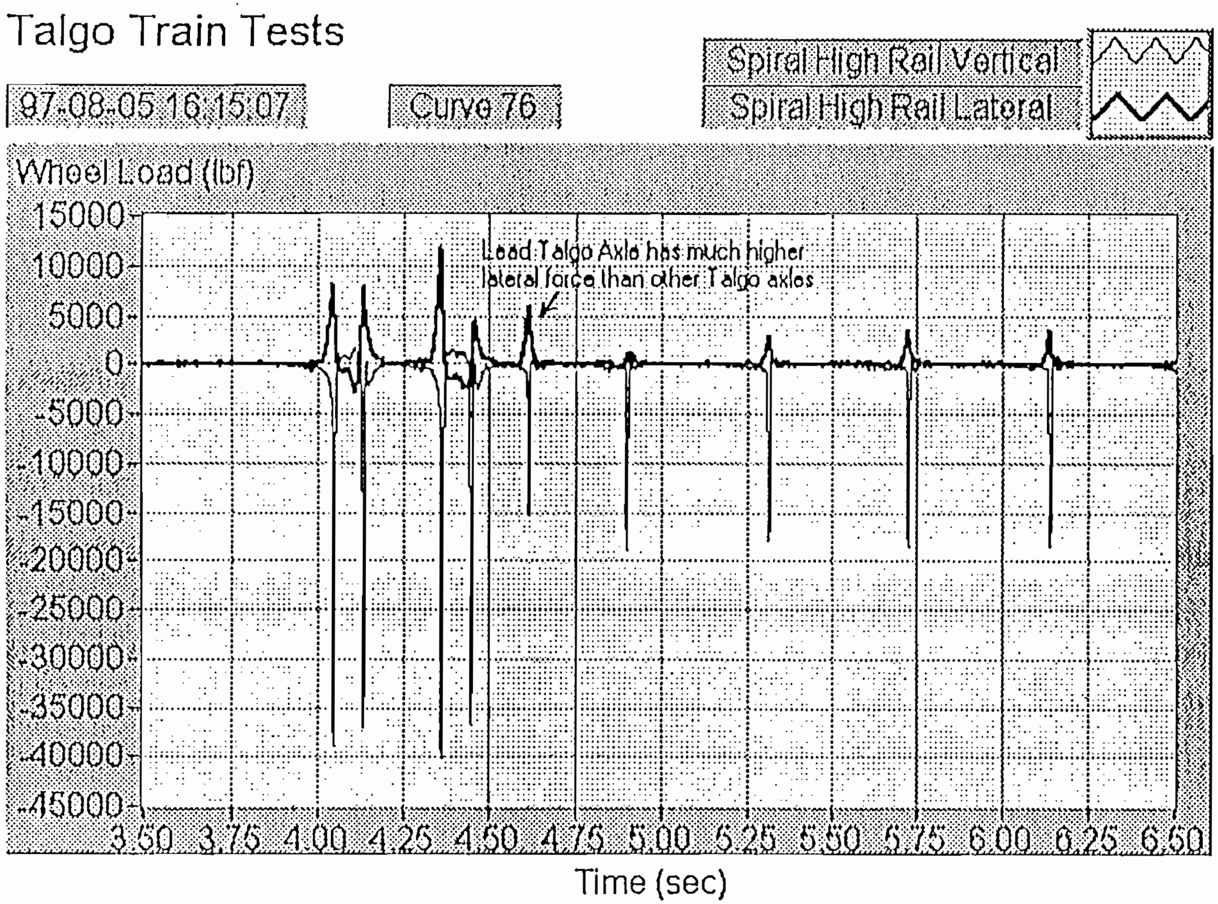
- Output report to be listing of all axle exceeding above threshold levels

* Rail overturning threshold
** Wheel climb threshold

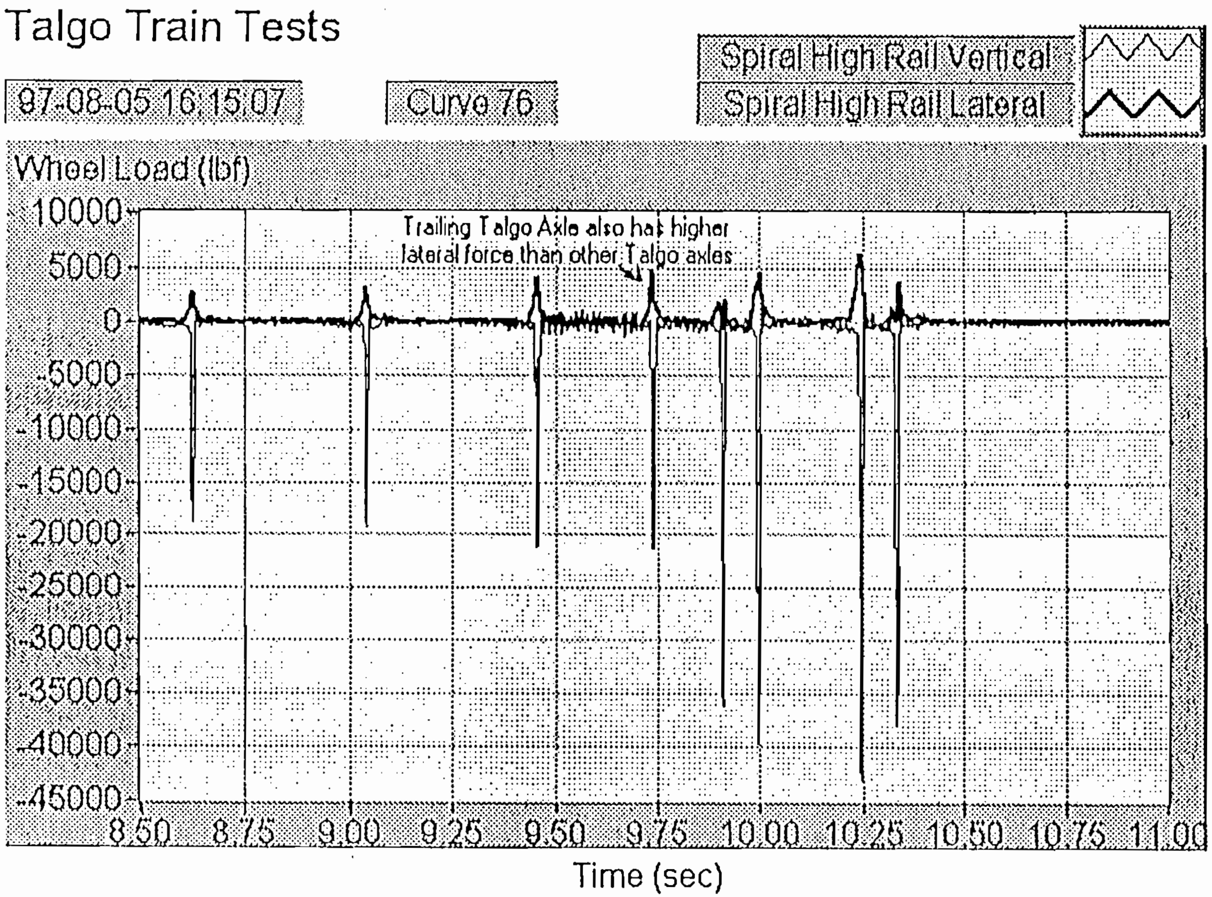
Appendix F: Talgo Trainset Records


Talgo Train Tests
97-08-13 17:23:30
Curve 34
Body High Rail Vertical
Body High Rail Lateral
Wheel Load (lbf)
20000
10000
0
-10000
-20000
-30000
-40000
-50000
-60000
First Talgo
Typical Talgo
Second Locomotive
3.40
3.60
3.80
4.00
4.20
4.40
4.60
4.80
5.00
5.20
5.50
Time (sec)

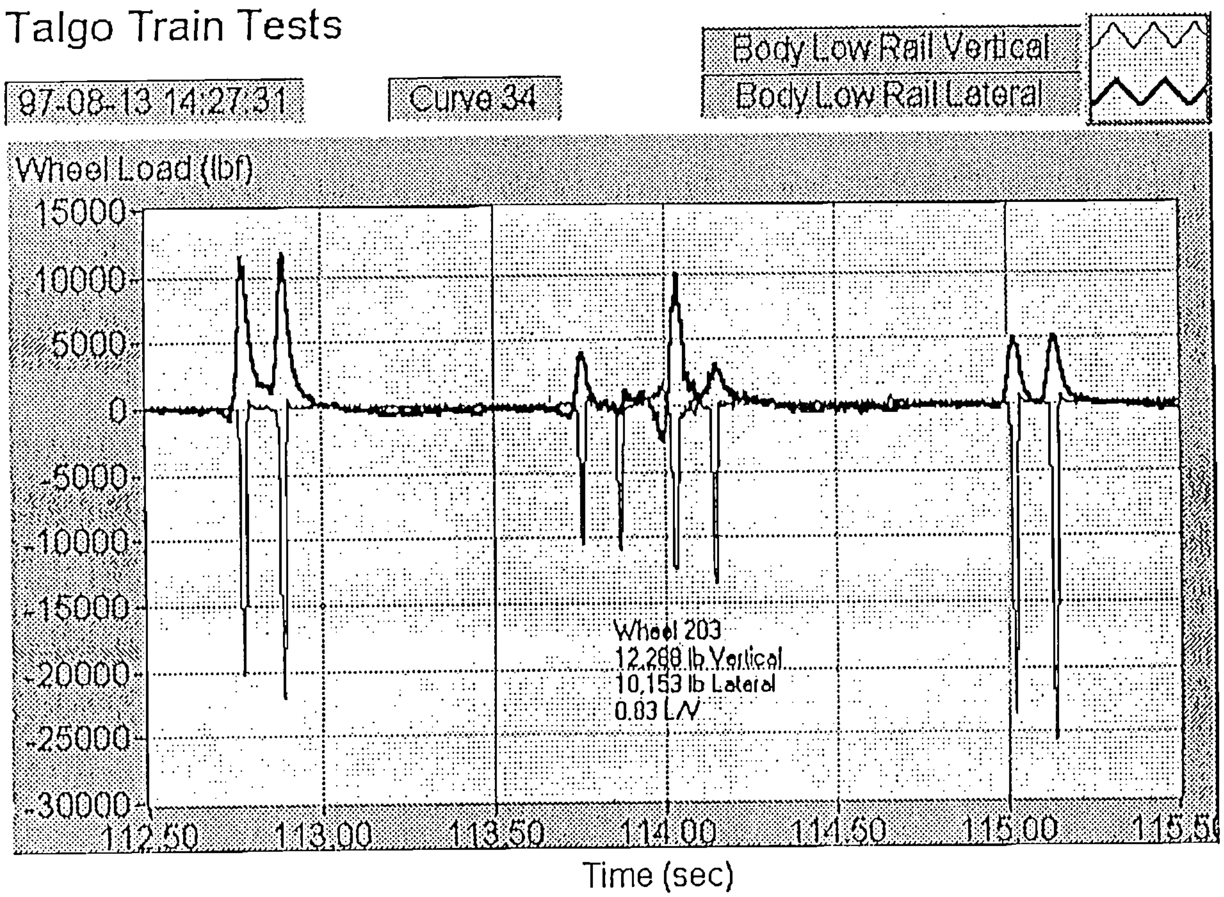
F1

Talgo Train Tests
97-08-05 16:15:07
Curve 76
Spiral High Rail Vertical
Spiral High Rail Lateral
Wheel Load (lbf)
15000
10000
5000
0
-5000
-10000
-15000
-20000
-25000
-30000
-35000
-40000
-45000
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00
6.25
6.50
Time (sec)
Lead Talgo Axle has much higher lateral force than other Talgo axles

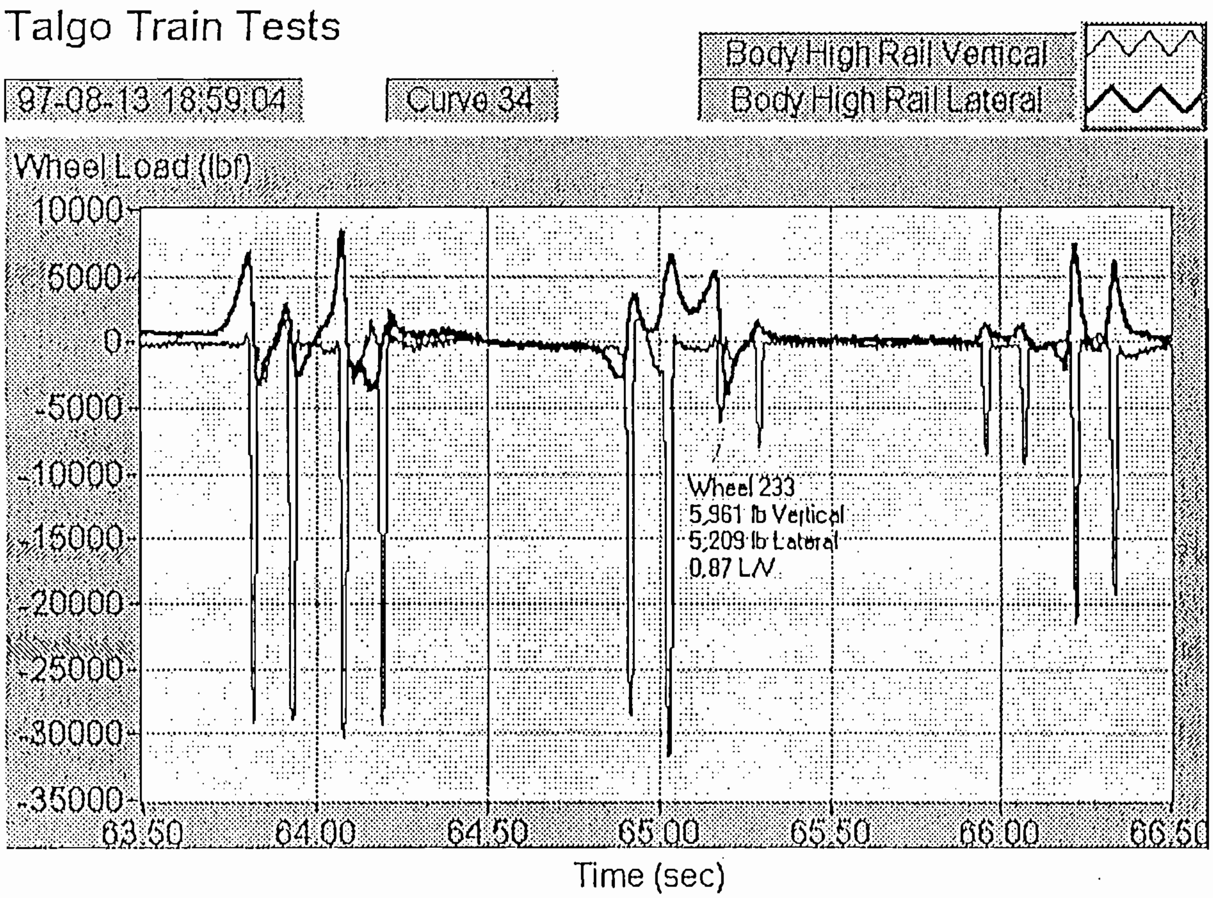
F2

Talgo Train Tests
97-08-05 16:15:07
Curve 76
Spiral High Rail Vertical
Spiral High Rail Lateral
Wheel Load (lbf)
10000
5000
0
-5000
-10000
-15000
-20000
-25000
-30000
-35000
-40000
-45000
8.50
8.75
9.00
9.25
9.50
9.75
10.00
10.25
10.50
10.75
11.00
Time (sec)
Trailing Talgo Axle also has higher lateral force than other Talgo axles

F3


Talgo Train Tests
97-08-13 14:27:31
Curve 34
Body Low Rail Vertical
Body Low Rail Lateral
Wheel Load (lbf)
15000
10000
5000
0
-5000
-10000
-15000
-20000
-25000
-30000
112.50
113.00
113.50
114.00
114.50
115.00
115.5
Wheel 203
12,288 lb Vertical
10,153 lb Lateral
0.83 L/V
Time (sec)

F4


Talgo Train Tests
97-08-13 18:59:04
Curve 34
Body High Rail Vertical
Body High Rail Lateral
Wheel Load (lbf)
10000
5000
0
-5000
-10000
-15000
-20000
-25000
-30000
-35000
63.50
64.00
64.50
65.00
65.50
66.00
66.50
Time (sec)
Wheel 233
5,961 lb Vertical
5,209 lb Lateral
0.87 L/V

F5

ENSCO PUB. NO. DOT-FR-99-05

HIGH CANT DEFICIENCY OPERATION OF THE TALGO TRAIN ON THE PACIFIC NORTHWEST CORRIDOR

VOLUME III of III

IDENTIFICATION OF THE FACTORS THAT AFFECT TRACK MAINTENANCE UNDER HIGH CANT DEFICIENCY OPERATIONS ON BNSF

MARCH 1999

Sponsored by:

Federal Railroad Administration
Office of Research and Development
Washington DC

Prepared by:

ZETA-TECH Associates, Inc.
900 Kings Highway North
P.O. Box 8407
Cherry Hill, NJ 08002

for

ENSCO, INC.
APPLIED TECHNOLOGY AND ENGINEERING DIVISION
5400 Port Royal Road
Springfield, VA 22151

PREFACE

In an effort to evaluate the impact of high cant deficiency operation on track loading, as well as to provide initial evaluation of operational safety, three (3) test curves were instrumented at locations in the spiral and curve body in order to measure lateral force (L), vertical force (V), and the L/V ratio on both the high and low rails as each axle of a given trainset passed by. Details of the collection and analysis of wayside force measurements are presented in Volume II - "Measurement of Wheel/Rail Forces as Generated by the Talgo Train". Results presented in Volume III pertain to maintenance issues related to high cant deficiency operations and are based on the wayside force measurements detailed in Volume II. The analysis focuses on the maintenance costs of increased operating speeds solely for curves in the BNSF Pacific Northwest Corridor.

Information presented in this volume was provided by ZETA-TECH Associates, Inc., a subcontractor to ENSCO, Inc. throughout this test program. ZETA-TECH has been involved with the high cant deficiency operation of the Talgo train on the BNSF Pacific Northwest Corridor since project inception.

IDENTIFICATION OF THE FACTORS THAT EFFECT TRACK MAINTENANCE UNDER HIGH CANT DEFICIENCY OPERATIONS ON BNSF

Definition of Issues

Revised
November 1997

by

ZETA-TECH

ZETA-TECH Associates, Inc.
900 Kings Highway North, Suite 208
Cherry Hill, NJ 08034

Phone: (609) 779-7795
Fax: (609) 779-7436
email: zarembski@zetatech.com
http://www.zetatech.com

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Introduction

There is growing interest in US in high speed passenger operations on existing freight railroad right of way. However, any increase in passenger train operating speeds on track with existing freight operations must take into account both safety and maintenance issues. This is certainly the case with the proposed changes in operations of the TALGO trainsets operating on the BNSF Railroad in the Portland-Seattle-Vancouver BC corridor. These proposed operating changes include increased operating speeds through curves on this corridor with existing curve superelevations. This requires operations at higher cant deficiencies than currently permitted under existing operating rules and safety standards. These higher cant deficiency operations have the potential for increased lateral loads, L/V ratios, and high rail vertical loads, all of which can potentially affect both safety and track maintenance.

In order to address the safety concerns, a series of tests were run on this corridor and the level of lateral force, vertical force, and L/V ratio monitored for a total of three curves (two north of Seattle and one south of Seattle). The resulting load levels and their safety implications were reported previously in the ZETA-TECH Associates, report "Measurement of Wheel/Rail Forces As Generated by TALGO Trains in High Cant Deficiency Operations on the Pacific Northwest Corridor" October 1997 (see Volume II of this report).

This report addresses the maintenance implications of the proposed high cant deficiency operations and will define the potential areas of increased track maintenance as well as a first order estimate of this increase. The focus of this analysis is on the effect on maintenance costs of increased operating speed (higher cant deficiency operations) for curves in the BNSF Pacific Northwest Corridor.

Effects of Increased Passenger Train Operating Speeds

As the speeds of passenger train operations are allowed to increase, key engineering and safety issues must be carefully considered. Specifically, issues relating to track maintenance, engineering, inspection, and safety associated with the operation of high speed passenger equipment and general freight equipment on the same right of way must be examined and addressed.

The focus presented here is on the operation of *increased speed passenger trains* on track that also operates heavy axle load freight equipment. Thus, the issues will be addressed from the point of view of the increase in allowable speeds on curves (by increasing allowable cant deficiencies) of the high speed passenger equipment on freight lines.

The following section summarizes several of the relevant issues, both safety and maintenance related. However, noting that the October 1997 report (see Volume II) dealt directly with safety issues, the primary focus of this report will be on maintenance.

A. Dynamic Effects of Higher Speeds

Among the major effects of increased speed passenger operations are the corresponding increase in loadings (both vertical and lateral), associated with increased speeds. This area represents a complex interaction between specific vehicle type and specific track conditions.

In order to evaluate the effect of high speed, and the risks associated with these speeds, the AMTRAK equipment must be evaluated in terms of the associated dynamic loadings. These loadings are applied at the vehicle axle level; thus, in the case of passenger cars (which are in general lighter in weight and possess better suspension systems than freight vehicles), the locomotive loadings are usually the greatest in terms of both vertical and lateral wheel/rail forces. However, passenger cars also experience increases in loading which can result in increased rates of component degradation.

The dynamic effects that must be considered include the following:

A.1. Lateral Dynamics and Curving Forces

Lateral load, and in particular lateral load in curves, is directly related to speed, degree of curvature, and unbalance (or Cant Deficiency). This was discussed in detail in the October 1997 report (see Volume II) and results summarized in the next section.

For fixed super-elevation, increasing speed results in an increased lateral load, as was observed in the test data. This relationship can be quite significant. Although AMTRAK equipment has "good" curving performance, the types of equipment generally used, to include "conventional" locomotives, can generate these types of high lateral loads due to:

- Speed and associated unbalance of curves
- Curving performance of vehicle (and truck)
- Angle of attack of wheel-set

These lateral loads include not only the "steady state" curving forces, such as those associated with centrifugal forces (and unbalance), but also a non-steady state dynamic component which can be larger than the steady state component. Note: in general locomotives produce the highest lateral loads (because of their increased weight and unsprung mass). However, even the effect of lighter passenger cars, such as the TALGO cars with their tilting mechanism can be significant.

From the point of view of derailment risk, the increase in lateral forces result in an increase in the L/V ratio (ratio of Lateral force to Vertical force) at each wheel. This is amplified in passenger equipment, because of a combination of high lateral loads (due to higher speeds) and lower vertical loads (since passenger equipment axle loads are usually lighter than corresponding freight equipment). Thus, the L/V ratio can be higher for passenger equipment, even when the speeds are equal. As noted in Volume II of this report, this increased L/V ratio can be significant and affects the following potential derailment areas (as previously discussed in Volume II):

- Wheel Climb
- Dynamic Gage Widening/Rail Overturning

From the point of view of maintenance, an increase in lateral forces can result in an increased rate of degradation for:

- Rail
- Ties
- Track Geometry

This is particularly the case on curves, where lateral degradation modes dominate. This will be discussed further in a later section.

A.2. Vertical Dynamics

As in the case of lateral loads, vertical loads and their associated vertical impacts are directly related to speed. In general, vertical load increases with speed, particularly in the higher speed regimes which passenger equipment operates on tangent track. On curves, the increase in load is accompanied by a shift in vertical load distribution with an increased level of loading found on the high rail and a reduced level of loading on the low rail.

The effects of these increased vertical loads can be an increase in loading on each of the key track elements and an increase in damage associated with these loadings. However, in looking at overall track and component degradation, the vertical load redistribution effect, with an increased vertical load on high rail and reduced vertical load on low rail, can offset damage to components such as rail and ties. In this case, an increase in per axle damage on the high rail can be offset by a corresponding reduction in per axle damage on the low rail (provided that the average load remains relatively constant).

A.3. Longitudinal Forces

Increased speed of operations also results in an increased need to brake and accelerate more frequently and more extensively (such as when approaching slow order sites, curves, stations, etc.). Test results have shown that longitudinal force generated by train braking is related to both the speed of the train and to its mass. Thus, high speed passenger trains generate significant longitudinal braking forces associated with their speed, while simultaneously, the heavy axle load freight equipment also generates high levels of longitudinal forces. These forces, in turn, can cause rail running (rail "creep") in continuously welded rail track, which in turn results in a change in rail neutral temperature, and an increase in the risk of hot weather buckling or cold weather pull-aparts. Train braking and/or acceleration forces can also generate compressive/tensile stresses in the rail, which can directly contribute to the risk of rail pull-aparts in cold weather and track buckling in hot weather.

Note, these high longitudinal forces are primarily associated with the higher passenger speed operations on tangents, and not with higher cant deficiency.

B. Track Standards for High Speed Tracks

Track standards, and in particular track geometrical standards, are intended to control and/or reduce the dynamic interactions between the vehicle and the track in the presence of an irregularity in the track or one of its components. Since these interactions are dynamic in nature, they are generally speed related, with many interactions becoming more severe with increasing speed. In order to control these dynamic responses, the magnitude of the allowable "defects" or irregularities in the track structure are reduced for higher speed operation. This is, in fact, the approach taken in the FRA Track Safety Standards which reduces allowable operating speeds as defects increase in magnitude (or conversely, decreases the allowable magnitude of any irregularities in track with higher speeds). Furthermore, the presence of heavy axle load freight equipment results in a more rapid degradation of the track structure and its components, resulting in a more rapid development of irregularities, and often the need for more frequent maintenance.

Track standards have been developed for each of the key areas of the track structure. From the point of view of higher speed passenger operations, the most critical of the standards include: track geometry, superelevation (cant deficiency or unbalance) on curves, rail surface condition, allowable wear limits, and special trackwork.

of the standards include: track geometry, superelevation (cant deficiency or unbalance) on curves, rail surface condition, allowable wear limits, and special trackwork.

In the case of increased operating speeds on curves due to increased level of allowable cant deficiency, it is necessary to ensure that either track class does not change or else account for the increase in maintenance costs associated with a change in track class. Note, for the TALGO operations considered here, track class is not expected to change.

C. Maintenance Issues

As has already been noted, the combination of high speed passenger and low speed heavy axle load freight traffic results in a significant differential in operating speeds, as well as a potential difference in class of track. These issues affect maintenance requirements (costs) which are briefly summarized below.

C.1. Rail

The effect of cant deficiency is associated with the operation of passenger and freight traffic at different operating speeds over the same curves. The relationship between superelevation and the operating speeds (and associated cant deficiencies) of both the passenger and freight equipment strongly influence the type and extent of rail damage. Increased cant deficiency, with its associated level of forces, particularly lateral forces in curves, results in increased gage face wear on the high rail from passenger operations with increased speed.

C.2. Ties

As already noted, the effect of cant deficiency is associated with the operation of passenger and freight traffic at different operating speeds over the same curves. This is the same effect as before, except that the damage is caused to the cross-ties, particularly wood cross-ties, with gage widening and plate cutting on the high side (due to increased cant deficiency operations).

C.3. Geometry (Ballast)

The effect of Cant Deficiency associated with the operation of passenger and freight traffic at different operating speeds over the same curves is the same effect as before; except that the damage is caused to the ballast/subgrade and manifests itself as degradation of the track geometry with accelerated cross-level and alignment defects.

Note, that the effect of the increased differential between high and low rail vertical loading can be significant, even if the average is constant, since cross-level damage is magnified by an increase in this vertical load differential.

Effect of Higher Cant Deficiencies on Track Loading

Test results on the TALGO trainset with increased operating speeds (and thus increased cant deficiencies) showed a distinct increase in lateral load on all three test curves within the spirals. These increased results, presented in detail in the test report (see Table 5, Volume II), are summarized below as follows:

Average (Mean) Lateral Loads (lb.) [Spiral, High Rail]

	Nominal Cant Deficiency (inches)					
	3	4	5	6	7	8
TALGO Loco	4075	4901	4892	5334	5356	5917
TALGO Car	2458	2782	2796	3260	2937	3311

Note, the mean or average values of lateral load are used here because these are the values that most affect maintenance costs. (Maximum values are related to derailment risk as discussed in Volume II.)

In comparison, the mean lateral load for the BNSF freight traffic in the body of the curve was

Mean Freight Lateral Load - High Rail 3211 lb.

This was well below the TALGO locomotive measured values (4075 lb. for current - 3" unbalance operations) and above the TALGO car value at 3". [Note; the weighted average TALGO lateral load, at 3" unbalance, was 3046 lb., approximately 5% below the mean freight loading.]

Noting that current operations are permitted for cant deficiencies of up to 3", the increase in lateral force associated with the higher levels of cant deficiency are as follows:

Lateral Load as Percentage of Lateral Load at 3" Cant Deficiency.

	Nominal Cant Deficiency (inches)					
	3	4	5	6	7	8
Loco	100.0%	120.3%	120.0%	130.9%	131.4%	145.2%
Car	100.0%	113.2%	113.8%	132.6%	119.5%	134.7%

Noting the discontinuity in the lateral load changes, the regression equations developed in the test report can be used to provide a more uniform load vs. cant deficiency behavior. The resulting lateral load values from the regression equations are as follows:

Mean Lateral Load from Regression Equations
Cant Deficiency (inches)

	3	4	5	6	7	8
Loco	4292	4607	4922	5237	5551	5866
Car	2553	2702	2850	2998	3147	3295

Again noting that current operations are permitted for cant deficiencies of up to 3", the increase in lateral force associated with the higher levels of cant deficiency are as follows:

Lateral Load as Percentage of Lateral Load at 3" Cant Deficiency
(based on Regression Eq.)
Cant Deficiency (inches)

Loco	100.0%	107.3%	114.7%	122.0%	129.3%	136.7%
Car	100.0%	105.8%	111.6%	117.4%	123.2%	129.1%

Noting that it is currently proposed that the cant deficiency be increased to 6" (from the current 3" maximum), then the effect on lateral load of increasing cant deficiency from 3 to 6 inches is:

	Actual	Regression
Loco	30.9%	22.0%
Cars	32.6%	17.4%

Noting that the Typical TALGO trainset (as tested) consists of 2 engines and 13 cars (with a total engine weight of 263 tons and a total car weight of 300 tons), a weighted lateral load effect can be calculated (based on the distribution of vertical weight, an assumption that has support from the FAST (Facility for Accelerated Service Testing) heavy axle load tests and the reported relationship between vertical and lateral load levels).

Weighted Lateral Load Increase (3" to 6" cant deficiency)

Actual	31.8%
Regression	19.5%

The test results likewise show an effect on the vertical loads on the high and low rail respectively. Specifically, the high rail vertical load increases with increasing cant deficiency and the low rail vertical load decreases with increasing cant deficiency. However, the total vertical load, in general, remains constant (in fact decreases slightly), with only the distribution between high and low rails changing. The mean vertical loads for high rail and low rail (and average of the two) are presented below for both the TALGO locomotives and cars as a function of cant deficiency.

Vertical Force Distribution as a Function of Cant Deficiency

TALGO Loco

	Nominal Cant Deficiency (inches)					
	3	4	5	6	7	8
Hi Rail	42795	43528	46918	47451	49133	49693
Low Rail	29007	26757	24088	22193	19696	18580
Average	35901	35007	35503	34822	34414	31136

TALGO Car

	Nominal Cant Deficiency (inches)					
	3	4	5	6	7	8
Hi Rail	20174	19914	21571	22147	22476	23006
Low Rail	14768	13713	12923	12310	11398	10559
Average	17471	16814	17247	17229	16937	16783

Again note that the average vertical loads generally remain constant (decrease slightly) for the increased cant deficiencies. This is due to the corresponding reduction in low rail vertical forces that occur as the high rail vertical forces increase.

Thus, for most of the component degradation mechanisms discussed above, the lateral load effect is significant on high cant deficiency operations on curves, while the vertical load effect is less significant, due to the "averaging" of vertical load noted above.

Effect of Increased Load on Track Damage

The analysis approach used here for determining the effect of increased loads on the track structure, and for quantifying the associated change in maintenance costs, is based on a methodology that was developed during studies which examined the effect of increased loading on track component degradation (and associated costs) [1,2,3,4]. It focuses on the direct effects of the increased load on the various track component failure mechanisms. Specifically it relates increased maintenance costs of the key track components (rails, ties, ballast, etc.) to the increased rate of component degradation associated with increased levels of loading. [Note; while the initial development of this methodology was geared to vertical load increases (e.g. increased axle load), the basic theory of load-failure relationship applies equally to lateral loading and as such is directly applicable to this study.]

The load effect is based on classical S-N (fatigue) theory, which associates the number of cycles to failure with stress raised to an exponential power. The classical relationship between stress (S) and cycles to failure (N) is given by:

$$\log(S) = -a(\log(N)) + b$$

where a is the slope of the stress/cycles (S/N) curve.

The stress value S, in turn, is directly related to the loading P. For linear elastic structures, such as railway track, the stress can be assumed to be proportional to the load, P. Thus:

$$S = k * P$$

Combining these equations, and converting to exponential form, produces the following relationship:

$$(P_1 / P_2)^n = (N_2 / N_1)$$

where n can be considered a "damage exponent" corresponding to the change in loading P, which will vary for each material, component, and failure mechanism. Based on this relationship, the damage factor relationship is established, in which:

$$F = (P/P_0)^n$$

where:

F = "damage factor"
P = new (higher) load
P_0 = original (existing) wheel load
n = load damage exponent

Separate damage exponents (n) and damage factors (F) are calculated for each track component and for each component failure mechanism. These major track components are rail, ties, and ballast/subgrade [for the purpose of this analysis, turnouts will be included under rail costs in accordance with standard railroad R-1 accounting procedures]. Since each of these components is affected by several different degradation (damage) mechanisms (e.g. wear, fatigue, etc.), separate damage exponents and corresponding damage factors must be developed for each combination of track components and degradation mechanisms. These relationships will be presented in the following sections of this report.

It should be noted that these rail, tie, and ballast/subgrade costs represent 43.3% of total reported maintenance of way costs [based on 1996 reported BNSF R-1 data]. Furthermore, these three cost categories can be divided as follows (based on BNSF R-1 data):

Rail	60.4%
Ties	21.4%
Ballast	18.2%

It should be noted here that the focus of this analysis is on the effect of increased loadings associated with high cant deficiency operations. Since these operations only occur on curves, the primary thrust of the damage mechanisms presented here will be curve related.

1. Rail

On heavy tonnage railway lines, rail maintenance and replacement is generally the largest single component of track maintenance cost. Extensive research studies have been undertaken to quantify the different failure/degradation mechanisms which affect rail, as well as the effect of such parameters as increased axle loads on rail failure and degradation.

Rail life is determined by a combination of wear and fatigue. Generally one of these mechanisms will dominate under a given set of operating conditions. Side or gauge face wear will usually be the dominant mechanism on curves while on tangent, surface fatigue and/or internal fatigue often dominate.

Earlier studies by the Burlington Northern [1] have identified the dominant failure mechanisms and the percentage of rail replaced due to each mechanism. These are as follows:

Mechanism	Percentage of Total Replacement for Each Mechanism
Wear	65%
Rail Surface Fatigue	10%
Rail Internal Defects (Fatigue)	25%

To determine the effect of the proposed increase in loads on rail life and thus rail maintenance costs, it is necessary to define damage exponents, n, for each of the above rail failure mechanisms. Making use of an extensive data base of research developed, the following range of damage effects have been defined.

Note; based on reported BNSF R-1 data, rail costs make up 60.4% of overall rail, tie, and ballast maintenance costs (capitalized and expensed).

Rail Wear

Rail wear is generally divided into side or gauge face wear and head wear, which can vary for the high and low rails on curves. As noted above, rail wear, particularly side wear, is traditionally associated with curved track. The Pacific Northwest Corridor follows this pattern. Noting that on curved track, side or gage face wear is the dominant failure mechanism, studies have shown that lateral load is the primary input parameter into this type of wear.

Rail wear has historically been treated as primarily linear with load, corresponding to an exponent of $n = 1$ [1]. This has been confirmed by the recent studies at FAST and other sites [5] which showed an equivalent damage exponent (n) of 1.0. Thus, for the case of curved track on BNSF, the effect of increased lateral load (due to high cant deficiency operations) is taken to be linear, with a corresponding damage factor of $n = 1.0$.

Rail Surface Fatigue

Rail surface fatigue is a result of wheel/rail contact stress, and includes corrugations, surface spalling (head checking), and other related problems. As was noted previously, this class of rail problems accounts for approximately 10% of all rail replacement on the BNSF line.

While lateral loads may contribute to the development of these defects, the primary causal mechanisms are related to the vertical load. This is likewise expected to be the case here.

The damage relationship for this class of defects has been found to be non-linear, with the traditional metal on metal contact resulting in an exponent of 3.0 to relate load to fatigue on rolling contact surfaces. However, recent research [6] identified an exponent limit of 1.8 under certain conditions of load and lubrication which has also been supported by some of the recent FAST research results. Thus a damage exponent of n = 1.8 is assumed here-in, as a function of increased vertical load. Note, however, that for the cant deficiency operating conditions here-in, the increase in vertical load is off-set by the decrease in lateral load, with no significant net increase in "average" vertical load. This damage exponent should be applied to the "average" vertical load.

Rail Internal Defects (Fatigue)

Rail fatigue (internal) is a failure mechanism that is commonly associated with increased vertical loads. Traditionally, rail fatigue was taken to be directly related to the slope of the S-N curve, as defined for steels. This results in a non-linear damage exponent value of 3.0 to 3.33. This was corroborated by studies by BHP Melbourne Research Laboratory [4].

Thus, for this study, for rail fatigue (internal), the "damage" effect is defined as a function of vertical load [and noting the averaging effect already discussed, as a function of average vertical load] with a damage exponent of n = 3.00.

2. Ties and Fasteners

The study route contains timber ties with a mix of cut spike and Pandrol fastenings. Experience with high density freight indicates that for high density track, mechanical degradation caused by vehicle loadings (both vertical and lateral) is the dominant failure mechanism. On lighter density lines, decay and environmental degradation become increasingly important together with the load effect. In all cases, an increase in level of loading results in an increase in the rate of tie degradation.

This effect has been the subject of numerous analytical and empirical studies. Early work by Talbot [7] and Hay [8] found cross-tie loading and the corresponding rate of degradation to be linearly related to load. This corresponds to a damage exponent of 1.0. This behavior is likewise supported by test data from FAST which shows only a very limited increase in degradation on hardwood cross-ties, but a linear increase in overall maintenance costs [9]. Maintenance includes such activities as adjustment of timber cross-tie fasteners, adjustment of skewed cross-ties, etc.

On curves, the major degradation mechanisms, which include gage widening, plate cutting, etc. are primarily related to lateral loads. Therefore, a linear damage relationship (n = 1) will be defined here-in for lateral loading on curves.

Note, on BNSF, tie maintenance represented 21.4% of overall rail, tie, and ballast maintenance costs.

3. Ballast and Subgrade

Track geometry degradation as well as degradation of the ballast and subballast is strongly dependent on the type of ballast and the type of subgrade.

For analytic purposes, the ballast on the Pacific Northwest corridor has been assumed to be good throughout; however, the subgrade has been divided into two categories: good subgrade and poor subgrade. Based on earlier BNSF studies, the distribution of these two subgrade types by track mileage is as follows:

Good Subgrade	90%
Poor Subgrade	10%

Overall, Ballast/Subgrade maintenance costs represented 18.2% of total BNSF rail, tie, and ballast costs.

Good Subgrade/Ballast

In the case of good ballast and good subgrade, track geometry degradation is almost universally considered to be linear with axle load [7,8]. This is further confirmed by heavy axle load testing at FAST which showed that deflections and corresponding pressures increase linearly with load [10]. So long as these pressures do not exceed the load bearing capability of the ballast or subgrade (i.e. for good subgrades), this linear relationship will remain valid, yielding a damage exponent n of 1.0.

On curves, the major degradation mechanisms, which include loss of alignment, track buckling, etc. are primarily related to lateral loads. Therefore, a linear damage relationship ($n = 1$) will be defined here-in for lateral loading on curves.

Poor Subgrade/Good Ballast

In the case of poor subgrade, most researchers agree that a non- linear relationship exists between loads and deformation, in particular cumulative deformations which result in the need for surfacing maintenance. The definition of poor subgrade is less than rigorous, however. While track supervisors know where their geometry problems are, the size and severity of the problems can be difficult to quantify.

Previous heavy axle load studies [2] have defined a range of exponents of between 3 and 7 for poor subgrades. Heavy axle load testing at FAST shows that poor subgrades have a rate of cross-level degradation between 2.8 and 4.1 times that of good subgrades [11,12]. This corresponds to a damage exponent of between 5.6 and 7.8. This is in line with the reported results of other researchers such as Selig [13], who have reported equivalent axle load exponents of the order of 6 to 7.

However, since these are primarily subgrade dependent degradation mechanisms, the degradation is primarily related to changes in vertical load. Again noting the difference between high and low rail loading, the average vertical load effect will be used. Thus, for poor subgrades (with good ballast) the damage exponents (n) of n = 5.6 is defined.

Tables 1 summarizes the degradation relationships, load dependencies, damage exponents and percentage of total rail tie and ballast costs for each component category.

Table 1: Summary, Range of Damage Exponents (n)

Component Category	**Vertical (V) or Lateral (L)**	**exponent (n)**	**% of Total**
Rail Wear	**L**	**1**	**39.3%**
Rail Internal Defects (Fatigue)	**V**	**3**	**6.0%**
Rail Surface Fatigue	**V**	**1.8**	**15.1%**
Timber Cross-ties	**L**	**1**	**21.4%**
Good Subgrade/Ballast	**L**	**1**	**16.3%**
Poor Subgrade/Good Ballast	**V**	5.6	**1.8%**

Calculation of Cost Impact of High Cant Deficiency Operations

Noting that the dominant load change effect is in the lateral direction, the initial estimate of the cost impact of increased cant deficiency operations will focus on those cost areas that are related to the lateral load. Noting Table 1, these maintenance cost areas include:

- Rail Wear
- Ties
- Surfacing/Ballast (Good Ballast/Subgrade only)

Furthermore, it must be noted that since the increased speeds (increased cant deficiency operations) are only on curves on the route, these maintenance cost impacts will be applied only to the curves on the line.

Based on BNSF data, the percentage of curved track on the TALGO routes are as follows:

Seattle - Blaine	32.5%
Seattle - Portland	27.4%

Annual Tonnage on the TALGO routes are as follows:

	No. of Tracks	Mileage	Freight MGT	Amtrak MGT	Total MGT	% Amtrak
Seattle - Everett	2	32.0	18.8	0.2	19.1	1.1%
Everett - Blaine	1	87.3	14.0	0.4	14.4	2.9%
Portland - Seattle	2	186.5	39.6	0.6	40.3	1.5%

Note, the Amtrak tonnage is based on using TALGO equipment to replace all current Amtrak trains and is based on the following Amtrak schedule and consist:

	Trains/Day TALGO (Current)	Other (to be replaced by TALGO equipment)	Annual MGT
Seattle - North	2		0.4
Seattle - South	2	4	1.2

One TALGO train consists of 2 engines with a weight of 131.5 Tons each and 13 cars with a total weight (with passengers) of 300 Tons for a total train weight of 563 Tons.

Noting, from the previous section, that the effect on lateral load of increasing cant deficiency operations from 3 to 6 inches is 31.8% based on actual test data (or 19.5%

based on a 'smoothed" regression analysis), then the increase in maintenance costs for the higher cant deficiency operations on curves (only) can be calculated.

This damage effect is calculated in two ways:

- Increase in per train cost
- Increase in MoW Budget by line segment

In both cases, the increased in maintenance cost is calculated based on the increase in lateral loads only. For the vertical load effect, it is assumed that the increase in vertical load on the high rail is offset by the decrease in vertical load on the low rail. **This is a very conservative assumption since it does not include the disparity between high and low rail vertical loads which increases with speed.**

Noting from Table 1, that the lateral load effect is linear (n =1) for all effected track components (rail, tie and ballast), then a linear assumption will be made throughout this analysis for the lateral load effect. [This is a conservative assumption for this analysis.]

Also from Table 1, not all of the rail, tie, and ballast costs are effected by the increase in lateral load. Based on this Table, 77% of the total rail, tie and ballast costs are effected by the increased lateral loads.

Finally, as already noted, this analysis will be applied only to curves, since there are no speed increases (and thus no increase in force levels) on the tangent portions of the route. For the purpose of this simplified analysis, it will be assumed that damage is linearly distributed between curves and tangents. This is very conservative since in general curves experience a higher rate of degradation (and a higher proportion of maintenance) than tangents.

Both sets of maintenance cost increase analyses are presented as follows:

Per Train Cost Increase

The per Amtrak train cost increase associated with the operation of the TALGO trains at higher cant deficiencies (and thus higher speeds) is calculated for the total corridor route and is calculated based on actual (measured) load increases as well as the regression based "smoothed" analysis.

Thus the following parameters (previously defined) are applied in this analysis:

% of curved track (for the entire Portland - Seattle - Everett-Blaine route) = 29.7%[1]

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[1] Based on a linear weighting of the miles of curves on each corridor.

% of MoW Budget made up of rail, tie, and ballast costs (from 1996 BNSF R-1 report) = 43.3%

Increase in lateral load for 6" cant deficiency operations (from 3")
Based on actual data = 31.8%
Based on a smoothed regression curve = 19.5%

Percentage of total rail, tie, and ballast costs effected by increased lateral load = 77.0%

Therefore, the increase in per train MoW Costs associated with the higher cant deficiency operations is calculated as follows:

	% Total MoW	% curves	Load Increase	% of R,T, &B	Per Train Increase
Based on Actual	43.3%	29.7%	31.8%	77.0%	3.2%
Based on Regression	43.3%	29.7%	19.5%	77.0%	1.9%

Thus, the increase in per Amtrak train costs is:
3.2 % based on actual loads
or 1.9 % based on Regression equation

If only rail, tie, and ballast costs are considered, then the increase in per train costs is:
7.3 % based on actual loads
or 4.5 % based on Regression equation

Attachment I presents the complete analysis.

Increase in Total Segment MoW Costs

An alternate approach to the increase in maintenance costs is to calculate these costs on a per segment basis as a percentage of total MoW costs.

This analysis is performed on a corridor specific basis, since the percentage of Amtrak traffic varies significantly per segments. For this corridor, the percentage of total traffic (by MGT) associated with Amtrak operations is as follows:

Seattle - Everett	1.1%
Everett - Blaine	2.9%
Portland - Seattle	1.5%

Using these traffic percentages, together with the previously defined factors results in the following determination:

Based on Actual Load Increases

Segment	% Amtrak	% Curves	Increase in Load	% MoW Effected	Increased Cost (R T B)
Seattle - Everett	**1.1%**	**32.5%**	**38.8%**	**77.0%**	**0.1%**
Everett - Blaine	**2.9%**	**32.5%**	**31.8%**	**77.0%**	**0.23%**
Portland - Seattle	**1.5%**	**27.4%**	**31.8%**	**77.0%**	**0.10%**

Based on Regression Equation

Segment	% Amtrak	% Curves	Increase in Load	% MoW Effected	Increased Cost (R T B)
Seattle - Everett	1.1%	32.5%	19.5%	77.0%	0.05%
Everett - Blaine	2.9%	32.5%	19.5%	77.0%	0.14%
Portland - Seattle	1.5%	27.4%	19.5%	77.0%	0.06%

The resulting, per segment, cost increase is presented in Table 2.

Table 2: Increase in MoW Budget by Segment

Segment	Increased Rail, Tie & Ballast Cost based on Actual	Increased Total MoW Cost based on Actual	Increased Rail, Tie & Ballast Cost based on Regression	Increased Total MoW Cost based on Regression
Seattle - Everett	0.1%	0.04%	0.05%	0.02%
Everett-Blaine	0.23%	0.10%	0.14%	0.06%
Portland-Seattle	0.10%	0.04%	0.06%	0.03%

Attachment I presents the complete analysis.

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Attachment 1

Average (Mean) Loads

		Cant Deficiency					
Lateral Load		3	4	5	6	7	8
	Talgo Loco	4075	4901	4892	5334	5356	5917
	Talgo Car	2458	2782	2796	3260	2937	3311
	% of 3						
	Loco	100.0%	120.3%	120.0%	130.9%	131.4%	145.2%
	Car	100.0%	113.2%	113.8%	132.6%	119.5%	134.7%
	% of 4						
	Loco		100.0%	99.8%	108.8%	109.3%	120.7%
	Car		100.0%	100.5%	117.2%	105.6%	119.0%

*********** Effect of increasing cant deficiency from 3 to 6 inches *******

	Actual	Regression
Loco	30.9%	22.0%
Cars	32.6%	17.4%
Weighted	31.8%	19.6%

Loco Regression L=314.76*CD+3348

Car Regression L=148.4*CD+2108

Loco	4292	4607	4922	5237	5551	5866
Car	2553	2702	2850	2998	3147	3295
% of 4						
Loco		100.0%	106.8%	113.7%	120.5%	127.3%
Car		100.0%	105.5%	111.0%	116.5%	122.0%
% of 3						
Loco	100.0%	107.3%	114.7%	122.0%	129.3%	136.7%
Car	100.0%	105.8%	111.6%	117.4%	123.2%	129.1%

Freight Cars

Mean	Lateral Load -High Rail		3211
Mean	Vertical	High Rail	21375
Mean		Low Rail	20513
Max		Low Rail	53742

TALGO VERTICAL mean	High Rail	Low Rail	Average
Loco	46689	23026	34858
Car	21573	12682	17128
TALGO Lateral Mean			
Loco	7513	2840	5177
Car	2211	1034	1623

Analysis of BNSF Maintenance Costs for TALGO operations in Pacific Northwest 11/13/97

Damage Effects

		Based on (P/P0)^n		n factor	Effected by Lateral Loa	Weight Based on Linera Effect	Weight Non-Linear
Rail		60.4%					
	Wear		65.0%	1.00	1	39.3%	
	Surface Fatigue		10.0%	1.80	0	0.0%	
	Internal Fatigue		25.0%	3.00	0	0.0%	
Ties		21.4%					
	Wood		100.0%	1.00	1	21.4%	
	Concrete		0.0%	1.00			
Ballast		18.2%					
	Good		90.0%	1.00	1	16.3%	
	Poor		10.0%	5.6	0	0.0%	
					Total	77.0%	

1996 BNSF

	Operating Schedule 410	Capital Schedule 330	Combined	% of RT&B
Rail	133098	522651	655749	60.4%
Ties	1857	230643	232500	21.4%
Ballast	3931	193211	197142	18.2%
Roadway	11830	33387	45217	
Small Tools	19739	0	19739	
Total	170455	979892	1150347	
Total	1107036	1550161	2657197	
%	15.4%	63.2%	43.3%	

Annual Tonnage on Segments Per Track

	Tracks	Mileage	Freight	Amtrak	Total	% Amtk	Weighted
Seattle - Everrett	2	32.0	18.6	0.2	18.8	1.1%	
Everett-Blaine	1	87.3	14.0	0.4	14.4	2.9%	14.38351
Portland-Seattle	2	186.5	39.6	0.6	40.3	1.5%	

Curves =	Seattle to Blaine	32.5%	
	Portland-Seattle	27.4%	
	Weighted average		29.7%

Check on Amtrak Schedule	Trains/Day Talgo	Other	365 days/year	Annual MGT
Seattle-North	2			0.41
Seatle South	2	4		1.23

One train=			
2 engine@	131.5	Tons	46.7%
13 Cars@	23.1	Tons	53.3%
	563	Tons	100%

Effect of Increase from 3 to 6 inches

Based on Regression Data	19.6%
Based on Actual Data	31.8%

Use lower value

Assume Linear in Lateral Direction (again conservative)

Increase in costs effects curves only;
assume increase in vertical load on high rail offset by decrease in vertical load on low rail

Based on Regression

Three Segments	% of Amtra	% Curve	Load Increase	% of Track Cost Effected	R,T &B Maint Cost Increase
Seattle - Everett	1.1%	32.5%	19.6%	77.0%	0.05%
Everett-Blaine	2.9%	32.5%	19.6%	77.0%	0.14%
Portland-Seattle	1.5%	27.4%	19.6%	77.0%	0.06%

Based on Actual

Three Segments	% of Amtra	% Curve	Load Increase	% of Track Cost Effected	R,T &B Maint Cost Increase
Seattle - Everett	1.1%	32.5%	31.8%	77.0%	0.09%
Everett-Blaine	2.9%	32.5%	31.8%	77.0%	0.23%
Portland-Seattle	1.5%	27.4%	31.8%	77.0%	0.10%

Increase in per train costs	Rail/Tie/Ball as % of Total MoW	% Curves	Load Increase	% of Track Cost Effected	Per Train Increase
Based on Regression	43.3%	29.7%	19.6%	77.0%	1.9%
Based on Actual	43.3%	29.7%	31.8%	77.0%	3.2%

Increase in per train costs	Based on	Actual	Regression
Increase in Rail, Tie, & Ballast only cost		7.3%	4.5%
Increase in total MoW costs		3.2%	1.9%

Based on	Actual		Regression	
Increase in Total MoW Budget by Segment	Rail, Tie & Ballast	Total MoW	Rail, Tie & Ballast	Total MoW
Seattle - Everett	0.09%	0.04%	0.05%	0.02%
Everett-Blaine	0.23%	0.10%	0.14%	0.06%
Portland-Seattle	0.10%	0.04%	0.06%	0.03%