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April 12, 2002



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The Honorable Vernon A. Williams
Secretary
Surface Transportation Board
1925 K Street, N.W.
Washington, DC 20423-0001

ENTERED
Office of the Secretary
APR 12 2002
Part of
Public Record

Re: STB Finance Docket No. 33697, National Railroad
Passenger Corporation under 49 U.S.C. § 24308(a) -
Petition for Declaratory Order - Weight of Rail

Dear Secretary Williams:

Enclosed for filing are an original and ten copies of
the "National Railroad Passenger Corporation's Reply to
Guilford's Motion for Further Clarification of the Board's
October 22, 1999 Decision." Also enclosed are three diskettes,
each containing an electronic copy of the pleading.

Thank you for your assistance in this matter.

Sincerely,

George W. Mayo, Jr.
Counsel for National Railroad
Passenger Corporation

GWM:jms

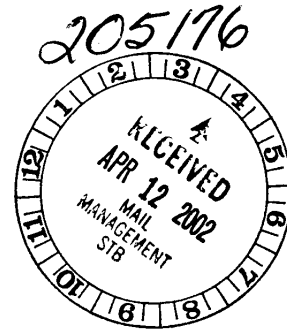
Enclosures

cc (w/enc.): The Honorable Linda J. Morgan (courtesy copy)
The Honorable Wayne O. Burkes (courtesy copy)
All Parties of Record

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EXPEDITED CONSIDERATION REQUESTED

BEFORE THE
SURFACE TRANSPORTATION BOARD



National Railroad Passenger
Corporation -- Petition for
Declaratory Order -- Weight
of Rail

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) STB Finance Docket No. 33697
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Public Record

**NATIONAL RAILROAD PASSENGER CORPORATION'S
MOTION FOR FURTHER CLARIFICATION
OF THE BOARD'S OCTOBER 22, 1999 DECISION**

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April 12, 2002

TABLE OF CONTENTS

	<u>Page</u>
MOTION FOR FURTHER CLARIFICATION	1
PROCEDURAL AND FACTUAL BACKGROUND	2
(i) Procedural History	2
(ii) Rehabilitation of the Plaistow-Portland Line To Support 79 Miles-Per-Hour Amtrak Operations	6
(iii) Initiation of Amtrak Service on Extensively Rehabilitated Plaistow-Portland Line	8
(iv) Track Modulus Testing and Related Dispute	10
PROPOSED PROCEDURAL SCHEDULE	12
ARGUMENT	14
I. TTCI'S USE OF THE TLV TO TEST THE TRACK MODULUS OF GUILFORD'S PLAISTOW-PORTLAND LINE WAS APPROPRIATE AND CONSISTENT WITH THE BOARD'S PRIOR APPROVAL	14
A. TTCI CONDUCTED DETAILED DYNAMIC AND STATIC TESTS ON THE PLAISTOW-PORTLAND LINE	18
B. TTCI'S TESTING REFLECTED CERTAIN IMPROVEMENTS IN ITS METHODOLOGY	21
II. THE CONCLUSIONS REACHED IN THE TTCI REPORT ARE SOUND AND STRONGLY SUPPORT AMTRAK 79 MILES-PER-HOUR OPERATIONS	27
III. OTHER INSPECTIONS CONFIRM THAT THE REHABILITATED LINE IS SUITABLE FOR 79 MILES-PER-HOUR AMTRAK OPERATING SPEEDS	34
CONCLUSION	40

Verified Statements

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John J. Cunningham

BEFORE THE
SURFACE TRANSPORTATION BOARD

_____	)	
National Railroad Passenger	)	
Corporation -- Petition for	)	STB Finance Docket No. 33697
Declaratory Order -- Weight	)	
of Rail	)	
_____	)	

**NATIONAL RAILROAD PASSENGER CORPORATION'S
MOTION FOR FURTHER CLARIFICATION OF
THE BOARD'S OCTOBER 22, 1999 DECISION**

The National Railroad Passenger Corporation ("Amtrak") hereby moves for further clarification of the Board's decision served in this proceeding on October 22, 1999 ("Rail Weight/Speed Decision"). Specifically, Amtrak seeks a ruling from the Board that in light of the recently reported results of track modulus testing on Guilford's 1/ 78-mile line between Plaistow, NH, and Portland, ME (the "Plaistow-Portland line"), Amtrak is authorized to operate on that line at speeds up to 79 miles per hour.

This track modulus testing, conducted on Amtrak's and NNEPRA's 2/ behalf by the Transportation Technology Center, Inc.

1/ Springfield Terminal Railway Company, Boston and Maine Corporation, and Portland Terminal Company are referred to collectively as "Guilford."

2/ As explained in the accompanying verified statement of Michael J. Murray (NNEPRA's Executive Director), the Northern New

("TTCI") (a subsidiary of the Association of American Railroads ("AAR")), demonstrates that the average track modulus of the Plaistow-Portland line is 5,346 lb/in² and that 99.95% of the line has a track modulus greater than 2,750 lb/in², the minimum set by the Board to permit Amtrak 79 miles-per-hour operations. 3/ In light of these test results, the Board should authorize - and order Guilford to permit - Amtrak to increase the operating speeds of its passenger trains from 60 miles per hour to 79 miles per hour over pertinent segments of the Plaistow-Portland line.

PROCEDURAL AND FACTUAL BACKGROUND

(i) Procedural History

This submission marks the fourth, and hopefully last, chapter in the Board's ongoing proceedings related to Amtrak's use of Guilford's Plaistow-Portland line in connection with

[Footnote continued]

England Passenger Rail Authority ("NNEPRA") is a body politic and corporate established by Maine statute in 1995 to promote rail passenger service between points in Maine and points within and outside the state. NNEPRA has been responsible for arranging for some \$54 million of state/federal funds and in-kind contributions required to pay for rehabilitation of Guilford's Plaistow-Portland line.

3/ See Read V.S., Ex. 2 at 12-13 (the "TTCI Report").

Amtrak's initiation of passenger rail service between Portland, ME, and Boston, MA. 4/

First, pursuant to Amtrak's application and because the parties could not reach agreement, the Board established the terms and conditions governing Amtrak's operations over Guilford's Plaistow-Portland line. STB Finance Docket No. 33381, Application of The National Railroad Passenger Corp. under 49 U.S.C. 24308(a) -- Springfield Terminal Ry., et al. (served May 29, 1998) ("Terms/Conditions Decision"). These terms and conditions (and the related rehabilitation plan) were predicated on Amtrak operations at speeds up to 60 miles per hour and rehabilitation of the Plaistow-Portland line to meet Federal Railroad Administration ("FRA") Class 3 standards.

Second, when NNEPRA obtained federal funding allowing a further upgrade of the Plaistow-Portland line to FRA Class 4 standards (which would permit Amtrak operations at speeds up to 79 miles per hour), the parties reached agreement as to the rehabilitation work necessary to accomplish this upgrade, with one exception - the weight of rail that would be required. Amtrak and NNEPRA supported use of 115-pound rail, but Guilford

4/ The remainder of the 114-mile line between Boston and Portland is owned by the Massachusetts Bay Transportation Authority.

demanded 132-pound rail. Amtrak submitted the dispute to the Board, which ruled in its Rail Weight/Speed Decision that 115-pound rail was appropriate for Amtrak operations at 79 miles per hour if the rail line was "rehabilitated and maintained to a standard that produces track modulus (k) values of not less than 2,750 lb/in² and that otherwise satisfies the FRA's track safety standards for rail passenger train operation up to such speeds." Id. at 9.

Third, when the rehabilitation was nearing completion but Guilford refused to permit Amtrak and NNEPRA to conduct track modulus testing on the Plaistow-Portland line to determine whether the track modulus required by the Board had been achieved, Amtrak sought an order from the Board granting such access and clarifying certain issues as to which there was disagreement with Guilford. The Board ordered Guilford to grant Amtrak and NNEPRA access to the line to conduct track modulus testing, ruled that the testing proposed by Amtrak and NNEPRA - using the Track Loading Vehicle developed by TTCI - was appropriate, and held that repeat track modulus testing would not be required once an adequate track modulus was demonstrated. STB Finance Docket No. 33697, National Railroad Passenger Corporation - Petition for Declaratory Order - Weight of Rail (served June 29, 2001) ("Rail Weight/Speed Clarification Decision").

Now, Amtrak is forced to come to the Board again, because Guilford refuses to accept the results of the track modulus testing conducted by TTCI. The TTCI testing found that the average track modulus of the Plaistow-Portland line is 5,346 lb/in² - almost twice the threshold level established by the Board in the Rail Weight/Speed Decision - and that the track modulus of 99.95% of the line exceeds the Board's 2,750 lb/in² standard. 5/ Nevertheless, Guilford refuses to allow Amtrak to operate at the 79 miles-per-hour speed that the Board approved in the Rail Weight/Speed Decision, insisting that Amtrak's maximum speed may not exceed 60 miles per hour. To permit implementation of the Board's earlier rulings in the Rail Weight/Speed Decision and the Rail Weight/Speed Clarification Decision, Amtrak seeks further clarification that the track modulus testing of the Plaistow-Portland line satisfied the Board's requirements, and that Amtrak may operate its passenger trains at speeds up to 79 miles per hour. 6/

5/ The only significant exception relates to a single, short stretch of track (less than one-fifth of a mile in the area of Kennebunk, ME) where track modulus below the Board's benchmark appears to be indicative of underlying track support problems. As explained below, Amtrak will operate at 30 miles per hour in this area until the problems are corrected.

6/ On March 4, 2002, NNEPRA wrote to Guilford forwarding a speed table which set forth by track segment the speeds up to 79

(ii) Rehabilitation of the Plaistow-
Portland Line To Support 79
Miles-Per-Hour Amtrak Operations

Amtrak, NNEPRA and Guilford entered into an agreement effective January 6, 1999 (the "Class 4 Rehabilitation Agreement") in which they agreed upon the scope of work necessary to upgrade the Plaistow-Portland line to FRA Class 4 standards, with the single exception of the required weight of rail (which the parties agreed to submit to the Board for resolution). 7/

[Footnote continued]

miles per hour at which Amtrak proposes to operate over the Plaistow-Portland line in light of the findings in the TTCI Report. See Murray V.S. at 16 & Att. 25. As explained in Part III of the Argument below, this speed table sets forth the speeds which Amtrak requests the Board to approve and to order Guilford to permit.

7/ See Murray V.S., Att. 1. As provided in the Class 4 Rehabilitation Agreement,

Amtrak and NNEPRA wish to amend the Rehabilitation Agreement and the Terms and Conditions to provide for the operation of Amtrak trains at speeds up to 79 miles per hour (FRA Class 4) as set forth in the revised Appendix I attached hereto. Amtrak, NNEPRA and Railroad have already agreed upon certain changes to the Scope of Work, jointly acknowledged to be appropriate to permit the safe, consistent and continuous operation of Amtrak trains at these higher speeds. Amtrak, NNEPRA and Railroad have been unable, however, to reach agreement on one final issue [i.e., the rail weight issue].

Id. at 2 (emphasis added).

As ultimately implemented, rehabilitation work on the line cost NNEPRA some \$54 million - \$10 million more work than the parties had agreed in the Class 4 Rehabilitation Agreement was necessary to meet FRA Class 4 standards, 8/ and nearly \$15 million more than would have been required to satisfy FRA Class 3 standards (that would permit 60 miles-per-hour passenger operations). See Murray V.S. at 4-5. The objective of this large expenditure of public funds was to make it possible to restore successful passenger rail service between Portland, ME and Boston, MA.

In refusing to allow Amtrak to operate at the Class 4 speeds (up to 79 miles-per-hour) for which the Plaistow-Portland line has been rehabilitated, Guilford is impeding full realization of this objective.

8/ This supplemental work included the installation of some 109,000 new mainline ties (approximately 1,400 ties per mile), almost 40 percent more ties than specified under the Class 4 Rehabilitation Agreement. It also included making two surfacing passes on the mainline, and installing 190,000 tons of ballast (more than 2,000 tons per mile) - almost twice the ballast called for under the Class 4 Rehabilitation Agreement. See Murray V.S. at 5.

(iii) Initiation of Amtrak Service on
Extensively Rehabilitated Plaistow-
Portland Line

Amtrak initiated passenger train operations between Portland and Boston (including operations over Guilford's Plaistow-Portland line) on December 15, 2001. With four round-trip trains a day and an average daily ridership of 790 passengers, this Amtrak service has been well received by the travelling public and is obviously fulfilling a critical public need. 9/ See Murray V.S. at 6.

However, the service is not as good as it should - and could - be in light of the expenditure of more than \$50 million of public funds to rehabilitate Guilford's Plaistow-Portland line. The rehabilitation work done on the line was designed to support FRA Class 4 operating speeds, so as to permit Amtrak's trains to travel at speeds up to 79 miles per hour, but Guilford prevents Amtrak's trains from operating faster than 60 miles per hour. This difference in maximum speeds is material.

Operating at a top speed of 79 miles per hour, Amtrak's trains would have a two and one half hour running time between

9/ At the outset, the Amtrak trains operated with three passenger cars and one café car, but ridership demand has been so great that at times a fourth (and even a fifth) passenger car has been added to some of the trains. See Murray V.S. at 6.

Portland and Boston; by contrast, constrained by their current top speed of 60 miles per hour, Amtrak's trains have a Portland-Boston running time of two hours and forty-five minutes. Testimony submitted by Amtrak earlier in this proceeding explains that a twelve-minute reduction in running time will make the Amtrak service more competitive with highway driving times, and projects that it would translate into 38,000 more passengers each year (or more than 100 additional riders per day) and some \$450,000 in additional operating revenues per year for NNEPRA. 10/ A fifteen-minute reduction in running time would be even more beneficial. See Murray V.S. at 7. Indeed, Guilford has conceded that the service will not be competitive unless operated at 79 miles-per-hour speeds. 11/

10/ See Bagley V.S. at 3-4 (filed as part of Amtrak's Opening Brief and Evidence (Apr. 2, 1999)).

11/ When Guilford sought to operate the Portland-Boston service itself, it asserted that "79 miles per hour passenger speeds [are] necessary for the proposed service to remain competitive." Springfield Terminal Railway Company Passenger Service Proposal for Maine, New Hampshire & Massachusetts, Nov. 1991, p. 8 (Exhibit 2 of the "Chronology Exhibits" that Guilford filed with the Board on March 26, 1997 in connection with its motion for summary judgment in STB Finance Docket No. 33381, Application of National Railroad Passenger Corp. under 49 U.S.C. 24308(a) - Springfield Terminal Ry., et al.) (emphasis added) ("STB Finance Docket No. 33381").

In light of these considerations, it is not surprising that Amtrak and NNEPRA seek authority to conduct 79 miles-per-hour Amtrak operations over Guilford's Plaistow-Portland line. Guilford's refusal to accept the results of the track modulus testing is the only impediment to this objective.

(iv) Track Modulus Testing and Related Dispute

On behalf of Amtrak and NNEPRA, TTCI conducted track modulus testing of Guilford's Plaistow-Portland line from September 26 to September 29, 2001, and from November 28 to November 30, 2001. On an ongoing basis, Amtrak and NNEPRA shared with Guilford information related to the planning for this testing and, as the testing was being conducted, data being generated through the testing. Guilford representatives were present throughout the TTCI testing, and their input was solicited during the course of testing. See Staplin V.S. at 7-8. Murray V.S. at 8-12 & Att. 1-14.

On January 10, 2002, TTCI issued its Report, entitled "Vertical Track Deflection Measurements Using the TLV, P-02-001, for Northern New England Passenger Rail Authority." As explained in the Report, TTCI found among other things that the average track modulus of the Plaistow-Portland line is 5,346 lb/in² and that 99.95% of the line has a track modulus greater than 2,750

lb/in², the minimum set by the Board to permit Amtrak 79 miles-per-hour operations. See Read V.S., Ex. 2 at 12-13. NNEPRA supplied Guilford with a copy of the report as soon as it was received. See Murray V.S. at 12-13.

Based on the TTCI Report, NNEPRA advised Guilford that Amtrak and NNEPRA considered the Board's requirements for increasing Amtrak's operating speeds from 60 miles per hour to 79 miles per hour to have been satisfied. Id. at 12-13 & Att. 15. NNEPRA also provided Guilford with a speed table which set forth by track segment the speeds up to 79 miles per hour at which Amtrak proposes to operate over the Plaistow-Portland line. Id. at 15-16 & Att. 25.

On March 7, 2002, the parties met at Guilford's headquarters. Amtrak and NNEPRA (along with TTCI, which participated by conference telephone) discussed with Guilford the TTCI Report and their assessment that the Report's track modulus findings strongly support 79-miles-hour Amtrak operations. Guilford took issue with the findings of the TTCI Report and the views expressed by Amtrak and NNEPRA, and advised that it would not permit 79 miles-per-hour Amtrak speeds over its line. Id. at 16.

Follow-up correspondence between the parties confirmed that Guilford will not permit 79 miles-per-hour operations over

the Plaistow-Portland line, despite the findings in the TTCI Report. Id. at 16-18 & Att. 26-28.

PROPOSED PROCEDURAL SCHEDULE

Amtrak proposes that the Board adopt a procedural schedule to govern this proceeding comparable to that employed in last year's reconsideration proceeding. It would entail the following:

- Guilford's reply would be due 45 days from the date the Board serves its procedural schedule governing the case.
- Amtrak's rebuttal would be due 15 days after Guilford files its reply.
- FRA would be requested to provide analysis and comment on the parties' filings 10 days after Amtrak files its rebuttal.

Amtrak is requesting that the Board give this matter expedited consideration. 12/ Amtrak and NNEPRA have been in an ongoing dispute with Guilford over Amtrak operating speeds for

12/ Pursuant to 49 U.S.C. § 24308(a)(2)(C), the Board is to decide an access dispute within 90 days after Amtrak submits the dispute. Amtrak is not seeking specific adherence to a 90-day schedule here, in that the instant motion combines elements of an access petition with a clarification request, the latter not being subject to a statutory schedule.

some three years. Despite two Board decisions in that time which have laid the groundwork for implementing the 79 miles-per-hour speeds for which the Plaistow-Portland line has been rehabilitated, and the TTCI Report which concludes that the line satisfies the Board's track modulus standard, Guilford continues to refuse Amtrak the right to operate at these speeds.

Through this proceeding, Amtrak hopes to bring an end to this long-running dispute, and to obtain explicit authority permitting Amtrak operations at speeds up to 79 miles per hour. If Amtrak were permitted by the Board to introduce this faster service before the Summer months are ended, it would have an opportunity to promote the service at a time when both business and leisure travel are likely to be at a high. This would be an ideal time to capitalize on the opportunity to expand Amtrak's ridership base, thereby improving the financial performance of the service and enhancing the public benefits of increased train (as opposed to highway) travel.

* * * *

In the argument that follows, Amtrak explains first that the methodology TTCI employed in analyzing the track modulus of the Plaistow-Portland line was appropriate and consistent with the Board's prior approval of that methodology; second, that the conclusions reached by TTCI in its Report are sound and strongly

support Amtrak operations over the line at speeds up to 79 miles per hour; and third, that other compelling evidence supports Board approval of Amtrak operations at these speeds.

ARGUMENT

I. TTCI'S USE OF THE TLV TO TEST THE TRACK MODULUS OF GUILFORD'S PLAISTOW-PORTLAND LINE WAS APPROPRIATE AND CONSISTENT WITH THE BOARD'S PRIOR APPROVAL

Track modulus is a measure of the firmness of the support underlying railroad track. Its principal use is in track design. It is not normally considered in track maintenance or inspections. Track modulus is not a safety criterion and therefore there is no FRA standard that track modulus must satisfy. See Cunningham V.S. at 3, 6-7; Staplin V.S. at 22-23. See also FRA Comments at 2 (filed June 8, 2001 in last year's proceeding) (track modulus "is not a safety indicator").

In the Rail Weight/Speed Decision, the Board required that the track modulus of the Plaistow-Portland line be tested after completion of the rehabilitation in order to confirm that the track had been successfully rehabilitated for 79 mile-per-hour passenger operations.

In last year's Rail Weight/Speed Clarification Decision, Amtrak submitted evidence describing how TTCI planned to utilize the TLV in testing the track modulus of Guilford's Plaistow-Portland line. Amtrak explained that the TLV was

uniquely suited to assess whether the \$54 million of rehabilitation work on Guilford's Plaistow-Portland line had established an adequate track modulus on the line to support 79 miles-per-hour Amtrak operating speeds, where the Board had held that a track modulus of at least 2,750 lb/in² would be required.

Rejecting Guilford's various challenges to TTCI's planned use of the TLV, the Board agreed with FRA (and Amtrak) that "[t]he TLV is . . . a state-of-the-art vehicle for applying vertical and lateral loads to the track structure and measuring any deflections in the track structure as a result of the applied loads.'" Id. at 4. The Board also agreed with FRA that "the test procedure that Amtrak has proposed 'is both reasonable and practical, [and it] should provide sufficient data to evaluate the average or nominal track modulus along the Plaistow-Portland Line following rehabilitation.'" 13/ Id.

13/ The Board quoted FRA's description of the TTCI testing methodology:

Moving at slow speeds (10 miles per hour) will enable the TTCI engineers to establish relative track deflection measurements which should correlate well with deflection measurements obtained through a static test. In situations in which vertical loads are constant and the rail section does not vary, track deflection measurements can be used as a surrogate measurement of track modulus due to their close relationship. Areas where changes in track deflection measurements would indicate a lower than average track

In so finding, the Board properly recognized the unique capabilities of TTCI's TLV. Until the TLV's recent development, it was not practical to measure track modulus over the length of a rail line, because this would require prohibitively time-consuming and expensive static tests at a multitude of locations all along the line. Indeed, track modulus - which is a design standard and not a safety standard - was rarely measured in the field, except for research or other special purposes at selected locations. Railroads do not rely on track modulus measurements to assess underlying track support, but rather depend on visual inspections of track and on track geometry readings. See Staplin V.S. at 4-5; Cunningham V.S. at 4-5.

TTCI's TLV for the first time makes it possible accurately to determine track modulus for the entire length of a rail line. As described below, it does this by (1) taking moving measurements of relative vertical track deflection, (2) taking

[Footnote continued]

modulus would be flagged and then tested statically to confirm the track modulus value.

Rail Weight/Speed Clarification Decision at 4, n.8.

static measurements of absolute vertical track deflection at selected locations and then by calculating the static track modulus associated with each such static deflection measurement, and (3) relating the static track modulus calculations back to the moving relative deflection measurements through a regression analysis to determine whether the latter are a reliable indicator of the former. If it determines that relative rail deflection measurements are a reliable indicator of track modulus (which it determined to be the case here), TTCI uses relative rail deflection data to determine track modulus over the entire length of the line. Id. at 5-6.

This is the methodology TTCI used in testing the Plaistow-Portland line on September 26-29 and November 28-30, 2001. Of course, more than a year passed between the TTCI testing proposal considered in the Board's Rail Weight/Speed Clarification Decision and the actual TTCI testing, and during that time TTCI's testing procedures evolved and improved. The discussion below describes first the steps TTCI employed in testing the Plaistow-Portland line, and then explains certain respects in which the testing methodology was updated from that described by Amtrak in last year's proceeding.

**A. TTCI CONDUCTED DETAILED DYNAMIC AND STATIC
TESTS ON THE PLAISTOW-PORTLAND LINE**

September 26-29 Testing. As explained in the accompanying verified statement of David Staplin, 14/ TTCI conducted its September 26-29, 2001 testing of the Plaistow-Portland line with the TLV in two phases - the first involving dynamic testing of the line's relative vertical deflection, and the second involving stationary testing of the line's absolute vertical deflection at select locations.

Throughout the testing, Phillip Brake, an Assistant Vice President - Engineering with Guilford, traveled on the TLV consist. In addition to Mr. Brake, Roger Bergeron, another Guilford Assistant Vice President - Engineering, also accompanied the TLV for a portion of the testing. Both Mr. Brake and Amtrak's consultant, Mr. Staplin, consulted regularly with the TLV personnel as they went about their testing activities.

14/ Mr. Staplin has over thirty years of experience in various facets of railway engineering, including having served as Amtrak's Chief Engineer from 1991 to 1994 and Executive Director of the American Railway Engineering and Maintenance of Way Association("AREMA") from 1995 to 1998. He is currently Director - Railroad Services with LTK Engineering Services. On Amtrak's and NNEPRA's behalf, Mr. Staplin was responsible for coordinating with TTCI regarding its planned testing of the Plaistow-Portland line, accompanying TTCI's TLV as it went about its test activities, providing guidance as to those locations where stationary deflection and track modulus testing should be conducted, and serving as a resource to TTCI as it prepared its Report. See Staplin V.S. at 1-4.

During the two days of dynamic track deflection testing, detailed deflection data was developed for the entire Plaistow-Portland line. Using this data, sites were selected for static track modulus testing, the objective being to measure a range of sample track support conditions ranging from soft to stiff.

Over the remaining two days of testing, a total of 56 static measurements were taken at 12 locations. TTCI intentionally tested different track features, such as highway crossings, bridges, and turnouts, to permit an assessment of whether track support varied significantly at these locations.

TTCI was unable to conduct all the desired static track modulus tests during the allotted two-day period, so NNEPRA made arrangements to have the TLV return to the line for follow-up testing. See Murray V.S. at 10 & Ex. 6.

November 28-30, 2001 Testing. TTCI's follow-up testing was performed from November 28 to November 30, 2001, as described in detail in Mr. Staplin's verified statement. Once again, Mr. Staplin traveled with the TLV as it went about performing the supplemental testing, as did Guilford's Phillip Brake.

On the first day of testing, TTCI repeated the dynamic relative deflection testing over a portion of the Plaistow-Portland line. TTCI advised Mr. Staplin that the deflection data generated during this testing coincided with the deflection data

generated during the September dynamic testing, confirming that the TLV was consistently analyzing the line's track support.

Following this dynamic testing, two days of static track deflection testing were conducted on the line. A total of 28 locations were tested, with between 3 and 9 individual track deflection measurements being done at each location. Based on discussions between Mr. Staplin and TTCI and data developed by TTCI (described below), these locations had been pre-selected before the November testing began, and the test plan identifying these locations had been shared with Guilford. See Murray V.S. at 11-12 & Att. 9 & 12-13.

To assist in identifying locations for November static testing, TTCI performed a regression analysis using the September data it had developed. Comparing the relative deflection data with the static track modulus test results from the 12 locations that were tested, TTCI determined that there was a high statistical correlation between the two. The analysis demonstrated that locations with deflection greater than 0.28 inches could be expected to have a track modulus less than 2,750 lb/in², among other things confirming the appropriateness of using a deflection limit of 0.28 inches during the September testing to identify locations for potential static testing. (As discussed below, TTCI refined this regression analysis in its Report.)

In creating the list of locations where static track modulus tests would be performed in November, TTCI and Mr. Staplin agreed that testing would be conducted in the area of certain locations with deflection greater than 0.28 inches. In addition, they included other locations for static testing where the deflection data showed that the locations had a range of support characteristics, including some locations evidencing very strong support characteristics. They also included locations for static testing where support characteristics might be influenced by particular track or civil features (such as being located at a bridge approach or at a highway crossing).

As discussed in Part II below, the data developed through this static testing was then integrated into TTCI's Report.

**B. TTCI'S TESTING REFLECTED CERTAIN
IMPROVEMENTS IN ITS METHODOLOGY**

As discussed in the accompanying verified statement of Steven M. Chrismer, 15/ there are certain respects in which TTCI

15/ Dr. Chrismer worked for sixteen years as a research engineer at the AAR and its subsidiary TTCI. Before his departure in 1998 to join LTK Engineering Services, his work concentrated on developing methods to determine track strength and characterization of track substructure support, and he was extensively involved in modifying the TLV to make it capable of assessing vertical track support on a continuous basis. He has closely followed development of the TLV's vertical track support assessment capabilities since leaving AAR/TTCI. See Chrismer V.S. at 1-2.

refined and improved its testing methodology from that addressed by the parties, and considered by the Board, in last year's clarification proceeding. These changes served to enhance the accuracy and reliability of the test results achieved, and conclusions reached, by TTCI. Furthermore, through such refinements and improvements, TTCI assured that the TLV continued to be the "state-of-the-art" vehicle to which the Board referred in its Rail Weight/Speed Clarification Decision.

Miscellaneous Methodology Improvements. When TTCI conducted its September 26-29, 2001 testing of the Plaistow-Portland line, it did so pursuant to a September 25, 2000 agreement with NNEPRA (i.e., an agreement entered into approximately one year before the testing was conducted). ^{16/} As noted above, and as specified in the September 25, 2000 agreement, testing of the line was to be conducted in two phases

^{16/} See Murray V.S. at 8-9 & Att. 4. Although the September 25, 2000 agreement undertook to describe how the testing would be performed, in certain respects this description had become outdated by the time the testing took place a year later. The supplemental agreement entered into between TTCI and NNEPRA on November 26, 2001, to govern the November 28-30 testing of the line, provided an accurate description of the testing methodology employed by TTCI in both its September and November testing (except that it mistakenly referred to the initial output of TTCI's dynamic testing as being based upon a 5-foot moving average of data, when in fact in both the September and November testing, it was based upon a 2-foot moving average of data). Id. at 12 & Att. 13; Chrismer V.S. at 4, n.2.

using TTCI's TLV - the first involving dynamic testing of the line's vertical track deflection, and the second involving stationary testing of the line's vertical track deflection and track modulus at select locations.

The agreement described first the dynamic testing phase, and then the static testing phase:

The TLV will be used to continuously measure the rail deflection of the track at a speed of 10 mph. The applied vertical load will be 30,000 lb. Data from both the TLV and the tank car will be digitally sampled at 20 samples-per-second which equates to a data point taken every 9 inches at 10 mph. A moving 25-foot average (34 data points) is then calculated as the final data output.

Markers will be placed in the data to represents [sic] mileposts, turnouts, bridges, grade crossings and other track features. . . . The data will be plotted as rail deflection as a function of track distance. Milepost and track feature markers will also be included in the plots.

In the second (stationary testing) phase, [t]he deflection data will be examined and stationary measurements will be performed at those locations where the largest rail deflections were measured. It is anticipated that 20 - 40 stationary measurements will be performed and that the effort will take one day. Track modulus will be calculated from the stationary deflection data based on the track stiffness between 10,000 lb. and 30,000 lb. The stationary measurements based on [sic] should be an acceptable indicator of the minimum track modulus for the line.

See Murray V.S., Att. 4.

Although this two-phase testing approach was implemented by TTCI during its September 26-29 and November 28-30 testing of the Plaistow-Portland line, certain of the testing parameters described in the year-old agreement were modified.

For example, in the dynamic testing phase, a vertical load of 40,000 pounds was employed in lieu of the 30,000 pounds described in the agreement, and also in lieu of the 33,000 pounds which during the clarification proceeding last year all parties understood would be the applied vertical load. TTCI used the 40,000-pound load because that weight better represents the upper loading range of a freight car movement taking into account the moving car's dynamic effects on track and underlying support structure (as discussed below, TTCI's use of this heavier load required modification of the 0.25-inch deflection benchmark to 0.28 inches). 17/

In addition, although the final data output of the dynamic test phase was a 25-foot moving average (discussed in greater detail below), through improvements in the TLV the underlying data upon which this average was based was more refined than originally contemplated. Deflection data was digitally sampled at 100 samples-per-second (not 20 samples-per-

17/ The upper loading range of a passenger car would be substantially lighter than that of a freight car. It would not afford as accurate an assessment of vertical track deflection where a mix of freight and passenger traffic moves over the subject line, as is the case of the Plaistow-Portland line.

second) and a 2-foot moving average was calculated, which in turn was translated into the 25-foot moving average.

With respect to the static testing performed by TTCI, track modulus was not calculated from the stationary deflection data based on the track stiffness between 10,000 pounds and 30,000 pounds, but rather between 10,000 pounds and 33,000 pounds. During last year's reconsideration proceedings, the parties were aware of this change, and both sides submitted evidence as to how deflection and track modulus should be measured under application of a 33,000-pound static wheel load. See Chrismer V.S. at 5-7.

TLV Paint Spray System. The September 25, 2000 agreement makes no mention of the paint spray system integrated into the TLV, a system which Amtrak's consultant Mr. Chrismer described in a statement filed in last year's clarification proceeding as placing a paint spot at each location on the line where a pre-established benchmark for dynamic track deflection was exceeded. As noted above and explained in the November 26, 2001 agreement, the TLV paint spray system was modified so that it applied a paint spot at each location on the line where a proprietary TTCI measurement called the Vertical Strength Index ("VSI") was exceeded. See Murray V.S., Att. 13 at 3.

In application, the VSI benchmark tends to be triggered where there are significant variations in detected track support. Accordingly, although the VSI benchmark and the vertical track

deflection benchmark are not always triggered by the same track support conditions, in many cases they are and the VSI paint spot will mark a location where the deflection benchmark has been exceeded. 18/ See Chrismer V.S. at 7-8.

Deflection Limit Used in Testing. In conducting its dynamic deflection tests of the line, the TLV used a 0.28-inch deflection limit to identify locations for potential stationary track modulus testing, rather than the 0.25-inch limit that was originally contemplated. The reason for this change is that, as originally planned, deflection was to be measured under a vertical wheel load of 33,000 pounds. But, as described above, the testing ultimately conducted measured deflection under a vertical wheel load of 40,000 pounds, an increase in load that required a related increase in the deflection limit. See Chrismer V.S. at 9-12.

Use of Regression Analysis. As discussed in Part II below, TTCI employed regression analysis to correlate the static track modulus of each location tested with the maximum relative deflection value recorded at that location. This regression analysis permitted TTCI to determine that a relative deflection

18/ During the September testing, the paint spotting system malfunctioned, and only some locations were marked. The malfunction was corrected for the November testing. TTCI was able to obtain the data needed for its analysis despite the malfunction. See Staplin V.S. at 9, 11.

measurement greater than 0.27 inches is indicative of a track modulus less than 2,750 lb/in².

When TTCI submitted its early testing proposal to NNEPRA in September 2000, it had not worked out the role that regression analysis would play in its overall testing approach. However, TTCI's ultimate use of this analysis, both on an interim basis using September 26-29 test data and in its final Report combining the September test data with the November 28-30 test data, permitted it to assess with confidence the track modulus of the Plaistow-Portland line as a whole and to identify the handful of locations (each involving only a few feet of track) where track modulus was marginally below the Board's 2,750 lb/in² standard. See Chrismer V.S. at 12-17.

II. THE CONCLUSIONS REACHED IN THE TTCI REPORT ARE SOUND AND STRONGLY SUPPORT AMTRAK 79 MILES-PER-HOUR OPERATIONS

The TTCI Report, dated January 10, 2002, sets forth TTCI's findings based on the testing it conducted on the Plaistow-Portland line during the preceding September and November. See Read V.S., Att. 2.

Using the results of the September and November tests, TTCI found that the Plaistow-Portland line has an average track modulus value of 5,346 lb/in², and that only 166 feet of the 355,186 feet of track over which Amtrak seeks to operate at

speeds greater than 60 miles per hour - that is, less than 0.05 percent - has a track modulus equal to or less than 2,750 lb/in². Of this 166 feet of track, 107 feet are concentrated in less than one-fifth of a mile between milepost 220.74 and milepost 220.93 (in the area of Kennebunk, ME).

As explained in the TTCI Report and elaborated upon by Mr. Staplin in his accompanying verified statement, TTCI based its findings on a three-step analysis.

First, TTCI began with the static deflection and track modulus measurements performed at 40 locations during the September and November tests. At each of these locations, between 3 and 9 individual measurements were made.

Second, TTCI used regression analysis to establish the relationship between the dynamic deflection data collected by the TLV in September, 19/ on the one hand, and the static deflection and track modulus data developed in September and November, on the other.

19/ The September dynamic deflection data was used because it was developed in a single run of the TLV consist from Portland to Plaistow, and the significant rainfall prior to the test run served to enhance the quality of the test results. The dynamic deflection data collected in November over part of the line conformed to the corresponding data collected in September, so consideration of the November data would not have produced different results. See Staplin V.S. at 7, 16-17.

TTCI began its regression analysis by determining the dynamic deflection data that coincided with the static deflection values measured at each location. In doing this, TTCI correlated (i) the static measurement with the highest deflection at each location with (ii) the maximum dynamic deflection at that location.

TTCI next calculated the track modulus derived from the static measurement with the highest deflection at each location. TTCI then plotted static track modulus values as a function of TLV-derived dynamic deflection data, separately plotting the track modulus values calculated from September and November data. It determined that there was no significant difference between the two sets of track modulus values in terms of the correlation they support.

Analyzing the statistical relationship of the data, termed the coefficient of determination or " r^2 ", TTCI found that the data had an r^2 of 0.821. This coefficient of determination indicates that dynamic track deflection data, as measured by the TLV, is a very reliable indicator of static track modulus. Under

TTCI's analysis, a dynamic track deflection of 0.274 inches is equivalent to a track modulus of 2,750 lb/in². 20/

Third, TTCI converted the dynamic deflection data developed in September into a 25-foot moving average of such data, and identified locations reflected in that moving average where deflection was equal to or greater than 0.27 inches and hence track modulus would be expected to be equal to or less than 2,750 lb/in². TTCI used 0.27 inches rather than the 0.274 inches supported by its regression analysis to be conservative and also to account for the fact that the TLV measurement system does not have the accuracy to resolve deflection data of less than 0.01 inches (absent this adjustment, a relative deflection reading of 0.27 inches would equate to a track modulus of 2,796 lb/in²).

20/ As explained above, prior to the September testing, it was estimated that a dynamic deflection of 0.28 inches equated to a track modulus of 2,750 lb/in². This was before data had been gathered which permitted the preliminary regression analysis TTCI performed after the September testing. This preliminary regression analysis supported continued use of 0.28 inches. The 0.274 inch figure produced by the final analysis confirms the reliability of the September and November testing done by TTCI, which used dynamic deflection data greater than 0.28 inches to indicate candidate locations for static testing. That testing would not have been performed any differently if the 0.274-inch figure had been used in lieu of the 0.28-inch figure. See Staplin V.S. at 18, n.4.

The 25-foot moving average of dynamic deflection data was used because it was considered to be the absolute minimum length of track appropriate for assessing basic track support conditions. Normally, weakness in track support conditions requires attention only when it appears over distances of several hundred feet, and typically such weakness is associated with the influence of certain soil types or geologic formations. The problems with track support at Kennebunk, ME (discussed below) fall into this category. Accordingly, TTCI's use of a 25-foot moving average of deflection data is quite conservative. 21/ See Staplin V.S. at 19-20; Chrismer V.S. at 19.

Based on the data it developed, TTCI determined that the track had an average track modulus of 5,346 lb/in² and a median track modulus of 5,258 lb/in². 22/ It also determined that only 166 feet of the 355,186 feet of track that it tested had a track modulus equal to or less than 2,750 lb/in². TTCI

21/ In addition, a normal rail car moving over a line depresses approximately 25 feet of track under each truck. Thus, using a 25-foot moving average of data permitted TTCI to capture the effects of a car on a particular segment of track. See Staplin V.S. at 20; Chrismer V.S. at 19.

22/ The high track modulus value for this fully-rehabilitated rail line reflects the fact that the line enjoys a superior support medium due to the glacial moraine subsoil, made up of sand, gravel, and boulders. See Cunningham V.S. at 3. See also Rekola V.S. at 2-4 (filed with Amtrak's Reply Brief and Evidence (Apr. 22, 1999) in an earlier phase of this proceeding).

lists each location where this occurs (p. 15), and provides in Appendix A a series of charts which depict by milepost the relative dynamic deflection which the TLV measured over those portions of the Plaistow-Portland line where Amtrak seeks to operate at greater than 60 miles per hour.

TTCI identifies 14 locations where dynamic track deflection is equal to or greater than 0.27 inches and track modulus thus would be expected to be equal to or less than 2,750 lb/in². Of these locations, seven are in the Kennebunk, ME area (milepost 220.74 to milepost 220.93), accounting for a total of 107 feet of track. 23/ Amtrak and NNEPRA are aware of track support problems in this area attributable to the clay subsurface and poor drainage. Indeed, no static testing was done in the area because these problems had already been identified. Drainage and other work has been done in the area to correct the problem, but until it is confirmed that no further work is required and that the track meets Federal Railroad Administration Class 4 standards (these standards are not based on any consideration of track modulus), Amtrak proposes to operate over this track at a maximum speed of 30 miles per hour.

As to the seven other locations, they are significantly different from the Kennebunk locations, which together encompass

23/ In fact, two of the seven locations - MP 220.74 and MP 220.92 - have a satisfactory track modulus of 2,796 lb/in² (conservatively reduced by TTCI to 2,750 lb/in²).

an extended track segment with support problems. Each of these other locations, found at isolated places on the Plaistow-Portland line, is at most only modestly below the Board's track modulus benchmark of 2,750 lb/in², and each extends for only a very short distance (ranging from two feet to 18 feet). 24/

As noted above, one location (MP 205.45) has a satisfactory track modulus of 2,796 lb/in² (conservatively reduced by TTCI to 2,750 lb/in²). At two other locations (MP 213.24 and MP 272.89) - each of which has a track modulus of 2,676 lb/in² - Amtrak will operate at 60 miles per hour rather than 79 miles per hour based on operating considerations unrelated to track modulus, and hence there is no track modulus issue. With respect to the remaining four locations - three of which have a track modulus of 2,676 lb/in² and the other of which has a track modulus of 2,462 lb/in² (MP 241.02) - these modulus

24/ TTCI conducted a static track modulus test at or in the general vicinity of each of these seven locations, with the exception of MP 205.45 (this location had a track deflection of 0.27, and hence had a satisfactory track modulus of 2,796 lb/in²). The static track modulus results obtained through this testing were based on data at a single, isolated spot. By contrast, the track modulus ascribed to a location by TTCI based on dynamic deflection data was based on a twenty-five-foot average of measurements. The former, single-point test results are not indicative of underlying substructure support, whereas the results obtained using the twenty-five-foot average data does afford a reliable assessment of such support. See Staplin V.S. at 21, n.6; Chrismer V.S. at 17-22.

measurements are not indicative of any significant systemic support problems at these locations.

In these circumstances, there is no justification for limiting Amtrak's speeds at these four locations. Certainly, there is no safety issue raised by the track modulus results at these locations. Track modulus is not a safety standard. Rather, it is a concept employed in the design of a rail line; because inadequate track support can lead to increased maintenance costs, railroads seek to construct rail lines with adequate track support (i.e., track modulus).

The data related to these four locations reveals that they do not suffer from material track support problems. Rather, their track modulus is very close to the Board's standard, and the slight departure from that standard is isolated to a few feet. In these circumstances, the Board can have confidence that the track will satisfactorily support 79 miles-per-hour Amtrak operations. See Staplin V.S. at 18-24; Chrismer V.S. at 17-22.

As explained in Part III below, there are additional reasons why the Board should approve Amtrak operations at speeds up to 79 miles per hour over the Plaistow-Portland line.

III. OTHER INSPECTIONS CONFIRM THAT THE REHABILITATED LINE IS SUITABLE FOR 79 MILES-PER-HOUR AMTRAK OPERATING SPEEDS

In addition to the state-of-the-art TLV inspection of the Plaistow-Portland line, other inspections confirm that the

line has been successfully rehabilitated and is suitable for 79-miles-per-hour passenger operation.

As discussed in Part I above, track modulus is a theoretical construct in the design of rail lines, but it is not used in the process of inspecting and maintaining rail lines. Until the development of the TLV, it was prohibitively expensive for railroads to measure track modulus over the length of a rail line. When track modulus was measured, for research or other special purposes, static tests were used, which could measure the track modulus only at discrete locations on a line.

To determine whether track has sufficient support, railroads rely, not on measurements of track modulus, but on periodic visual inspections by experienced railroad maintenance personnel, and on mechanized inspections using a track geometry car. Through such inspections, railroads are able to identify track segments that require maintenance to improve track support.

As described in the accompanying verified statement of John J. Cunningham, Amtrak's Chief Engineer for Policy, Planning, and Standards, 25/ Amtrak performed a visual inspection and a

25/ Mr. Cunningham has spent 40 years in the railroad industry, the last 35 of which have been in maintenance-of-way positions. In his present position he is responsible for overseeing Amtrak's technical standards for track construction, track maintenance and track safety, and for developing Amtrak's capital program for

track geometry car inspection of the entire line from Plaistow to Portland in June and July 2001, after the rehabilitation of the line was substantially complete. These inspections showed that the line was suitable for passenger operations at the speeds proposed by Amtrak.

The visual inspection was made by Conrad Ruppert, Amtrak's Division Engineer, on June 27, 2001, using a hi-rail vehicle. Mr. Ruppert traveled the length of the rehabilitated line, observing conditions and stopping to make more detailed inspections where appropriate. Other than the track support problems in the vicinity of Kennebunk, ME, he concluded that the condition of the line was suitable for Amtrak's proposed operations at speeds up to 79 mph. See Cunningham V.S. at 7.

The track geometry car inspection of the Plaistow-Portland line was made on July 8-9, 2001. A track geometry car uses a non-contact inertial measurement system to inspect the gage, alignment, cross-level, and other parameters of track. Such an inspection does not directly measure track modulus, but

[Footnote continued]

track construction and rehabilitation. He is a former member of the Board of Directors of AREMA, formerly the American Railway Engineering Association, and is a member of AREMA Committee 12 (Passenger & Commuter) and AREMA Committee 17 (High Speed Rail).

inadequate track support results in frequent deficiencies in these track geometry parameters, which will be detected by the track geometry car. Amtrak has developed a special track geometry car, which is capable of conducting tests while operating at the rear of a train at speeds of up to 125 miles per hour. The test of the Plaistow-Portland line was conducted at speeds of up to 60 miles per hour; the inspections of the main tracks was completed in one day and the sidings were tested on the return trip the following day.

This inspection showed that the rehabilitated track has satisfactory gage, alignment, and cross-level to satisfy FRA standards for passenger operations at the speeds at which Amtrak proposes to operate. Like the visual inspection, the track geometry car inspection showed problems in the Kennebunk area that require a speed restriction until the support problems there are corrected. See Cunningham V.S. at 7-9.

Another inspection of the rehabilitated line was made by Amtrak's consultant, Mr. Staplin. Mr. Staplin became thoroughly familiar with the condition of the Plaistow-Portland line through his participation in TTCI's September and November 2001 inspections of the line with its TLV equipment, including both the dynamic measurements and the static measurements of rail deflection. Based on this knowledge and on his 30 years of

railroad experience, he was able to evaluate what the TLV measurements meant in terms of the quality of the track at each location.

Mr. Staplin recently supplemented this knowledge of the track conditions by riding in the cab of an Amtrak locomotive on a regular Downeaster passenger train between Plaistow and Portland. As Mr. Staplin explains in his verified statement, a locomotive cab is a good place to observe and assess track quality because the locomotive is the heaviest vehicle in a passenger train consist, and its suspension is not designed to enhance passenger comfort. See Staplin V.S. at 24.

Mr. Staplin found that the ride quality over the entire line was satisfactory, even at the locations where the TLV inspection indicated that there were short segments with inadequate track support. Mr. Staplin explains that this result was to be expected, because there are only very short stretches of track with sub-par support, and the track modulus at these locations is only modestly below the Board's standard. Id.

The inspections described by Mr. Cunningham and Mr. Staplin are the kinds of inspections that all railroads rely on to determine whether track conditions are suitable for their proposed operations. These inspections established that the

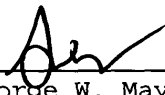
rehabilitated line between Plaistow and Portland is suitable for operation at the speeds proposed by Amtrak.

Amtrak has developed a detailed speed table which sets forth the speeds at which Amtrak proposes to operate over various segments of the Plaistow-Portland line. This speed table is appended to, and explained in, a March 4, 2002 letter NNEPRA sent to Guilford. See Murray V.S. at 15-16 & Att. 25. Amtrak requests that the Board, in connection with approving Amtrak operating speeds up to 79 miles per hour, also specifically approve the segment-specific speeds proposed by Amtrak, as detailed in this speed table.

CONCLUSION

For the reasons set forth above, Amtrak requests the Board to rule that in light of the findings in the TTCI Report and in conformity with the Amtrak speed table provided to Guilford, Amtrak shall be permitted to operate at speeds up to 79 miles per hour over Guilford's Plaistow-Portland line. Amtrak also requests that the Board adopt the procedural schedule it has suggested.

Respectfully submitted,


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April 12, 2002

CERTIFICATE OF SERVICE

I hereby certify that on this 12th day of April, 2002,
I caused to be served by the means indicated below a copy of the
foregoing National Railroad Passenger Corporation's Motion for
Further Clarification of the Board's October 22, 1999 Decision on
the following:

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George W. Mayo, Jr.

MURRAY

DC - 70989/100 - #116565 v.1

VERIFIED STATEMENT OF
MICHAEL J. MURRAY

My name is Michael J. Murray. I am Executive Director of the Northern New England Passenger Rail Authority ("NNEPRA"). My business address is 58 Fore Street, Building 30, Portland, Maine 04101.

NNEPRA is a body politic and corporate established by Maine statute in 1995 to promote rail passenger service between points in Maine and points within and outside the state. Its first priority, as established by the Maine legislature, is the restoration of rail passenger service between Portland, Maine and Boston, Massachusetts.

Professional Background and Prior Testimony

Throughout my more than thirty years in state government, I have been involved in rail transportation matters of importance to the State of Maine in one capacity or another. I graduated from the University of Maine at Orono in 1972 with a Bachelor of Science Degree in Civil Engineering. I am a Registered Professional Engineer in the State of Maine, and have served on the Rail Technical Committee for the Coalition of Northeastern Governors and as an advisor to the Maine Department of Transportation on matters relating to the implementation and

operational oversight of passenger rail initiatives within the State of Maine.

In preceding phases of this proceeding, I have provided verified statements which have been filed by the National Railroad Passenger Corporation ("Amtrak") as part of its Opening Brief and Evidence (Apr. 2, 1999) and its Motion for Testing Access and Clarification (Mar. 12, 2001). In my earlier verified statements, I have summarized the history of NNEPRA's and Amtrak's efforts to reestablish passenger rail service between Portland, Maine and Boston, described the NNEPRA-funded rehabilitation work which has been performed on the lines of the Springfield Terminal Railway Company, Boston & Maine Corporation, and Portland Terminal Company (collectively, "Guilford") between Portland and Plaistow, New Hampshire (the "Plaistow-Portland line"), and addressed NNEPRA's and Amtrak's efforts to obtain Guilford's agreement or absent that, Board authority, to conduct 79 miles-per-hour passenger operations over the Plaistow-Portland line.

In this statement, I address two basic subjects. First, I summarize the NNEPRA-financed rehabilitation work which has now been completed on the Plaistow-Portland line, and report on the status of Amtrak's current passenger operations over that line which commenced on December 15, 2001. Second, I discuss

dealings and communications among NNEPRA and Amtrak, on the one hand, and Guilford, on the other, with respect to (i) establishing 79 miles-per-hour Amtrak operations over the Plaistow-Portland line and (ii) conducting track deflection and track modulus testing on the line to confirm the appropriateness of operations at that speed.

A. Rehabilitation of the Plaistow-Portland Line and Initiation of Amtrak Operations

Rehabilitation Work. As of July 2001, rehabilitation work on the 78-mile Plaistow-Portland line was substantially completed, at a cost of approximately \$54 million. ^{1/} By agreement, NNEPRA provided the funding for this work, and Guilford actually performed the work. The purpose of the work was to bring the line up to FRA Class 4 standards and thereby support 79 miles-per-hour operations by Amtrak.

The parties entered into an agreement effective January 6, 1999 entitled "Agreement Among Northern New England Passenger Rail Authority, National Railroad Passenger Corporation, and Springfield Terminal Railway Company, Boston and Maine Corporation, and Portland Terminal Company Concerning Resolution of Disagreement Regarding Train Speeds" (the "Class 4

^{1/} The remainder of the 114-mile line between Boston and Portland is owned by the Massachusetts Bay Transportation Authority.

Rehabilitation Agreement") (see Attachment 1). In that agreement, the parties agreed upon the scope of work necessary to upgrade the Plaistow-Portland line to FRA Class 4 in all respects but one: the required weight of rail (which the parties agreed to submit to the Board for resolution, NNEPRA and Amtrak concluding that 115-pound rail was adequate, and Guilford claiming that 132-pound rail was required). 2/ The agreement also specified by line segment the speeds up to 79 miles per hour at which Amtrak would operate if the Board were to agree with NNEPRA and Amtrak that 115-pound rail was adequate to support such speeds.

Whereas rehabilitation of the line to FRA Class 3 standards (which would have limited Amtrak's trains to maximum speeds of 60 miles per hour) had been projected to cost

2/ As provided in the Class 4 Rehabilitation Agreement,

Amtrak and NNEPRA wish to amend the Rehabilitation Agreement and the Terms and Conditions to provide for the operation of Amtrak trains at speeds up to 79 miles per hour (FRA Class 4) as set forth in the revised Appendix I attached hereto. Amtrak, NNEPRA and Railroad have already agreed upon certain changes to the Scope of Work, jointly acknowledged to be appropriate to permit the safe, consistent and continuous operation of Amtrak trains at these higher speeds. Amtrak, NNEPRA and Railroad have been unable, however, to reach agreement on one final issue [i.e., the rail weight issue].

Id. at 2 (emphasis added).

\$39.6 million, NNEPRA ultimately spent \$54 million in rehabilitating the line to satisfy FRA Class 4 standards. This \$54 million expenditure was some \$10 million more than the \$44 million originally contemplated under the Class 4 Rehabilitation Agreement. The work actually done on the line at NNEPRA's behest surpassed in material respects what the parties agreed in the Class 4 Rehabilitation Agreement was needed to permit "safe, consistent and continuous operation of Amtrak trains" at speeds up to 79 miles per hour.

Supplemental improvements included the installation of some 109,000 new mainline ties (approximately 1,400 ties per mile), almost 40 percent more ties than specified under the Class 4 Rehabilitation Agreement. In addition, two surfacing passes were made on the mainline, installing 190,000 tons of ballast (more than 2,000 tons per mile) - almost twice the ballast previously agreed on.

This rehabilitation work has put the Plaistow-Portland line into excellent physical shape. This is evidenced, among other things, by the very favorable track geometry readings obtained by Amtrak's track geometry car when it tested the line last Summer, and by the similarly favorable track deflection and track modulus findings made by the Transportation Technology

Center, Inc. ("TTCI") in its January 10, 2002 report on its testing of the line.

Initiation of Amtrak Service. Amtrak initiated revenue passenger train operations between Portland and Boston (including operations over Guilford's Plaistow-Portland line) on December 15, 2001, but with maximum operating speeds of only 60 miles per hour (the maximum currently permitted by Guilford). With four round-trip trains a day, this Amtrak service has been very well received by the travelling public. At the outset, the Amtrak trains operated with three passenger cars and one café car, but ridership demand has been so great that at times a fourth (and even a fifth) passenger car has been added to the trains. Since the initiation of this service, average ridership has been about 790 passengers per day.

Although this new Amtrak service is obviously fulfilling a critical public need, the service the public is getting is not as good as the more than \$50 million of public monies spent to rehabilitate Guilford's Plaistow-Portland line would justify. The rehabilitation work done on the line was designed to support Amtrak operations at FRA Class 4 operating speeds up to 79 miles per hour. Until the track modulus question at issue in this proceeding is resolved, however, Amtrak's trains are operating at a maximum speed of only 60 miles per hour (as

though the Plaistow-Portland line had only been rehabilitated to FRA Class 3 standards). This difference in maximum speeds is material.

Operating at a top speed of 79 miles per hour, Amtrak's trains would have a two and one-half hour running time between Portland and Boston. By contrast, constrained by their current top speed of 60 miles per hour, Amtrak's trains have a scheduled Portland-Boston running time of two hours and forty-five minutes. In a verified statement submitted earlier in this proceeding by Stan Bagley (at the time, President of Amtrak's Northeast Corridor Strategic Business Unit), he explained that a twelve minute reduction in running time will make the Amtrak service more competitive with highway driving times, and projected that it would translate into 38,000 more passengers each year (or more than 100 additional riders per day) and some \$450,000 in additional operating revenues per year. 3/ A fifteen minute reduction in running time would be even more beneficial.

NNEPRA and Amtrak want to offer the best possible, and most competitive, passenger service between Portland and Boston. There is a clear public demand for the service that will only be enhanced if Amtrak's trains are permitted to operate at speeds up

3/ See Bagley V.S. at 3-4 (filed as part of Amtrak's Opening Brief and Evidence (Apr. 2, 1999)).

to 79 miles per hour, speeds which Guilford's Plaistow-Portland line was specifically rehabilitated to support.

B. Track Modulus Testing

Following the Board's June 29, 2001 decision in this proceeding - in which the Board ruled among other things that using TTCI's Track Loading Vehicle ("TLV") was a reasonable and practical method of conducting track modulus testing of the Plaistow-Portland line - NNEPRA and Amtrak moved forward with having this testing conducted.

The preceding summer, I delivered by hand to Guilford a July 7, 2000 TTCI "Statement of Work," in which TTCI outlined how it proposed to use its TLV to conduct the track modulus testing, and advised that the charge for the testing would not exceed \$65,000. ^{4/} (See Attachment 2.) TTCI revised its Statement of Work on September 25, 2000, further elaborating on the testing it would do. (See Attachment 3.) On September 28, 2000, at NNEPRA's request, TTCI provided an amended testing schedule, proposing to conduct testing in November 2000 if Guilford's rehabilitation work on the Plaistow-Portland line was completed by then and Guilford would allow testing access (neither contingency was met). (See Attachment 4.) All of these materials were attached

^{4/} The TTCI testing conducted in September 2001 (described below) ultimately cost NNEPRA (after the application of certain wage rate adjustments) a total of \$71,530.

to my verified statement filed as part of Amtrak's Motion for Testing Access and Clarification (Mar. 12, 2001), and thus were provided to Guilford.

Based on this documentation provided to me in the Summer and Fall of 2000, and at my request following the Board's June 29, 2001 decision, TTCI made arrangements in September 2001 to move the TLV consist to Guilford's Plaistow-Portland line and to perform track deflection and track modulus testing of the line. TTCI conducted dynamic vertical track deflection testing on September 27, 2001, and then performed static track modulus testing at certain locations on September 28-29, 2001.

The data generated through this testing was promptly shared with Guilford. On October 12, 2001, Guilford's Executive Vice President, David Fink, wrote me asserting that Guilford's examination of the data generated by TTCI showed "deflection greater than .28 inches in 63 out of the 74 miles" of the Plaistow-Portland line, and that accordingly "passenger trains will not be able to safely exceed 59 miles per hour." (See Attachment 5.)

On October 23, 2001, I wrote back to Mr. Fink advising that NNEPRA and Amtrak did not share Guilford's assessment of the TTCI test results. (See Attachment 6.) I explained that:

[O]ur engineering consultants [have advised]
that the data generated during the TLV's

runs, which was provided to Guilford's engineers, indicate that the deflection criterion (.28 inches or less) was satisfied on well over 99% of the line. The only locations not meeting this criterion were Kennebunk and some very short (typically 10 feet or less) stretches at other locations. The static tests that were performed indicate that the track modulus on the vast majority of the line is substantially in excess of the specified 2750 lb./in./in. Accordingly, we believe that the requirements for 79 mph operation have been satisfied.

I further explained that the TLV had been unable to perform stationary tests at as many locations as had originally been contemplated in TTCI's "Statement of Work," and I noted my understanding of Guilford's position that additional stationary testing should be performed. In light of this, I explained that NNEPRA and Amtrak had contacted TTCI to determine the feasibility of follow-up testing in November, and requested Guilford's cooperation in allowing this testing to go forward.

On November 1, 2001, Mr. Fink wrote to me, identifying certain complaints Guilford had with respect to the manner in which TTCI had conducted track deflection and track modulus testing of the Plaistow-Portland line, and reiterating Guilford's earlier expressed view that it "will not allow any passenger operations at speeds greater than 59 miles per hour until acceptable [test] results are obtained." (See Attachment 7.)

Guilford did, however, agree to allow TTCI to return to the Plaistow-Portland line for further testing in November.

On November 2, 2001, I wrote to Mr. Fink, reemphasizing that NNEPRA and Amtrak believed that the testing performed by TTCI to date supported 79 miles-per-hour passenger operations, and advising that NNEPRA and Amtrak would respond to the testing complaints Mr. Fink had raised in his November 1 letter after the supplemental TTCI testing had been completed. (See Attachment 8.) I also provided Mr. Fink with certain information in regard to the then-anticipated timing of this supplemental TTCI testing.

On November 9, 2001, I wrote to Mr. Fink, forwarding a copy of the "work program" listing the milepost locations that would be candidate locations for TTCI to conduct static track modulus tests when it returned to Guilford's line later in the month. (See Attachment 9.)

On November 16, 2001, I wrote to Mr. Fink updating him on the timing of the TTCI testing. (See Attachment 10.)

On November 20, 2001, I wrote to Mr. Fink, updating him on the timing of the TTCI testing, and requesting Guilford's assistance in providing a signal maintainer at certain test sites. (See Attachment 11.)

On November 21, 2001, I wrote to Mr. Fink, forwarding a detailed schedule of the testing TTCI proposed to perform during

the period November 28-30, and providing an updated "work plan" showing the candidate locations for conducting static track modulus tests. (See Attachment 12.)

On November 26, 2001, I wrote to Mr. Fink, forwarding him a copy of TTCI's "Statement of Work" dated November 26, which set forth the methodology TTCI would employ in performing its supplemental testing of the Plaistow-Portland line. (See Attachment 13.) In this statement, TTCI advised that the estimated cost of the supplemental testing would be \$63,500.

On December 11, 2001, I wrote to Mr. Fink, forwarding underlying data generated by TTCI during its late November testing. (See Attachment 14.) Like the data provided to Guilford following TTCI's September testing, this data included deflection measurements as well as modulus calculations from the 28 locations where static track modulus tests were performed by TTCI, a strip chart output from the TLV showing the relative deflection and vertical strength indices taken during the November 28 rolling dynamic test, and enlarged graphical output plots from the rolling dynamic test for each of the static test locations.

On January 14, 2002, I wrote to Mr. Fink, forwarding to him a copy of TTCI's report - entitled "Vertical Track Deflection Measurements Using the TLV", P-02-001, for Northern

New England Passenger Rail Authority (Jan. 10, 2002) ("TTCI Report") and appended as Attachment 2 to the accompanying verified statement of David Read - and explaining that the report provides firm support for the 79 miles-per-hour operating speeds at which Amtrak proposes to conduct passenger operations over designated segments of the Plaistow-Portland line. (See Attachment 15.) I noted that the report had found the line's mean track modulus value to be 5,346 lb/in/in, and its track modulus to exceed 2,750 lb/in/in over more than 99.95% of the trackage where Amtrak operations are planned to exceed 60 miles per hour. I suggested that if Guilford had questions regarding the TTCI Report or continued to take exception to 79 miles-per-hour Amtrak operating speeds, the parties should meet to see if their differences could be resolved without further resort to the Board. I urged that the meeting occur as soon as possible, and proposed January 22 or 23 as possible dates.

On January 18, 2002, Mr. Fink wrote to me, advising that he had received a copy of the TTCI Report, expressing the same criticisms Guilford had earlier directed at the TTCI testing, and requesting additional information from TTCI relating to the testing. (See Attachment 16.) Mr. Fink advised that Guilford would meet with NNEPRA, Amtrak and TTCI to go over the

results of the TTCI Report after it had had an opportunity to complete its own study of the report.

On January 23, 2002, I wrote to Mr. Fink, advising that TTCI would be providing Guilford the data requested, and urging that the parties meet not later than February 15. (See Attachment 17.) I requested a copy of Guilford's study of the TTCI Report, so that answers to any questions raised in the study could be developed. (No Guilford study was ever provided to me.)

On January 25, 2002, Mr. Fink wrote to me, advising that although Guilford was agreeable to meeting with NNEPRA, Amtrak and TTCI and would propose to host the meeting at its North Billerica offices, it would not agree to a deadline being imposed for the meeting. (See Attachment 18.) He urged that the data requested by Guilford be provided on an expedited basis.

On January 30, 2002, I wrote to Mr. Fink, expressing pleasure with Guilford's willingness to meet, and noting that all the data requested by Guilford (to the extent not provided some time ago) had been forwarded to Guilford. (See Attachment 19.) I acknowledged Guilford's unwillingness to agree to a deadline for the meeting, and urged that it take place as soon as possible.

On February 4, 2002, Guilford's Assistant Vice President - Engineering, Phillip D. Brake, wrote to me requesting additional information from TTCI. (See Attachment 20.)

On February 4, 2002, Mr. Fink wrote to me advising that Guilford had received the data it had earlier requested, and proposing a meeting among the parties on February 22. (See Attachment 21.)

On February 8, 2002, I wrote to Mr. Fink, advising that the author of the TTCI Report would be out of the country on February 22, and proposing February 27 or 28 as alternative meeting dates. (See Attachment 22.)

On February 8, 2002, I wrote to Mr. Brake, responding to his request for supplemental information. (See Attachment 23.)

On February 11, 2002, Mr. Fink wrote to me, explaining that Guilford representatives were not available for a meeting on February 27 or 28, and proposing that the meeting among the parties be held during the week of March 4. (See Attachment 24.) The parties thereafter settled upon a March 7 meeting date.

On March 4, 2002, I wrote to Mr. Fink, forwarding to him a speed table which set forth by track segment the speeds up to 79 miles per hour at which Amtrak proposes to operate over the Plaistow-Portland line in light of the findings in the TTCI

Report. (See Attachment 25.) The speeds set forth in the speed table largely conform to the speeds agreed to among the parties in the Class 4 Rehabilitation Agreement; in those limited instances where there are exceptions, the reasons for the exceptions were explained.

On March 7, 2002, the parties met at Guilford's North Billerica offices to review the TTCI report, and to see if agreement could be reached regarding Amtrak conducting passenger operations at speeds up to 79 miles per hour. The author of the TTCI Report, David Read, as well as other TTCI representatives, participated in the meeting by conference call. At the conclusion of the meeting, Guilford advised that it was unwilling to permit 79 miles-per-hour Amtrak operations over the Plaistow-Portland line.

On March 11, 2002, I wrote to Mr. Fink expressing my regret that Guilford did not agree with NNEPRA and Amtrak that, in light of the findings in the TTCI Report, Amtrak should be permitted to operate at speeds up to 79 miles per hour over the Plaistow-Portland line. (See Attachment 26.) I noted that NNEPRA, Amtrak, and TTCI undertook to answer every question raised by Guilford during the meeting, including questions that related back to Mr. Fink's November 1, 2001 letter to me (Attachment 7). I summarized our response to various challenges

raised by Guilford, noting among other things that (i) the testing methodology employed by TTCI had appropriately evolved and improved since that initially proposed by TTCI, (ii) Guilford was kept fully apprised of the testing conducted by TTCI and the results obtained (including having Guilford representatives present throughout the testing), (iii) TTCI properly correlated track deflection and track modulus data, (iv) TTCI properly focused its findings on 25-foot moving average deflection data, rather than the interim 2-foot moving average deflection data which Guilford seems to favor, and (v) track modulus is not a safety consideration (as Guilford contends), but rather is a design and maintenance consideration. I advised Mr. Fink that Guilford had left NNEPRA and Amtrak no choice but to seek relief from the Board.

On March 18, 2002, Mr. Fink wrote to me setting forth in writing Guilford's various objections to the TTCI track modulus testing and findings that were expressed during the March 7 meeting among the parties. (See Attachment 27.) Mr. Fink confirmed that Guilford would not permit Amtrak to conduct passenger operations at speeds up to 79 miles per hour over the Plaistow-Portland line.

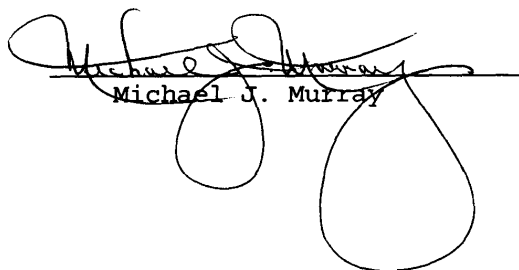
On March 29, 2002, I wrote to Mr. Fink, responding to his March 18 letter and explaining that there was no substance to

Guilford's objections regarding the TTCI track modulus testing and findings. (See Attachment 28.) I advised that in view of Guilford's refusal to permit 79 miles-per-hour Amtrak operations, NNEPRA and Amtrak would have to seek Board relief.

VERIFICATION

I, Michael J. Murray, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on April 8, 2002.


Michael J. Murray

AGREEMENT AMONG NORTHERN NEW ENGLAND PASSENGER
RAIL AUTHORITY, NATIONAL RAILROAD PASSENGER CORPORATION,
AND SPRINGFIELD TERMINAL RAILWAY COMPANY, BOSTON AND MAINE
CORPORATION, AND PORTLAND TERMINAL COMPANY CONCERNING
RESOLUTION OF DISAGREEMENT REGARDING TRAIN SPEEDS

WHEREAS, Northern New England Passenger Rail Authority (referred to herein as "NNEPRA") and Boston and Maine Corporation, Portland Terminal Company and Springfield Terminal Railway Company (collectively referred to herein as "Railroad") are parties to an Agreement for Track Improvements on the Plaistow to Portland Corridor (referred to herein as the "Rehabilitation Agreement"); and

WHEREAS, Railroad and National Railroad Passenger Corporation (referred to herein as "Amtrak") are parties to certain Terms and Conditions for Operation Between Massachusetts/New Hampshire State Line and Portland, Maine (referred to herein as the "Terms and Conditions"); and

WHEREAS, Amtrak wishes to operate over the Rail Lines (as that term is defined in the Terms and Conditions) at the speeds set forth in revised Appendix I set forth in Attachment 3(c) hereto; and

WHEREAS, Amtrak and Railroad disagree on the weight of rail necessary to operate at these speeds; and

WHEREAS, Amtrak and Railroad have agreed to submit this issue to the Surface Transportation Board (referred to herein as the "STB") for resolution and have further agreed to a proposed procedural schedule for the submission to the STB of evidence and argument on this issue; and

WHEREAS, NNEPRA and Railroad have agreed to certain changes to (i) the Scope of Work set forth in Exhibit A to the Rehabilitation Agreement in the event the STB permits

Amtrak to operate at the speeds set forth in said revised Appendix I; (ii) the Work Schematic set forth in Exhibit B to the Rehabilitation Agreement in the event the STB permits Amtrak to operate at the speeds set forth in said revised Appendix I; and (iii) the Initial Project Budget set forth in Exhibit D to the Rehabilitation Agreement in the event the STB permits Amtrak to operate at the speeds set forth in said revised Appendix I; and

WHEREAS, Amtrak and Railroad have agreed to certain changes to be made to the Terms and Conditions in the event the STB permits Amtrak to operate at the speeds set forth in said revised Appendix I;

NOW, THEREFORE, in consideration of the mutual promises, conditions, terms and obligations herein set forth, NNEPRA, Amtrak and Railroad agree as follows:

1. Submission of Speed Issue to STB.

- a. Amtrak shall apply to the STB for an order permitting Amtrak to operate at the speeds set forth in revised Appendix I set forth in Attachment 3(c) hereto and asking the STB to resolve the following single outstanding disagreement between Amtrak and NNEPRA, on the one hand, and Railroad, on the other:

On or about July 10, 1998, NNEPRA and Railroad entered into the Rehabilitation Agreement, and Amtrak and Railroad entered into the Terms and Conditions. Apart from certain agreed-to changes arrived at by the parties, these two documents reflect and are meant to implement the terms and conditions set forth in the STB's Decision served May 29, 1998, in STB Finance Docket No. 33381 (the "Decision"). The Rehabilitation Agreement contains a Scope of Work for rehabilitating the Rail Lines (as that term is defined in the Terms and Conditions) to permit operation of Amtrak trains at speeds up to 60 miles per hour (FRA Class 3) as set forth in Appendix I to the Terms and Conditions. Amtrak and NNEPRA wish to amend the Rehabilitation Agreement and the Terms and Conditions to provide for the operation of Amtrak trains at speeds up to 79 miles per hour (FRA Class 4) as set forth in the revised Appendix I attached hereto. Amtrak, NNEPRA and Railroad have already agreed upon certain changes to the Scope of Work, jointly acknowledged to be appropriate to permit the safe, consistent and continuous operation of Amtrak trains at these higher speeds. Amtrak, NNEPRA and Railroad have been unable, however, to reach agreement on one final issue.

The Rehabilitation Agreement and the Terms and Conditions provide for the installation of 115-pound continuous welded rail, as originally requested by Amtrak and NNEPRA and approved by the STB in its Decision, to permit operation of Amtrak trains at Amtrak and NNEPRA's requested speeds of up to 60 miles per hour. The parties have been unable to agree as to the appropriate weight of rail required for the safe, consistent and continuous operation of Amtrak trains at speeds up to 79 miles per hour. Amtrak and NNEPRA assert that 115-pound rail is appropriate, while Railroad asserts that 132-pound rail is the appropriate weight. The issue presented to the STB to resolve is stated as follows:

Applying the engineering standards agreed to by NNEPRA and Railroad in the Rehabilitation Agreement, with particular reference to the engineering standards of the American Railway Engineering Association ("AREA") specified therein, what is the appropriate weight of continuous welded rail to be installed on the Rail Line in order to ensure the safe, consistent and continuous operation of Amtrak trains at speeds of up to 79 miles per hour?

- b. Amtrak, in its initial application filing with the STB, shall propose that the STB establish a procedural schedule for resolving the issue identified in paragraph 1(a) above which provides for the parties to file (1) simultaneous written opening argument and evidence 45 days after the STB's initiation of the proceedings, and (2) simultaneous written reply argument and evidence 20 days after the opening submissions.

2. Conditional Amendment to Rehabilitation Agreement. In the event the STB issues an order permitting Amtrak to operate at the speeds set forth in revised Appendix I set forth in Attachment 3(c) hereto, the Rehabilitation Agreement will thereupon be amended (without the need for any further written memorandum) as follows:

- a. Work Element #2 of the Scope of Work set forth in Exhibit A to the Rehabilitation Agreement will be replaced with revised Work Element #2 set forth in Attachment 2(a) hereto;

- b. Work Element #6 of the Scope of Work set forth in Exhibit A to the Rehabilitation Agreement will be replaced with revised Work Element #6 set forth in Attachment 2(b) hereto;
- c. Work Element #8 of the Scope of Work set forth in Exhibit A to the Rehabilitation Agreement will be replaced with revised Work Element #8 set forth in Attachment 2(c) hereto;
- d. The Initial Project Budget set forth in Exhibit D to the Rehabilitation Agreement will be replaced with the revised Initial Project Budget set forth in Attachment 2(d) hereto; and
- e. The oversize charts that are part of Exhibit B to the Rehabilitation Agreement will be revised to reflect the changes agreed to by the parties and reflected in Attachments 2(a), 2(b), and 2(c) hereto.

In the event the STB does not issue an order permitting Amtrak to operate at the speeds set forth in revised Appendix I set forth in Attachment 3(c) hereto, the Rehabilitation Agreement will not be so amended.

3. Conditional Amendment to Terms and Conditions. In the event the STB issues an order permitting Amtrak to operate at the speeds set forth in revised Appendix I set forth in Attachment 3(c) hereto, the Terms and Conditions will thereupon be amended (without the need for any further written memorandum) as follows:

- a. In Section 3.2 of the Terms and Conditions, references to "FRA Class 3" will be replaced with "FRA Class 4";
- b. Section 6.11 of the Terms and Conditions will be replaced with revised Section 6.11 set forth in Attachment 3(b) hereto;

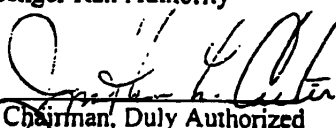
- c. Appendix I to the Terms and Conditions will be replaced with revised Appendix I set forth in Attachment 3(c) hereto;
- d. Appendix II to the Terms and Conditions will be replaced with revised Appendix II set forth in Attachment 3(d) hereto; and
- e. Appendix III, Table 1 to the Terms and Conditions will be replaced with revised Appendix III, Table 1 set forth in Attachment 3(e) hereto.

In the event the STB does not issue an order permitting Amtrak to operate at the speeds set forth in revised Appendix I set forth in Attachment 3(c) hereto, the Terms and Conditions will not be so amended.

IN WITNESS WHEREOF, NNEPRA, Amtrak and Railroad have caused this instrument to be executed by their respective representatives thereunto duly authorized.

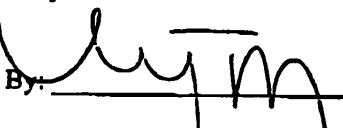
Date: 12-4-98

Northern New England
Passenger Rail Authority

By: 
Chairman, Duly Authorized

National Railroad Passenger
Corporation

Date: 12/18/98

By: 

Boston and Maine Corporation
Portland Terminal Company
Springfield Terminal Railway Company

Date: 1-6-99

By: 

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ATTACHMENT 2(a)

Work Element #2 (REVISED)

Mainline Ties (new)*

Track 002;
MP 274.70 - MP 272.90

(Included in tie count
below)

Main Track;
MP 274.70 - MP 200.00

78,000

Total Main Line Ties

78,000

Passing Siding Ties (relay)

Newfields Siding
MP 257.60 - 255.70

Ties included in
siding construction
8,450

Dover Siding;
MP 243.50 - 241.00

Wells Siding;
MP 228.00 - 226.00

Ties included in
siding construction
1,200

Saco Industrial Siding;
212.10 - 211.80

Old Orchard Siding;
MP 210.50 - 208.60

7,350

Total Passing Siding Ties

17,000

Note: * Includes replacement of defective bridge ties and switch timber to meet FRA standards.
Use existing tie plates from mainline track.
Tie disposal included in installation costs.
Use 7x 9" ties for mainline.
Use 7x 9" relay ties for passing sidings. (To be purchased)

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ATTACHMENT 2(b)

Work Element #6(a) (REVISED)**Grade Crossing Signal Upgrades (New Hampshire)**SEE WORK ELEMENT #6(a) ATTACHMENT (Sheets 1 through 16)¹⁸

<u>Location</u>	<u>Name</u>	<u>Existing Equipment</u>	<u>Improvements*</u>
MP 272.80	Main Street Plaistow	Predictors/ Gates	Signal System Upgrade
MP 271.10	Cranes Crossing Newton	Motion/ Flashers	Signal System Upgrade
MP 270.20	Main Street Newton	Motion/ Flashers	Signal System Upgrade
MP 268.60	Russ Xing Newton	Flashers	Signal System Upgrade
MP 267.69	New Boston Rd. (Crafts) Kingston	Motion/ Flashers	Signal System Upgrade
MP 265.57	Kensington Rd. (Rt. 107) East Kingston	Motion/ Gates & EC	Signal System Upgrade
MP 264.45	Sanborns (Sanborn Rd.) East Kingston	Motion/ Flashers	Signal System Upgrade
MP 262.50	Powder Mill Rd. Exeter	Motion/ Gates & EC	Signal System Upgrade
MP 260.87	Front Street Exeter	Motion/ Gates & EC	Signal System Upgrade
MP 260.53	Main Street Exeter	Motion/ Gates & EC	Signal System Upgrade
MP 260.27	Salem Street Exeter	Motion/ Gates & EC	Signal System Upgrade
MP 256.68	Squamscot St. Newfields	EC Flashers	Install Predictors**
MP 254.00	Exeter Rd. (Rt. 108) Newmarket	Gates/ Motion	Signal System Upgrade
MP 253.40	Elm Street (Shackfords) Newmarket	Motion/ Flashers	Signal System Upgrade

Note: Salvaged material to be stored for reuse on private crossings within project area.

* Improvements per attachments, summary description only.

** Work programmed by NHDOT - not included in project.

Work Element #6(b) (REVISED)

Grade Crossing Signal Upgrades (Maine)

SEE WORK ELEMENT #6(b) ATTACHMENT (Sheets 1 through 16)

<u>Location</u>	<u>Name</u>	<u>Existing Equipment</u>	<u>Improvements*</u>
MP 239.50	Berwick Road (Slattery's)	DC	Signal System
	South Berwick	Gates	Upgrade
MP 234.34	Elm Street	Gates	Signal System
	North Berwick		Upgrade
MP 233.40	Main Street	DC	Signal System
	North Berwick	Gates	Upgrade
MP 231.00	Bragdon Xing	Motion/	Signal System
	Wells	Flashers	Upgrade
MP 228.20	Wells Dump	D829	Signal System
	Wells	Auto signal	Upgrade
MP 225.50	Burnt Mill Road	Motion	Signal System
	Wells	Detectors	Upgrade
MP 224.40	Cole's Hill Road	OL/	Signal System
	Wells	Flashers	Upgrade
MP 219.90	Curriers Road	OL/	Signal System
	Kennebunkport	Gates	Upgrade
MP 218.20	Towns Crossing	Flashers/	Signal System
	Kennebunkport	DC	Upgrade
MP 208.50	Temple Ave.	OL/	Signal System
	Old Orchard Beach	Flashers	Upgrade
MP 207.80	Union	Motion/	Signal System
	Old Orchard Beach	Gates & EC	Upgrade
MP 207.70	Atlantic	Motion/	Signal System
	Old Orchard Beach	Gates & EC	Upgrade
MP 207.20	Old Orchard Street	Motion/	Signal System
	Old Orchard Beach	Gates & EC	Upgrade
MP 206.80	Walnut Ave.	No Gates	Signal System
	Old Orchard Beach	Flashers only	Upgrade
MP 203.10	Winnock's Neck Road	No	Signal System
	Scarborough	AHCW	Upgrade

Note: Salvaged material to be stored for reuse on private crossings within project area.

* Improvements per attachments, summary description only.

Work Element #6(c) (REVISED)

Private Crossings (Maine & New Hampshire)

Location	Existing Equipment	Improvements
Various	None	Post & Chain with Locking Device
Various	None	Provide Crossing Improvements if and as directed by NNEPRA

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ATTACHMENT 2(c)

Work Element #8 (REVISED)

Bridge Rehabilitation ***SEE NEW WORK ELEMENT #8 ATTACHED (Sheets 1 and 2 of 2)**

Location	Name	BridgeNo.	Improvements
MP 262.32	Gunpowder River	48.68	Bearing, girders, timbers, pointing
MP 252.99	Newmarket Ponds	58.01	Sub & superstructure repairs
MP 252.81	Lamprey River	58.99	Bearing, timber, superstructure
MP 246.62	Bellamy River	64.38	Bearing, timber, superstructure
MP 222.05	Sea Road	88.95	Clean bearings, timber
MP 211.83	Elm Street	99.17	Bearing, timber, superstructure
MP 211.57	Saco River	99.43	Rebuild pier cap & clean bearings
MP 211.10	Common Street	99.90	Clean bearings & new stringers
MP 209.68	Old Orchard Rd	101.32	Bearings, timber, steel repairs
MP 204.28	Dunston River	106.72	Superstructure repairs & timber
MP 202.93	Nonesuch River	108.08	Superstructure repairs & timber

* Note: See attached narrative for detailed description of bridge work.

Bridge Rehabilitation Detailed Description (REVISED)

Bridge Rehabilitation**MP 262.32 - Gunpowder River (#48.68)**

This is an open deck, steel plate girder structure, three spans, with an overall length of 102 feet. The rehabilitation will consist of complete superstructure replacement, including: bearings, girders, timbers and the construction of new track including hardware. The stone masonry piers and abutments will be repointed and riprap will be placed at one pier.

MP 252.99 - Newmarket Ponds (#58.01)

This is a 61 foot 5 span ballasted timber trestle. The rehabilitation will consist of removal and replacement of defective and non performing timbers in the pier bents, longitudinal beams, and deck. Optional timber repair methodologies may be employed.

MP 252.01 - Lamprey River (#58.99)

This is a ballasted deck, single span, steel through truss structure, with an overall length of 127 feet. The rehabilitation is intended to be minor consisting of truss and stringer bearing replacement with some isolated bridge timber and superstructure steel repair.

MP 246.62 - Bellamy River (#64.38)

This is a 45 foot long, single span, open deck, steel plate girder structure. The rehabilitation will consist of complete superstructure replacement, including: bearings, girders, timbers, addition of an approach slab and the construction of new track including hardware. The stone masonry abutments will be repointed.

MP 222.05 - Sea Road (#88.95)

This 22 foot long, single span, open deck, steel plate girder structure requires only minor rehabilitation. The work will consist of cleaning and resetting bearings, and replacement of timbers and track.

MP 211.83 - Elm Street (#99.17)

This is an open deck, single span, steel through truss structure, with an overall length of 115 feet. The rehabilitation will encompass essentially complete replacement of the superstructure on the current track side except the trusses. This will include: bearings, stringers, timbers, and trackwork.

MP 211.57 - Saco River (#99.43)

This is a ballasted deck, steel plate girder structure(deck girders), three spans, with an overall length of 266 feet. The rehabilitation will consist of cleaning and resetting misaligned bearings and reconstruction of the pier cap that is cracked and moves under live load.

MP 211.10 - Common Street (#99.90)

This is a two span ballasted deck, steel plate girder structure, with an overall length of 150 feet. The rehabilitation will consist of various superstructure repairs and replacements, including: bearing cleaning and resetting, girder repairs, and miscellaneous steel work. The abutments will have cracks repaired.

MP 209.68 - Old Orchard Road (#101.32)

This is a single span open deck, steel plate girder structure, with an overall length of 42 feet. The rehabilitation will consist of superstructure steel repairs and timber and track replacements. Anchor bolts will also be replaced.

MP 204.28 - Dunstan River (#106.72)

This is a 435 foot, 38 span ballasted timber trestle. The rehabilitation will consist of removal and replacement of all superstructure timbers and track and selective removal and replacement of defective and non performing timbers in the pier bents. Optional timber repair methodologies may be employed.

MP 202.93 - Nonesuch River (#108.08)

This is a 197 foot, 17 span ballasted timber trestle. The rehabilitation will consist of removal and replacement of all superstructure timbers and track and selective removal and replacement of defective and non performing timbers in the pier bents. Optional timber repair methodologies may be employed. This structure was estimated to be repaired in conjunction with the Dunstan River bridge. Repair and replacement design strategies will be developed together.

**Construction Cost Estimate
Final Work Plan (79 mph)**

**SHEET 1 OF 2
Work Element # 8
(Revised)**

Bridge No.	Over	Town	Milepost Location	Construction Cost Estimate	Summary of Work and Notes
36.76	Bryant's Brook	Plaistow, NH	274.24	\$75,000	(1) New Slab
37.83	Harriman's Brook	Plaistow, NH	273.17	\$5,000	(1) Conc. Repairs
39.48	Newton Meadow Brk.	Newton, NH	271.52	\$75,000	(1), (2) New Slab
44.33	Pow-wow River	East Kingston, NH	266.67	\$75,000	(1), (2) New Slab
47.57	Great Brook	East Kingston, NH	263.43	\$75,000	(1), (2) New Slab
47.73	agricultural pass	East Kingston, NH	263.27	\$75,000	(1), (2) New Slab
47.79	Brickyard Brook	East Kingston, NH	263.21	-None-	NO WORK
48.68	Gunpowder River	Exeter, NH	262.32	\$170,000	(1), (3), (4) Superstructure Rehab.
49.70	Little River	Exeter, NH	261.30	\$20,000	(1), (3) Timbers, Bearings
51.62	Lyford (Rt. 85)	Exeter, NH	259.38	\$20,000	(1), (3) Timbers
57.15	Moonlight Brook	Newmarket, NH	253.85	-None-	NO WORK
58.01	New Market Ponds	Newmarket, NH	252.99	\$260,000	(3), (4), (5) Structural Timber
58.99	Lamprey River	Newmarket, NH	252.01	\$120,000	(1), (3) Bearings
61.09	Oyster River	Durham, NH	249.91	-None-	NO WORK
61.54	Colovos Rd. (UNH)	Durham, NH	249.46	\$100,000	(1), (3) Conc. Repairs, Bearings
64.38	Bellamy River	Madbury, NH	246.62	\$300,000	(1), (3) Replace Superstructure
64.97	Hanson's Pass	Dover, NH	245.97	\$15,000	(1), (3) Conc. Repairs
66.84	Cocheco River	Dover, NH	244.16	\$35,000	(1), (3) Bearings, walkway
67.26	Broadway	Dover, NH	243.74	\$75,000	(1), (3) New Slab
69.60	un-named stream	Rollinsford, NH	241.40	-None-	NO WORK
71.16	Salmon Falls River	Rollinsford, NH	239.84	\$135,000	(1), (3) Bearings, Misc. Steel, Walkway
75.58	Brackett Falls Road	North Berwick, ME	235.42	\$75,000	(1), (2), (6) New Slab
77.02	Great Works River	North Berwick, ME	233.98	-None-	NO WORK
86.81	Merriland River	Wells, ME	224.19	-None-	NO WORK
86.93	Coles (Old U.S. 1)	Wells, ME	224.07	\$110,000	(1), (3) Timbers, Brgs., Misc. Steel
87.73	Branch Brook	Kennebunk, ME	223.27	-None-	NO WORK
88.95	Brown Road	Kennebunk, ME	222.05	\$20,000	(1), (3) Timbers, Brgs., Misc. Steel
89.35	Mousam River	Kennebunk, ME	221.65	-None-	NO WORK
90.66	Kennebunk River	N.Kennebunk, ME	220.34	-None-	NO WORK
92.79	Goff Mill Brook	N.Kennebunk, ME	218.21	-None-	NO WORK
94.12	Hough's Brook	N.Kennebunk, ME	216.88	\$30,000	(1), (3) New Headwall
99.17	Elm Street	Biddeford, ME	211.83	\$110,000	(1), (3) Timbers, Brgs., Misc. Steel
99.24	abandoned road (Smith St.)	Biddeford, ME	211.76	\$50,000	(1), (3) Bearings & Bolts
99.38	Corporation Way	Saco, ME	211.62	\$55,000	(1), (3), (6) Brgs., Bolts, Misc. Steel
99.43	Saco River	Saco/Biddeford, ME	211.57	\$105,000	(1), (3) Seats, Bearings
99.63	Main Street	Saco, ME	211.37	-None-	NO WORK
99.71	Front Street	Saco, ME	211.29	\$15,000	See Note (7)
99.82	Wharf Street	Saco, ME	211.18	\$15,000	See Note (7)
99.90	Common Street	Saco, ME	211.10	\$25,000	See Note (7)
100.09	James Street	Saco, ME	210.91	\$15,000	See Note (7)
100.37	Beach Street	Saco, ME	210.63	\$15,000	See Note (7)
101.32	Goose Fair Road	Saco, ME	209.68	\$45,000	See Note (7)
101.38	Goose Fair Brook	Saco, ME	209.62	-None-	NO WORK
106.72	Dunstan River	Scarborough, ME	204.28	\$575,000	(3), (8) Structural Timber
108.08	Nonesuch River	Scarborough, ME	202.93	\$350,000	(3), (8) Structural Timber
2.43	Broadway	Portland, ME	198.43	-None-	NO WORK
1.12	Fore River	Portland, ME	196.98	\$10,000	(1), (3), (14) Timbers
SUBTOTAL ALL BRIDGES				\$3,250,000	
CONTINGENCY 20% (Note 9.)				\$650,000	
TOTAL BRIDGE PROGRAM (Note 10.)				\$3,900,000	

SEE NOTES ON SHEET 2 OF 2

BRIDGES

Construction Cost Estimate
Final Work Plan (79 mph)December 1, 1998
SHEET 2 OF 2
Work Element #8 (Revised)Notes:

1. Work to be done in accordance with the recommended repairs in the 1995 "Bridge Report", unless noted otherwise.
2. Switchover of track anticipated. All work including engineering for switchover by GRS under track force account work.
3. Switchover of track not anticipated. All work accomplished with temporary outages or under live load.
4. Work to be done in accordance with the 1997 plans completed by VHB, except that GRS will not perform work.
5. Work to be done in accordance with the 1995 plans completed by RHP, except that GRS will not perform work.
6. GRS will investigate if bridge can be filled-in. If so, bridge will be filled-in if costs are within construction cost estimate.
7. GRS has completed most of the recommended repairs in 1995 "Bridge Report". Additional work for these bridges will be completed as specified in the reports for work elements not completed by GRS.
8. Work to be done in accordance with the 1995 plans completed by RHP, as modified by 1998 inspection, except that GRS will not perform work.
9. The 20% contingency includes an estimated 5 track throws @ \$50,000 each=\$250,000, GRS flagging and GRS structural engineering oversight (in office-not field inspection/supervision).
10. Total Bridge Program includes original NNEPRA/GRS bridge work program per May 1998 agreement plus additional bridge program to accommodate 79 mph per June-Nov. 1998 negotiations.
11. Bridge work will be accomplished by contractors, not by GRS Force Account work. All bridges at all times before, during, and after construction will remain under the ownership and control of GRS.
12. NNEPRA will be responsible for all permits, inspection, bid documents, bidding, award, shop drawing review and construction close-out.
13. Prior to beginning the work indicated for each bridge, a joint inspection by NNEPRA's engineer, GRS' engineer, and the contractor will be performed to confirm the extent and nature of the indicated rehabilitation.
14. Prior to the beginning the work a joint inspection by NNEPRA's engineer and GRS' engineer, will be performed to confirm that the concrete repairs indicated in the "Bridge Report" are not required.
15. Bridge timbers will be provided & installed by GRS under Trackwork Force Account, not under Bridge Construction Cost Estimate.
16. The Construction Cost Estimate for each bridge will be aggregated to provide a Total Bridge Program until all specified work is complete. Underages from individual bridges will be reserved for overages on other bridges.

ROM AMTRAK

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ATTACHMENT 2(d)

Initial Project Budget (REVISED)

Item #	Work Element	Approved FTA Budget	Proposed Budget	Other Funding
1	Rail - Replace Main Line Rail Only	18,057,141	18,508,556	
2	Ties - Replace <u>95,000</u> ties (Rigby to Plaistow) [include sidings]	4,743,000	<u>6,007,800</u>	
3	Surface-(1-1/2 passes) 82.7 miles	991,200	991,200	
4	Turnouts - Replace steel on 17 turnouts (Rigby-Plaistow)	1,050,000	1,050,000	
5 (a)	Crossing surface (New Hampshire)	450,000	450,000	
5 (b)	Crossing surface (Maine)			1,125,000*
6 (a)	Grade crossing signal upgrades (New Hampshire)	700,000	<u>858,864</u>	
6 (b)	Grade crossing signal upgrades (Maine)			<u>1,302,646*</u>
6 (c)	Private crossings - locking gates & other work (allowance)	25,000	<u>425,000</u>	
7	Wayside signal improvements- Remove pole line, install in track code, adjust block length	500,000	500,000	
8	Bridge rehabilitation	1,758,000	<u>3,900,000</u>	
9	Undercutting and ditching	1,200,000	1,972,000	
10	Sidings			
	- Newfields Siding	1,032,000	1,032,000	
	- Dover Interlocking (relocate west)	198,000	198,000	
	- Retire N. Berwick Siding	120,000	120,000	
	- Wells Siding (1-1/2 miles)	1,770,000	1,770,000	
	- Saco Industrial (Run-around Track)	231,000	231,000	
11	Other -Straighten Track at S. Berwick	60,000	60,000	
12	Portland Layover	875,000	875,000	
13	Rigby Bypass Track	2,837,000	2,687,000	
Total GRS Work Program Items (REVISED)		\$36,597,341	<u>\$41,636,420</u>	<u>\$2,427,646</u>

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ATTACHMENT 3(b)

Section 6.11 Consistency with STB Decision

Except as provided in Section 6.13, and except as Railroad and Amtrak may agree by way of written amendment to these Terms and Conditions, the provisions of these Terms and Conditions are intended to implement, without any modification, the provisions of the STB Decision. Except as provided in Section 6.13, and except as Railroad and Amtrak may agree by way of written amendment to these Terms and Conditions, in the event of any conflict between these Terms and Conditions and the STB Decision, the STB Decision shall control.

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ATTACHMENT 3(c)

APPENDIX I

PASSENGER TRAIN SPEEDS

Pursuant to these Terms and Conditions, the Rail Lines will be maintained to permit operations at the following speeds:

PASSENGER TRAIN SPEEDS BETWEEN:	MILES PER HOUR
MP 196.4 and MP 197.1	30
MP 197.1 and MP 201.0	60
MP 201.0 and MP 206.77	79
MP 206.77 and MP 207.8	40
MP 207.8 and MP 211.0	79
NO. 2 TRACK - (CPF 209) and (CPF 211)	30
MP 211.0 and MP 211.5 (curve restriction on each side of station stop)	50
MP 211.5 and MP 212.7	60
MP 212.7 and MP 233.0	79
MP 233.0 and MP 233.5	75
NO 2. TRACK - MP 228.0 and MP 226.0	30
MP 233.5 and MP 238.9	79
MP 238.9 and MP 239.6	65
MP 239.6 and MP 243.6	79
NO. 2 TRACK - (CPF 241) and (CPF 243)	30
MP 243.6 and MP 244.0 (station stops)	45
MP 244.0 and MP 244.2	75
MP 244.2 and MP 252.6	79
MP 252.6 and MP 254.1	60
MP 254.1 and MP 257.5	79
SIDING CPF 256 and CPF 258	20
MP 257.5 and MP 261.0 (includes station stops)	65
MP 261.0 and MP 264.1	70
MP 264.1 and MP 272.9	79
MP 272.9 and MP 274.6	60

NOTE 1: Information relative to Mile Posts (MP) shown above:

- a. Mattawamkeag, Maine = MP 0.0 as shown in Springfield Terminal Timetable No. 3, effective April 5, 1992.
- b. Portland, Maine (vicinity of Congress Street) = MP 196.4
- c. Massachusetts/New Hampshire state line is approximately MP 274.6

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ATTACHMENT 3(d)

APPENDIX IISCHEDULED RUNNING TIMES

Pursuant to these Terms and Conditions, the Rail Lines will be operated and maintained to permit operations of Amtrak trains with a high level of on-time performance utilizing the following scheduled running times:

Plaistow to Portland ~~93~~ 105 Minutes

Portland to Plaistow ~~93~~ 105 Minutes

The above scheduled running times are based on the following:

Passenger Train Speeds - Appendix I.

Stops at four of the stations shown in Appendix III, Table 3.

Any revision of scheduled running times for Amtrak intercity passenger trains operated on the Rail Lines shall be agreed upon by the parties and shall include appropriate amounts of time for running time and station stops, plus 6% recovery time. For trains scheduled to stop at Old Orchard Beach, the scheduled running times shall be revised or an additional 5 minutes per stop (including 2.0 minutes for dwell) shall be allowed over the above-scheduled running times for the purpose of calculating on-time performance pursuant to Appendix III.

The Service will operate four (4) round trips daily, approximately on the schedules set forth below:

Tentative Schedule:

<u>Depart</u> <u>Portland</u>	<u>Arrive</u> <u>Boston</u>	<u>Depart</u> <u>Boston</u>	<u>Arrive</u> <u>Portland</u>
6:05 ~~5:55~~ a.m.	8:35 ~~8:57~~ a.m.	9:45 a.m.	12:15 ~~12:27~~ p.m.
7:05 ~~8:55~~ a.m.	11:35 ~~11:57~~ a.m.	12:45 p.m.	3:15 ~~3:27~~ p.m.
1:50 ~~1:40~~ p.m.	4:20 ~~4:22~~ p.m.	5:30 p.m.	8:00 ~~8:12~~ p.m.
5:20 ~~5:10~~ p.m.	7:50 ~~7:52~~ p.m.	9:30 p.m.	12:00 ~~12:12~~ a.m.

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ATTACHMENT 3(e)

APPENDIX IIITABLE 1

The Checkpoint Performance Rate to be used in the calculations in Appendix III B. and C. is the rate listed below for the amount of Scheduled Time From Origin set forth below.

<u>Train Nos.</u>	<u>Origin-Checkpoint</u>	<u>Tolerance (Minutes)</u>	<u>Scheduled Time From Origin (Minutes)</u>	<u>Checkpoint Performance Rate</u>
All Trains	Plaistow (State Line) - Portland	5	~~105~~ 93	\$780
	Portland - Plaistow (State Line)	5	~~105~~ 93	\$780

TABLE 2CONSISTS

The Scheduled Times set forth in Table 1 are based upon the following locomotive and car consists:

<u>Train No.</u>	<u>Locomotives and/or Cars</u>
All Trains	up to 6

A.D.9.7

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Jul 21 00 11:50a Victor W Salemme

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55500 DOT Road
P.O. Box 11130
Pueblo, Colorado 81001-0130

David Read
Sr. Engineer II
719 584 0559
Fax 719 584 0770
david_read@ttci.aar.com

July 7, 2000

Mr. Mike Murray
Executive Director
Northern New England Passenger Rail Authority
5 Industry Rd.
South Portland, ME 04106

Dear Mr. Murray,

Enclosed is one copy of the Track Modulus white paper and proposal for track modulus measurements deliverable per contract 00-5-00447. Please contact me or Peter Conlon (719 584 0554) if you have any questions.

We appreciate the opportunity to have worked with you on this project and look forward to working with you in the future.

Sincerely,

David Read
Sr. Engineer

cc:
P. Conlon
P. Herman
B. Kochevar
E. Walsh

TTCI is a subsidiary of the Association of American Railroads

PART 1.

TRACK MODULUS DEFINITION AND MEASUREMENT

Vertical track modulus, also referred to as modulus of track elasticity or track foundation modulus, as defined by the American Railway Engineering and Maintenance of Way Association (AREMA), is the load that causes a one-inch vertical rail deflection per linear inch of track.¹ It is a measure of the rail support stiffness and is derived from analysis in which the rail is considered to be a continuously supported beam on an elastic foundation of closely spaced springs.

Based on this analysis, track modulus can be expressed as

$$U = \frac{(k)^{4/3}}{(64EI)^{1/3}} \quad (1)$$

where

U = track modulus (lb/in/in)
E = rail steel modulus of elasticity (psi)
I = rail moment of inertia (in⁴)
k = vertical track stiffness (lb/in)

The track stiffness term is defined as

$$k = \frac{P}{y} \quad (2)$$

where

P = vertical load (lb)
y = rail deflection (in)

It is important to note the difference between track stiffness and track modulus. Track stiffness is the ratio of rail deflection and applied load. The stiffness of all track components, including the rail, is included in the result. However, the track modulus calculation excludes the flexural stiffness of the rail to represent the rail support condition.

Another important consideration in the track modulus calculation is the vertical load. Normally, the maximum static wheel load is used. For freight operations, the vertical load will be 33,000 lb or 36,000 lb and can be less if the operation is primarily passenger equipment.

Track modulus is considered to be an important indicator of track quality and strength and is a required term in many track design calculations. However, it is rarely quantified and the actual modulus of most track is unknown. Nominal modulus values, presumably based on experimental data, have been published for specific track configurations by Hay², Alf and others³. This information along with data from the Facility for Accelerated Service Testing (FAST) track at Pueblo, Colorado⁴ indicate that modulus values of 2,500 lb/in/in or higher are typical of a stable track structure. Modulus less than 1,500 lb/in/in - 2,000 lb/in/in would be indicative of track prone to significant rail deflection and rapid track geometry degradation.

Factors Influencing Track Modulus

As stated, track modulus represents the overall stiffness property of the rail supporting system including rail fasteners and pads, ties, ballast and subgrade. To determine the individual effect that each of these components has on the modulus, a parametric study was performed by Selig and Li⁵ using the GEOTRACK model. Results of this effort indicate that stiffness of the subgrade has the most significant effect on track modulus. The granular layer (ballast and subballast) thickness and rail fastener pad stiffness and wood tie compressibility also contribute to the track modulus. Tie dimension and spacing have less effect on track modulus and, by definition, the rail section has no effect.

This study strongly suggests that track modulus is primarily a reflection of the subgrade condition. Therefore, those factors that effect subgrade strength such as soil type, density and moisture content, tend to have a similar effect on track modulus. Track modulus can vary significantly at those locations where the subgrade strength is sensitive to seasonal effects such as freeze-thaw cycles and wet/dry cycles.

Another parameter effecting track modulus was found to be the compressibility of wood which is why wood tie track tends to have lower modulus when compared to concrete tie track over similar substructures. Previous work performed by Stewart and Selig⁶ and Stewart⁷, tends to reinforce these results.

These findings imply that common track maintenance activity such as surfacing or tie renewals will not provide much long term benefit to low track modulus locations. In most cases, a strengthening of the subgrade and/or improved drainage will be required.

Measurement of Track Modulus

Several test methods have been proposed to determine track modulus, including two techniques in which the area under the track deflection curve, or deflection basin, is measured and a single point load/deflection measurement method. Investigations by Choros and Zarembski⁸ found the single point load/deflection measurement to be the preferred method since it involves only one rail deflection measurement as opposed to the multiple measurements needed for the deflection area methods. The single point method is also relatively simple to calculate using the beam-on-elastic foundation model found in equation (1). The disadvantage of the single point method is that it requires a vehicle with a single axle truck or a vehicle modified with load generating actuators attached to the center.

To compensate for the fact that virtually all rail vehicles have two or three axle trucks, Kerr⁹ has developed the following equation to include the effect of the superimposed load from adjacent axles on the rail deflection measured under one axle:

$$\frac{W_m}{P} = \frac{\beta}{2\nu} [1 + e^{-\beta L_1} (\cos \beta L_1 + \sin \beta L_1)] + e^{-\beta L_2} (\cos \beta L_2 + \sin \beta L_2) \quad (3)$$

where

W_m = measured rail deflection (in)

P = load (ton)

$\beta = (\nu/4EI)^{1/4}$

L_1 = distance from lead axle to #2 axle (in)

L_2 = distance from lead axle to #3 axle in three axle truck (in)

This method requires measurement of rail deflection under the lead axle of a car or locomotive with known truck weights. This is typically performed using a scale graduated in 0.01 inches fastened to the rail with tape or magnets and read with a survey level located next to the track. The measured deflection is divided by the wheel load (truck weight/# of wheels/2000) to give the term W_m/P in inches-per-ton. The only other required parameters are the rail EI values and the distance between the lead and adjacent axle(s) in the truck.

Included in Appendix A is a table and plot of W_m/P values for moduli of 500 lb/in/in to 6,000 lb/in/in in 100 lb/in/in increments. The values were calculated for 115#/112# rail and the standard axle spacing of 70 inches for a 100-ton truck. A similar table would be generated for different rail sections or different axle spacings.

Effect of "Slack" on Track Modulus

The above discussion of the track modulus measurement uses the total deflection of the rail in the modulus calculation. Recalling that track modulus represents the elastic response of the track components beneath the rail to an applied vertical load, any free movement of the rail due to gaps between the rail base and tie plate or between the tie bottom and ballast bed will produce an exaggerated deflection and low modulus value.

For example, using the rail and axle spacing conditions of Appendix A, a total rail deflection of 0.25 inches is measured under a loaded 100-ton car. The W_m/P value is 0.015209, which referring to Appendix A, gives a modulus value of 1,794 lb/in/in. However, of the 0.25 inches measured, 0.10 inches were due to a rail-to-tie plate gap. The true W_m , therefore, is 0.15-inches which will give a significantly higher modulus.

Since slack in the track structure is fairly common, especially with wood ties and track spike fasteners, an empty/loaded car approach can be used to produce more accurate modulus values. Rail deflection is measured under an empty car and again at the same location under a loaded car and equation (3) is modified to:

$$\frac{W_m}{P} = \frac{W_{mh} - W_{mi}}{P_h - P_i} \quad (4)$$

where

W_{mh} = rail deflection under heavy car (in)
 W_{mi} = rail deflection under empty car (in)
 P_h = heavy car wheel load (tons)
 P_i = empty car wheel load (tons)

Using an empty car in the above example to remove the 0.10-inches of slack, W_m becomes 0.15 inches and P becomes 12.5 tons, or 0.012 for the ratio. Track modulus is then 2,400 lb/in/in.

The disadvantage of the empty/loaded car method is that it doubles the measurement time and requires some switching since the locomotive should be located between the two cars.

References

- ¹ *Manual for Railway Engineering, Volume 4.* American Railway Engineering Association, 1999.
- ² Hay, W. W. *Railroad Engineering* second edition. John Wiley and Sons, Inc. 1982.
- ³ Doyle, N. F. *Railway Track Design a Review of Current Practice.* Australian Government Publishing Service, 1980.
- ⁴ Read, D. M., et al. Track Modulus Measurements at the Pueblo Soft Subgrade Site. *Transportation Research Record 1470*. TRB, National Research Council, Washington D.C., 1994.
- ⁵ Selig, E. T. and D. Li. Track Modulus: Its Meaning and Factors Influencing It. *Transportation Research Record 1470*, TRB, National Research Council, Washington D.C., 1994.
- ⁶ Stewart, H. E. and E. T. Selig. Predicted and Measured Resilient Response of Track, *Journal of the Geotechnical Engineering Division*. ASCE, Vol 108, No. GT11, Nov 1982.
- ⁷ Stewart, H. E. Measurement and Prediction of Track Modulus. *Transportation Research Record 1022*. TRB, National Research Council, Washington D.C., 1985.
- ⁸ Choros, J. A. M. Zerembski, and I. Gitlin. Vertical Track Modulus: Test Results and Comparison of Analysis Techniques. Report No. FRA/ORD-79/34. U.S. Department of Transportation, Washington D.C., 1979.
- ⁹ Kerr, A. D. A Method for Determining the Track Modulus Using a Locomotive or Car on Multi-Axle Truck. *AREA Bulletin* 692, Vol. 84, 1983.

Attachment 1

PART 2.

TRACK MODULUS MEASUREMENT PROPOSAL FOR THE NORTHERN
NEW ENGLAND PASSENGER RAIL AUTHORITY

STATEMENT OF WORK

Revised July 7, 2000

Background

The Northern New England Passenger Rail Authority (NNEPRA) has requested a proposal from Transportation Technology Center, Inc. (TTCI) to measure track modulus over a 78-mile track segment. The track is currently undergoing significant rehabilitation to accommodate intercity passenger rail service and the existing track modulus is unknown. The route is currently used exclusively for freight operations. The Surface Transportation Board has specified a minimum vertical track modulus of 2,750 lb/in/in in order to initiate proposed passenger service over the track at speeds up to 79 mph (FRA track class 4).

Measurement Technique

Track modulus is calculated from measured wheel load and rail deflection data. TTCI has developed methodology to measure rail deflection continuously using the Track Loading Vehicle (TLV). The TLV has a load application bogie located at the center of the vehicle capable of generating over 33,000 lb of vertical force on both rails through hydraulic actuators as the vehicle moves along the track. Vertical deflection of the rail is measured with laser displacement sensors. The TLV is permanently joined to the AAR-100 test car and requires a locomotive for propulsion. Speed of the TLV in test mode is about 10 mph.

The TLV is not currently capable of providing an absolute measurement of rail deflection that is required to calculate track modulus. The data output is a relative rail deflection plotted as a function of distance. To obtain accurate track modulus values, it is necessary to stop the TLV and perform a stationary measurement. During the stationary measurements, the TLV load bogie applies the vertical force and rail deflection is measured with a wayside optical level.

It is proposed that the TLV be used to continuously profile the line. Stationary measurements will then be performed at those locations where the largest rail

deflections were measured. Track modulus will be calculated from the stationary deflection data, which should be an acceptable indicator of the minimum track modulus for the line.

Schedule

This project is currently anticipated for September – October, 2000.

ID	Task Name	Duration	Week 1	Week 2	Week 3	Week 4	Week 5
			Week 1	Week 2	Week 3	Week 4	Week 5
1	SHIP TLV TO MAINE	14 days					
2	SETUP	1 day					
3	CONT DATA COLLECTION	1 day					
4	STATIONARY MEASUREMENTS	1 day					
5	TEARDOWN/PREP TO SHIP	1 day					
6	TLV RETURN TO TTC	14 days					
7	REPORT	15 days					

Deliverables

TTCI will produce a letter report to NNEPRA within 15 calendar days documenting the test procedure and results.

Responsibilities

TTCI will be responsible for operating the TLV consist, arranging for its shipment to Maine and return shipment to TTC, collecting and analyzing the data and producing a report

NNEPRA will be responsible for coordinating with the host railroad. The host railroad will need to provide a locomotive and operating crew.

Cost

TTCI will perform this project based on the level of effort defined above on a cost driven basis not to exceed \$65,000.

Attachment 1

PART 2.

TRACK MODULUS MEASUREMENT PROPOSAL FOR THE NORTHERN
NEW ENGLAND PASSENGER RAIL AUTHORITY

STATEMENT OF WORK

Revised September 25, 2000

Background

The Northern New England Passenger Rail Authority (NNEPRA) has requested a proposal from Transportation Technology Center, Inc. (TTCI) to measure track modulus over a 78-mile track segment. The track is currently undergoing significant rehabilitation to accommodate intercity passenger rail service and the existing track modulus is unknown. The route is currently used exclusively for freight operations. The Surface Transportation Board has specified a minimum vertical track modulus of 2,750 lb/in in order to initiate proposed passenger service over the track at speeds up to 79 mph (FRA track class 4).

Description of TLV Dynamic Measurement Technique

Track modulus is calculated from measured wheel load and rail deflection data. TTCI is in the process of developing a methodology to measure rail deflection continuously using the Track Loading Vehicle (TLV). The TLV has a load application bogie located at the center of the vehicle capable of generating over 33,000 lb of vertical force on both rails through hydraulic actuators as the vehicle moves along the track. Vertical deflection of the rail relative to the center of load axle is measured with laser displacement sensors. The TLV is coupled to an empty tank car that is used to generate a nominal 1,000 lb rail load at the center of the car. Vertical rail deflection under the tank car is measured using the same technique as is used on the TLV. The recorded rail deflection is then calculated by subtracting the tank car deflection from the TLV deflection. In addition to the tank car, the TLV is permanently joined to the AAR-100 test car that is used for data acquisition and TLV system control. The 3 car consist is not self-propelled and requires a locomotive and operating crew from the host railroad.

Current Limitations of TLV Measurement Technique

The TLV is not currently capable of providing an absolute measurement of rail deflection required to calculate track modulus. An offset is introduced into the data taken on curves. To obtain track modulus values, it will be necessary to review the dynamic rail deflection data generated by the TLV and then perform stationary measurements at selected locations. The stationary measurement locations will generally be selected to represent the areas of highest rail deflection measured by the TLV. During the stationary measurements, the TLV load bogie will apply the vertical force and the rail deflection will be measured with a wayside optical level. The total number of stationary measurement sites will depend on the general condition of the track and the variability of the dynamic deflection data recorded by the TLV. The number of stationary measurements may also be dictated by the availability of track time.

Description of TLV Measurement Procedure

The TLV will be used to continuously measure the rail deflection of the track at a speed of 10 mph. The applied vertical load will be 30,000 lb. Data from both the TLV and the tank car will be digitally sampled at 20 samples-per-second which equates to a data point taken every 9 inches at 10 mph. A moving 25-foot average (34 data points) is then calculated as the final data output.

Markers will be placed in the data to represent mileposts, turnouts, bridges, grade crossings and other track features. It will be necessary to stop the TLV consist at 10-mile intervals (approximate) for a period of 15 to 20 minutes to save the recorded data and to produce data plots. The data will be plotted as rail deflection as a function of track distance. Milepost and track feature markers will also be included in the plots.

The deflection data will be examined and stationary measurements will be performed at those locations where the largest rail deflections were measured. It is anticipated that 20 - 40 stationary measurements will be performed and that the effort will take one day. Track modulus will be calculated from the stationary deflection data based on the track stiffness between 10,000 lb and 30,000 lb. The stationary measurements based on should be an acceptable indicator of the minimum track modulus for the line.

TLV Support, Logistical and Special Requirements

1. TTCI will arrange for transportation of the TLV consist from Avondale, CO to an interchange location to be defined by NNEPRA or Guilford.
2. A siding or spur track at least 400 long will be needed to store the TLV consist when not performing measurements.
3. The generators on the TLV and AAR 100 test car will require refueling at the end of the project. About 400 gallons of #2 Diesel fuel will be needed.

Schedule

The proposed schedule is shown below. Three weeks are allowed to ship the TLV consist from TTC to the Guilford interchange point. The TTCI crew would be at the TLV the morning of November 6, 2000 to prepare the consist for measurements. Three days are scheduled for measurements and one day to prepare the TLV to ship back to TTC. The week of November 13 is shown as a contingency if the TLV does not arrive in 3 weeks.

ID	Task Name	Duration	October				November					C
			10/1	10/8	10/15	10/22	10/29	11/5	11/12	11/19	11/26	
1	SHIP TLV TO MAINE	19 days			10/16			11/2				
2	SETUP	1 day						11/6	11/6			
3	CONT DATA COLLECTION	2 days						11/7	11/8			
4	STATIONARY MEASUREMENTS	1 day						11/9	11/9			
5	TEARDOWN/REP TO SHIP	1 day						11/10	11/10			
6	CONTINGENCY	5 days						11/13		11/17		
7	REPORT	15 days						11/13				

Deliverables

TTCI will produce a letter report to NNEPRA within 15 calendar days documenting the test procedure and results. The report will include copies of the data and

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FARRELL ROSENBLATT RUSSEL

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SEP 29 2000 THU 12:43 PM TTC INC

FAX NO. 719 584 0770

P. 05

Responsibilities

TTCI will be responsible for operating the TLV consist, arranging for its shipment to Maine and return shipment to TTC, collecting and analyzing the data and producing a report

NNEPRA will be responsible for coordinating with the host railroad. The host railroad will provide a locomotive, operating crew, siding or spur track for the consist when not testing and approximately 400 gallons of Diesel fuel as noted above.

Cost

TTCI will perform this project based on the level of effort defined above on a cost driven basis not to exceed \$65,000.

TLV Support, Logistical and Special Requirements

1. TTCI will arrange for transportation of the TLV consist from Avondale, CO to an interchange location to be defined by NNEPRA or Guilford.
2. A siding or spur track at least 400 long will be needed to store the TLV consist when not performing measurements.
3. The generators on the TLV and AAR 100 test car will require refueling at the end of the project. About 400 gallons of #2 Diesel fuel will be needed.

Schedule

The proposed schedule is shown below. Three weeks are allowed to ship the TLV consist from TTC to the Guilford interchange point. The TTCI crew would be at the TLV the morning of November 13, 2000 to prepare the consist for measurements. Three days are scheduled for measurements and one day to prepare the TLV to ship back to TTC.

ID	Task Name	Duration	November							December		
			10/16	10/22	10/29	11/5	11/12	11/19	11/26	12/3	12/10	12/17
1	SHIP TLV TO MAINE	17 days	10/23				11/10					
2	SETUP	1 day				11/13	11/13					
3	CONT DATA COLLECTION	2 days				11/14	11/15					
4	STATIONARY MEASUREMENTS	1 day				11/16	11/16					
5	TEARDOWN/PREP TO SHIP	1 day				11/17	11/17					
6	REPORT	17 days				11/20				12/12		

Deliverables

TTCI will produce a letter report to NNEPRA within 15 calendar days documenting the test procedure and results. The report will include copies of the data and calculated modulus values from the stationary tests.

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NNEPRA Employee

207-780-1001

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10/12/01 15:55

ID:Guilford Rail System

FAX:978-663-6907

PAGE 1



BOSTON & MAINE CORPORATION
MAINE CENTRAL RAILROAD COMPANY
SPRINGFIELD TERMINAL RAILWAY COMPANY

IRON HORSE PARK
NO. BILLERICA, MASS. 01822

October 12, 2001

Mr. Michael Murray
Executive Director
Northern New England Passenger Rail Authority
58 Fore Street
Portland, Maine

Dear Mike:

It has been almost three weeks since Guilford Rail System (GRS) participated in the K value testing of the Boston to Portland rail line.

Our review of the data generated by TTCI shows deflection greater than .28 inches in 63 out of the 74 miles. With this data in hand, it is clear to us that passenger trains will not be able to safely exceed 59 miles per hour.

Sincerely,


David A. Fink
Executive Vice President

CC: John Carter
John Melrose



NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY

October 23, 2001

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing

Dear David:

I am writing in response to your October 12, 2001 letter, in which you state that, based upon the data generated by the TTCI track loading vehicle ("TLV") during its four days of testing of the Plaistow-Portland line, Guilford does not believe that passenger trains operating over the line can safely exceed 59 miles per hour.

NNEPRA and Amtrak do not share your assessment. I have been advised by our engineering consultants that the data generated during the TLV's runs, which was provided to Guilford's engineers, indicate that the deflection criterion (.28 inches or less) was satisfied on well over 99% of the line. The only locations not meeting this criterion were Kennebunk and some very short (typically 10 feet or less) stretches at other locations. The static tests that were performed indicate that the track modulus on the vast majority of the line is substantially in excess of the specified 2750 lb./in./in. Accordingly, we believe that the requirements for 79 mph operation have been satisfied.

As you are aware, for a number of reasons, the TLV was unable to perform stationary tests at as many locations as had originally been contemplated in TTCI's "Statement of Work." I understand that Guilford believes TTCI should perform additional stationary testing on the line. Accordingly, NNEPRA and Amtrak have approached TTCI to determine if it is feasible for the TLV to return to the line in mid-

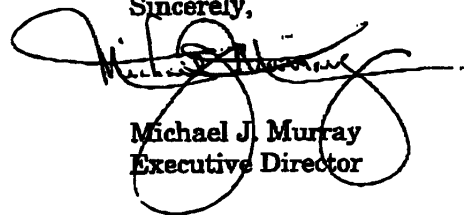
Mr. David A. Fink
October 23, 2001
Page 2

November, prior to its return to Colorado, to perform three to four days of additional tests before TTCI issues its report.

If such testing proves feasible, NNEPRA is prepared to authorize it. However, before doing so, NNEPRA would want assurances from Guilford that, in accord with the practice of all other railroads over which the TLV and its support cars have moved, it will permit the three-car TLV consist to move between Mechanicville and the Portland-Plaistow line in regular freight service, since the movement of this consist in special trains is both unnecessary and prohibitively expensive. In addition, as before, a Guilford locomotive and crew will be required to move the TLV consist as it engages in its testing, and Guilford's assistance in permitting the testing to be done as fast and efficiently as possible will be needed.

Please let me know if Guilford is willing to accommodate additional testing as described above.

Sincerely,



Michael J. Murray
Executive Director

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NNEPRA Employee

207-780-1001

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ID:Guilford Rail System

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PAGE 2



BOSTON & MAINE CORPORATION
MAINE CENTRAL RAILROAD COMPANY
SPRINGFIELD TERMINAL RAILWAY COMPANY

IRON HORSE PARK
NO. BILLENICA, MASS. 01867

EXECUTIVE DEPARTMENT
(978) 663-1186

November 1, 2001

Michael J. Murray
Executive Director
Northern New England Passenger Rail Authority
55 Fore Street
Building 30
Portland, ME 04101

Re: Track Modulus Testing

Dear Mike:

I am in receipt of your letter dated October 23, 2001, in which Amtrak and NNEPRA dispute our assessment that the recent track modulus testing has not satisfied the criteria established by the Board for passenger operations at speeds of up to 79 miles per hour. In support of this position, you claim that, "... the data generated during the TLV's runs, which was provided to Guilford's engineers, indicate that the deflection criterion (.28 inches or less) was satisfied on well over 99% of the line."

Although the test results provided to GRS do not support this blanket statement, we should address some preliminary issues before discussing our analysis of this data. First, I was somewhat surprised that NNEPRA has now taken on the role of spokesman for Amtrak, since NNEPRA supposedly had no direct involvement in the proceedings before the STB. Accordingly, NNEPRA's assumption of this role under the present circumstances is particularly troubling because our concerns arise from the fact that the recent testing had little or no relation to the program presented for approval by Amtrak at the STB. Consequently, since NNEPRA has historically claimed to have little direct involvement in the STB proceedings, I do not believe that NNEPRA is the proper party to explain: (a) the significant discrepancies between the proposed testing program and the actual testing performed; or (b) the failure to perform static testing at a substantial number of those locations where both the proposed and the revised deflection criteria were exceeded. Nevertheless, since NNEPRA has apparently elected to finally assume a leadership role, I would ask that you review the following and provide me with your thoughts as soon as possible. In addition, since your letter appeared to be based upon information that GRS has yet to review, I would appreciate a copy of the reports/data relied upon in reaching

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NNEPRA Employee

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ID:Guilford Rail System

FAX:978-663-6907

PAGE 3

these conclusions, including the report promised by the TTCI Scope of Work within 15 days of completion of the testing.

As you should know, the need to perform the recent testing originally arose as a result of the disagreement over our belief that 132-pound rail was necessary to support safe passenger operations, and NNEPRA's belief that the use of this weight of rail would be prohibitively expensive. To resolve this disagreement, the parties agreed to present the following issue to the Board:

Applying the engineering standards agreed to by NNEPRA and Railroad [Guilford] in the Rehabilitation Agreement, with particular reference to the engineering standards of the American Railway Engineering Association [now AREMA] specified therein, what is the appropriate weight of rail to be installed on the Rail Line in order to ensure safe, consistent and continuous operation of Amtrak trains at speeds of up to 79 miles per hour? (*emphasis added*)

As a result, throughout the Board proceedings to decide the speed at which Amtrak trains could operate on this line, the AREMA standards were the basic premise underlying each party's submissions, including the following representations by Amtrak in the latest round at the STB:

1. Deflection data gathered the first two days are used as a guide for where to test for track modulus because there is a high correlation between the two. *A location with significant track deflection can generally be expected to have a comparatively low track modulus.*
2. The AREMA maximum deflection criteria of *.25 inches* will be used as the limiting value at which a follow up track modulus measurement will be performed. Where the TLV detects deflection greater than this amount, it will place a paint mark at the location in question.
3. Analysis of the TLV's output deflection data, *combined with subsequent track inspection to spot the paint marks left by the TLV*, will identify where the limiting deflection criterion has been exceeded and where follow up inspections are required.
4. The test plan also provides for testing any *suspected* low modulus areas by static means. *This testing provides an additional way of assuring that the overall results are of sufficient accuracy.*
5. TTCI has developed the TLV so that the relative track deflection that it measures closely correlates with absolute track deflection. *The best test of this will occur when stationary measurements are made at locations where the relative track deflection data recorded by the TLV indicates that an absolute measurement should be made (because preset relative deflection limits are exceeded).*
6. In fact, the limit should be .28 inches, but TTCI will use .25 inches to be conservative.

Based upon these representations, the Board found the following:

1. But as FRA points out, using the dynamic test at 10 miles per hour to locate parts of the line with lower than average track modulus *will demonstrate the particular points at which a static test needs to be performed.*

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ID:Guilford Rail System

FAX:978-663-6907

PAGE 4

2. As FRA points out, the test procedure that *Amtrak has proposed* is both reasonable and practical, and it should provide sufficient data to evaluate the average or nominal track modulus along the Plaistow-Portland line following rehabilitation.
3. We find: Track modulus testing on the Plaistow-Portland line through the use of the TLV *in the manner described by Amtrak* is a reasonable and practical method of testing the track to determine whether the level of rehabilitation described in our prior decisions has been met.

With this background in mind, as well as the limited information that has been provided to GRS to date, we do not believe that the recent testing performed by TTCI was done in accordance with the plan proposed to the STB. This position is based upon the following:

1. Based upon your October 23rd letter, the recent testing used a limiting value of .28 inches to identify areas where static testing should be performed, as opposed to the limiting value of .25 inches proposed by Amtrak. Despite this commitment to a specific limiting value, without any consultation with the STB, GRS or FRA, the value was unilaterally changed during the testing, which is unsupportable. Moreover, this limiting value exceeds the AREMA maximum deflection criterion, as defined by Amtrak in its submissions to the Board. Finally, Amtrak also had previously informed the Board that .28 inches is the appropriate limiting factor, but in any event .25 inches would be used during testing to be conservative and to ensure that all areas with potentially low track modulus would be identified for static testing. Apparently, this plan was abandoned somewhere along the way.
2. As represented to the Board, at each location where the TLV detected a deflection greater than .25 inches, Amtrak planned to apply a paint mark, and subsequent track inspection would spot where those marks were located so that the required follow up static inspections would be performed. Obviously, on this issue the recent testing failed miserably. First, very few paint marks were applied, even though approximately 464 locations over approximately 70 miles were identified as having a deflection greater than .28 inches. Second, despite the large number of locations identified, and the willingness of GRS to allow the TLV to remain on our lines for additional time, static testing was performed in only 12 "zones", covering feet, as opposed to the miles that were identified. Clearly, this is a depressingly small portion of the area that should have been tested.
3. There is also no justification for failing to perform static tests at all areas where the deflection was greater than .28 inches, much less .25 inches, because Amtrak's submission stated several times that: (a) this static testing would be required; (b) there is a high correlation between high deflection and low track modulus; and (c) the best method to ensure the accuracy of the TLV methodology would be to perform such testing.
4. Your letter also claims that NNEPRA is essentially ignoring those areas where low track modulus values were identified, because those areas are "very short (typically 10 feet or less)". We are not aware that the Board provided that "very short" areas of low track modulus were exempt from the Board's requirements, and we disagree that these locations should be ignored. Moreover, GRS would submit that these areas should be identified as being indicative of potentially larger problems, although the rather cursory

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NNEPRA Employee

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ID:Guilford Rail System

FAX:978-663-6907

PAGE 5

Notwithstanding our concerns that the recent testing effectively ignored the vast majority of those locations where the rail line likely fails to meet the required standards, the point of this letter is to make known our objections to the fact that the testing was not performed in the manner approved by the STB. In short, Amtrak, with the support of NNEPRA and Trainriders Northeast, requested that the Board decide that: (a) the proposed testing methodology was reasonable and practical; and (b) once an adequate track modulus is demonstrated using this method, no further track modulus testing would be necessary. While the Board did ultimately decide that this proposed testing was reasonable, NNEPRA then remarkably condoned the performance of the recent testing in a manner that had little or no relation to the method approved by the Board. As a result, today there are still two issues outstanding: (a) the testing has yet to be performed in the manner described by Amtrak, and approved by the Board; and (b) consequently, until the proper testing is performed, the criteria established by the Board to allow passenger service at speeds greater than 59 miles per hour have not been satisfied.

Based on the foregoing, GRS will not allow any passenger operations at speeds greater than 59 miles per hour until acceptable results are obtained by performing testing in the manner presented to, and approved by, the STB. While we appreciate NNEPRA's offer to bring back the TLV for more static testing in November, this offer simply misses the point; which is that static testing will not correct the fact that the initial TLV testing was not performed pursuant to the Board's decision. Accordingly, while NNEPRA is free to conduct additional static testing in the near future, we would suggest that NNEPRA also plan to conduct the appropriate testing sometime in the spring or summer (the optimal time for such testing, according to Amtrak) of 2002.

With regard to the movement of the TLV consist in regular freight service, we will agree to this request, provided that we do not have a repeat of the events that surrounded the original movement of this consist. As you may recall, Guilford spent a great deal of time and effort to track and locate this consist during the last movement, with little assistance from NNEPRA or TTCI. In fact, a full day and a half was wasted while this consist was turned to accommodate the needs of TTCI, which could have been avoided had NNEPRA provided the proper shipping and placement information. Moreover, despite the original plan to conduct testing for a maximum of three days, in reality this testing took six days, unnecessarily interfering with our freight operations. Finally, the relative lack of interest by NNEPRA personnel in such an important project continues to trouble Guilford. More particularly, we believe that NNEPRA should be more committed to monitoring the next round of testing, and should spend more than a brief visit on the consist. Otherwise, we risk a repeat of the insufficient testing that was performed during September, which will ultimately require even more testing in the future.

Thank you for your attention to this matter. Please feel free to contact me if you should have any questions or comments.

Sincerely,


David A. Fink
Executive Vice President

04-02-2001 08:13

FARRELL ROSENBLATT RUSSEL

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v 02 01 07:38

NNEPRA Employee

207-780-1001

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ID:Guilford Rail System

FAX:978-663-6907

PAGE 6

cc: J. Carter
J. Melrose

**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

November 2, 2001

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, MA 01862

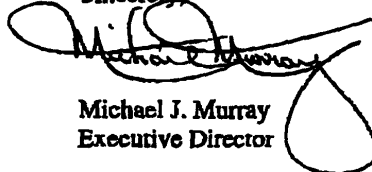
Re: Track Modulus Testing

Dear David:

Thank you for your letter of November 1, in which you indicated that additional testing of Guilford's Plaistow-Portland line using TTCT's track loading vehicle (the "TLV") can proceed and that Guilford will move the TLV consist in regular freight service between Mechanicville and the Plaistow-Portland line. I assume that Guilford also is willing to provide a locomotive and crew to move the consist while it is conducting the testing.

As I indicated in my letter to you of November 1, arrangements have already been made to move the TLV back to Mechanicville. NNEPRA now will instruct TTCT to proceed with additional testing on the Plaistow-Portland line starting on November 12. NNEPRA expects this additional testing will last three or four days and will be conducted in a manner that minimizes any impact on Guilford's operations.

Sincerely,


Michael J. Murray
Executive Director

P.S. — Your November 1 letter certainly makes clear that Guilford takes issue with the testing that was conducted in September. As you know, NNEPRA and Amtrak both believe that the data generated to date by the TLV show that the requirements for 79 mph operation have been satisfied. I would suggest that the appropriate time for engaging in the discussion initiated in your letter is after the upcoming additional testing has been completed.

58 Fore Street
Building 30
Portland, ME 04101

Tel: 207/780 1000

123

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**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

November 9, 2001

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing

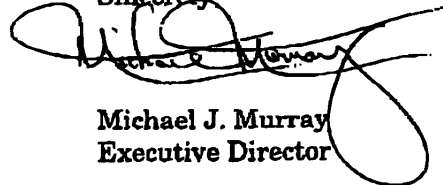
Dear David:

Following up on our earlier correspondence regarding the testing that TTCI will be conducting on behalf of NNEPRA and Amtrak on Guilford's Plaistow-Portland line (now scheduled to start on November 16, 2001), enclosed is a copy of the "work program" under which that testing will be performed. TTCI is still completing its formal "plan of work" for the testing; I will forward a copy of this plan to you as soon as I receive it.

As I have mentioned before, we will need a Guilford locomotive and crew to move the TTCI consist while it is engaged in testing. We will work with Guilford so that the testing is conducted in such a way that Guilford line operations are not disrupted, and ask that Guilford work with us to permit the testing to be done as quickly and efficiently as possible.

If you have any questions, please let me know.

Sincerely



Michael J. Murray
Executive Director

58 Fore Street
Building 30
Portland ME 04101

Tel (207) 780-1000
Fax (207) 780-1001

TLV Proposed Phase II Static Test Plan - MP 199.0 - 272.91

MP	5' average defl (in)	Prop. Pass. Speed	Highway Grade Crossing	Turn out	Underpass	Overpass	Signal Location	No Apparent Reason	Comments
225.82	0.343	79		1					CPF 226
228.13	0.319	79		1					CPF 229
230.00		79						1	Potential high modulus site
233.02	0.552	75		1					Old CPF 233 Turnout
236.00		79						1	Potential medium modulus site
239.05	0.375	65	1						Private Crossing
240.79	0.322	79				1			Dover Rd., Br. 70.31
241.02	0.348	79						1	Low Modulus Test Area
241.21	0.345	79			1				Br. 69.76
241.48	0.379	79					1		WB home signals
247.09	0.421	79				1			Knox Marsh Rd. Br. 63.64
249.46	0.323	79		1					Br. 61.54
250.60		79						1	Potential high modulus site, WE spiral
256.38	0.309	79				1			Main St., Br. 54.59
257.89	0.415	65		1					CPF 258
257.97	0.387	65					1		WB Home signal CPF 258
259.44	0.403	65			1				Lyford, Br. 51.62
260.51	0.449	65	1						Main St.
261.30	0.423	70			1				Little River, Br. 49.70
262.35	0.318	70							Gurpowder River, Br. 48.68
262.45	0.489	70					1		Intermediate signal and defect detector
262.61	0.392	70	1						Powder Hill Rd.
265.13	0.342	79	1						Field Crossing
265.47	0.538	79	1						Route 107
267.35		79						1	Pol. medium mod. Site, SE of curve
268.94	0.348	79				1			Partridge Hill Rd., Br. 42.12
271.15	0.416	79	1						Graves Crossing

126

10

**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

November 16, 2001

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing

Dear David:

I am writing to advise that TTCI's testing of the Plaistow-Portland line has been delayed due to Norfolk Southern's misrouting of the TLV consist.

We currently anticipate that the TLV consist will arrive in Mechanicville on November 18 or 19, 2001. Testing is now scheduled to commence on November 28, 2001, starting from the Wells Beach siding and heading west. Please note that the TLV consist should be positioned so that the AAR 100 coach car is at the west end of the consist, the AAR 110 TLV is in the middle of the consist, and the AAR 120 tank car is at the east end of the consist.

We appreciate Guilford's cooperation in accommodating this amended testing schedule. The equipment misrouting which has occasioned it was beyond our control.

If you have any questions, please let me know.

Sincerely,

Michael J. Murray
Executive Director

58 Fore Street
Building 3D
Portland ME 04101

Tel (207) 780-1000
Fax (207) 780-1001



**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

November 20, 2001

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries
Iron Horse Park
North Billerica, MA 01862

Dear Dave:

I was pleased to learn that the TTCL's Track Loading Vehicle ("TLV") consist has reached Rigby Yard, following its earlier misrouting by Norfolk Southern. Our plans presently call for one day of dynamic testing on November 28 (starting from the Wells Beach siding and heading west), followed by three days of static testing on November 29, November 30 and December 1.

I understand that one lesson learned from the static testing performed by the TLV in September at Winnock's Neck Road was that the presence of a signal maintainer can facilitate static testing at test sites on or near highway grade crossings. I understand that while Guilford's Phil Brake was present during the Winnock's Neck Road static tests, the issue was not revisited since there was no other static testing on or near highway grade crossing in September.

I provided to you with my letter of November 9 a list showing where static testing presently is planned. Five of the test sites are at grade crossings, though not all are public crossings. In addition, some of the other test sites may fall on or near starting circuits for highway warning devices. I would ask that Guilford provide a signal maintainer for those test sites where Guilford, in its judgment, believes the presence of a signal maintainer will facilitate static testing.

If you have any questions, please let me know.

Sincerely,

Michael J. Murray, P.E.
Executive Director

50 Fore Street
Building 30
Portland, ME 04101

Tel (207) 780-1000
Fax (207) 780-1001



**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

November 21, 2001

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing

Dear David:

Enclosed is the schedule which we anticipate will govern the TTCI testing of the Plaistow-Portland line commencing on November 28, 2001. The schedule contemplates that testing will end on November 30, although it is possible that it will have to carry over to December 1 if testing delays are experienced.

You will note that the schedule calls for static testing on November 28 at a location between Rigby and Wells Beach (MP 213.23) which was not identified in testing-related information I have previously provided you. Based on data developed by TTCI in its earlier testing, this location appeared to show a relatively high deflection for a material distance. Although we had originally not been inclined to do additional testing between Rigby and Wells Beach so as to avoid any potential interference with ongoing track work at Kennebunk, the delay occasioned by Norfolk Southern's misrouting of the TTCI consist and the progress made at Kennebunk during the period of such delay, suggests that this location should now be included. Accordingly, static testing will start out of Rigby and not out of Wells Beach as I had earlier advised you. This means that the TLV consist should remain in storage at Rigby Yard prior to testing and not be moved to Wells Beach.

I am also enclosing an updated list of candidate static test locations, from which at least 18 sites will be selected and tested. This list is the same as the list I forwarded to you on November 9, except that it adds the above-referenced new

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Mr. David A. Fink
November 21, 2001
Page 2

location. To reiterate a point I made in my letter to you yesterday, six (I had earlier advised you that it was five) of these potential test sites are at grade crossings (although not all are public crossings) and some of the sites are on or near starting circuits for highway warning devices. We ask that Guilford provide a signal maintainer at those test sites where Guilford believes the presence of a signal maintainer will facilitate static testing.

Finally, as noted in my earlier correspondence with you, this is just a reminder that the TLV consist should be positioned so that the AAR 100 coach car is at the west end of the consist (immediately behind the Guilford locomotive), the AAR 110 TLV is in the middle, and the AAR 120 tank car is at the east end.

If you have any questions, please let me know.

Sincerely,



Michael J. Murray, P.E.
Executive Director

RECOMMENDED TEST PLAN

Tuesday, November 27, 2001

4:30 PM Position TLV consist for access by TTCI crew in Rigby Yard for purposes of provisioning and checking equipment

Wednesday, November 28, 2001

7:00 AM Leave Rigby Yard, travel at track speed to MP 213.27 and perform static test.

8:15 AM Proceed at track speed from MP 213.23 to MP 225.8.

9:00 AM Start rolling dynamic test from MP 225.8 and test to MP 272.9, beginning double track at Atkinson.

4:30 PM Finish test, run locomotive test consist to be prepared for static testing next day.

5:30 PM Finish for the day, tied up at Atkinson, NH.

Thursday, November 29, 2001

7:00 AM Back out of Atkinson Siding and proceed at track speed to MP 271.15.

7:30 AM Begin static testing at MP 271.15 and test up to 14 locations to and including 256.38.

6:30 PM Put train away for night on Newmarket Siding set-off tracks.

Friday, November 30, 2001

7:00 AM Head out of Newmarket Siding and run at track speed to MP 250.50.

7:30 AM Resume static testing at MP 250.50 and test up to 13 locations, to and including MP 225.82.

6:00 PM Depending on how much time crew has left, tie train up at Wells Beach Siding in the Eastern Propane Track or deadhead at track speed to Rigby Yard.

Orientation of Test Equipment

The order of the test equipment, leaving Rigby Yard on November 28, 2001, from railroad west to east is as follows: Guilford locomotive, AAR 100 coach, AAR 110 TLV, and AAR120 tank car.

TLV Proposed Phase II Static Test Primary Plan - MP 199.0 - 272.91

MP	5' average defl (in)	Prop. Pass. Speed	Highway Grade Crossing	Turn out	Under pass	Over pass	Signal Location	No Apparent Reason	Comments
213.23	0.359	79		1					Wood Structures Turnout
225.82	0.343	79		1					CPF 226
228.73	0.319	79		1					CPF 229
230.00		79						1	Potential high modulus site
233.02	0.552	75		1					Old CPF 233 Turnout
235.00		79						1	Potential medium modulus site
239.05	0.375	65	1						Private Crossing
240.79	0.922	79				1			Dover Rd., Br. 70.31
241.02	0.846	79						1	Low Modulus Test Area
241.21	0.345	79		1					Br. 69.76
241.48	0.379	79					1		WB home signals
247.08	0.421	79				1			Knox Marsh Rd. Br. 63.64
249.48	0.323	79		1					Br. 61.54
250.50		79						1	Potential high modulus site, WE spiral
256.38	0.309	79				1			Main St., Br. 64.59
257.89	0.415	65		1					CPF 258
257.97	0.367	65					1		WB Home signal CPF 258
260.44	0.403	65			1				Lyford, Br. 51.62
260.51	0.449	65	1						Main St.
261.30	0.423	70		1					Little River, Br. 49.70
262.35	0.318	70							Gunpowder River, Br. 49.68
262.45	0.489	70					1		Intermediate signal and defect detector
262.61	0.392	70	1						Powder Hill Rd.
265.13	0.342	79	1						Field Crossing
265.47	0.538	79	1						Route 107
267.36		79							
268.94	0.349	79				1		1	Pot. medium mod. Site, SE of curve
271.15	0.416	79	1						Partridge Hill Rd., Br. 42.12
									Cranes Crossing

Total Number of Locations 6 5 5 4 3 5 28

135



**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

November 26, 2001

BY FACSIMILE AND FIRST-CLASS MAIL

**Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862**

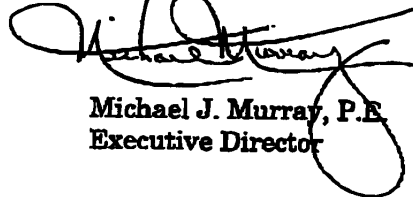
Re: Track Modulus Testing

Dear David:

As earlier promised, enclosed is a copy of the "Statement of Work" pursuant to which TTCI will be testing the Plaistow-Portland line commencing on November 28, 2001.

If you have any questions, please let me know.

Sincerely,



**Michael J. Murray, P.E.
Executive Director**

**58 Fore Street
Building 30
Portland, ME 04101**

**Tel: (207) 750-1000
Fax: (207) 750-1001**

Attachment 1

STATEMENT OF WORK**ADDITIONAL TRACK DEFLECTION MEASUREMENTS ON THE GUILFORD
SYSTEM****Engineering Change Order #2
TTCI Contract 00-S-00496****Submitted to Northern New England Passenger Rail Authority****Revised November 26, 2001****I. Background**

Transportation Technology Center, Inc. (TTCI) performed vertical rail deflection measurements under contract to the Northern New England Passenger Rail Authority (NNEPRA) from September 26 – 29, 2001 in an attempt to quantify track stiffness and track modulus on the Guilford Rail System (Guilford). This project was initiated by NNEPRA in response to the Surface Transportation Board mandated minimum vertical track modulus of 2,750 lb/in/in for operation of 79 mph passenger service between Plaistow, NH and Portland, ME.

The measurements were performed using TTCI's Track Loading Vehicle (TLV) consist and proprietary rail deflection measurement system. The TLV consist includes the TLV (AAR 110), AAR 100 passenger coach and tank car (AAR 120).

The TLV is a research tool developed and operated by TTCI. Although it is currently configured to measure vertical track support and stiffness variation under a rolling wheel load, TTCI does not market the TLV as a commercial, production product for measuring vertical track modulus in a moving or dynamic manner.

Continuous deflection measurements, also referred to as dynamic measurements, were performed with the TLV consist operating at a nominal speed of 10 mph on the Guilford freight mainline between milepost (MP) 197 (Portland, Maine) and MP 273 (Atkinson, New Hampshire). The applied vertical force during the dynamic measurements was 40,000 lb and rail deflection was measured on one rail only.

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NNEPRA Employee

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The TLV dynamic rail deflection measurement system is capable of measuring only relative deflections based on offset calculations during dynamic tests. Because of this measurement limitation and the ultimate requirement of this project for absolute deflection values, stationary or static measurements were performed at selected locations to produce a set of absolute deflection data that could be compared to the relative deflection recorded at the same location and to allow correlation of the relative and absolute deflection data. Static measurement sites were selected from the dynamic deflection data with the intention of measuring sample track support conditions ranging from very soft to stiff.

Static rail deflection was determined by measuring rail elevation at an applied vertical force of 10,000 lb and 33,000 lb and 2,000 lb vertical force using a survey-level setup next to the track and sighting a machinist scale attached to the rail. A total of 56 static measurements were performed at the following 12 locations: MP 203.2, 203.43, 209.57 (3 nearby locations), 210, 249.63 (3 nearby locations), 256.5, 257 and 257.02. The track stiffness between 10,000 lb and 33,000 lb load was used to calculate track modulus.

The following technical and price proposal is submitted in response to a request from NNEPRA for additional testing between Portland, ME and Atkinson, NH. The work would be implemented as Engineering Change Order 2 to the existing TTC/NNEPRA contract.

II. Scope of Work

Work to be Done

1. Perform dynamic measurements between MP 225 and 272.9 where the TLV paint spray system did not function during the first test.
2. Perform a minimum of 18 additional static measurements at a rate of at least 9 static measurements per day to augment the existing static data set and enhance the static-to-dynamic rail deflection correlation. The completion of 9 static measurements per day will be contingent on adequate support from Guilford, specifically efficient logistical support and adequate track time and train crew availability.

Measurement Procedure

The dynamic and static measurement procedures will be identical to those used in the first test and are summarized as follows:

1. The TLV will continuously measure relative deflection of a single rail at a speed of 10 mph while applying a 40,000 lb vertical rail load. Deflection data will be digitally sampled at 100 samples-per-second and a moving 5-foot average will be calculated from the raw data as the data output.

Milepost locations will be manually marked. The paint spray system will be used as before to mark locations where the VSI exceeds 0.07 inches.

Relative deflection and VSI data will be displayed as time or distance history plots on a computer monitor real-time during the test. Hard copies of the same plots will be produced at the end of the test or at any time the TLV stops during the test. A moving 25-foot average will be calculated as a final data output.

The TLV uses a paint-spray system to mark track locations where the Vertical Strength Index (VSI), a proprietary index developed to identify a nominal "soft" track threshold condition for the AAR research work, exceeds 0.07 inches. Unlike other track inspection devices that use paint to identify conditions that are out-of-specification, the TLV paint marks do not correlate to a specific rail deflection, stiffness or modulus value and do not necessarily mark a track segment that is "out of spec". The paint marks will be used to aid the TLV crew in pinpointing locations for inspection or possible subsequent static measurements.

2. Static rail deflection measurements will be performed at vertical loads of 2,000, 10,000 and 33,000 lb using a survey level and scale attached to the rail. Measurement accuracy is ± 0.010 inches.

Static measurements will be performed at locations between MP 225 and 272.9 selected from the potential locations included in Attachment 2 and/or from locations that were spray painted during the dynamic tests. Static measurements will be performed at no fewer than 18 separate locations. At least 9 static measurements will be performed each day as noted above.

Data Analysis and Deliverables

The purpose of the post-test data analysis will be to correlate the dynamic deflection data to track modulus values calculated from the static rail deflections. Conclusions will then be drawn regarding what percentage of track and which track segments do not meet the 2,750 lb/in/in modulus criterion.

Results of the data analysis will be sent to NNEPRA and LTK within 15 working days after completion of testing.

The final test report will include a description of the test operation and methodology and results of the data analysis.

III. TLV Support, Logistical and Special Requirements

1. TTCI will arrange for transportation of the TLV consist from Philadelphia, PA to Mechanicville, NY or other Guilford interchange location. TTCI will arrange for transportation of the TLV consist from a Guilford interchange location to Avondale, CO at the end of the test. TTCI will coordinate with appropriate Guilford personnel regarding movement of the TLV consist while on Guilford property.
2. The TLV will test in an increasing MP (railroad west) direction only when performing dynamic measurements. The consist must have the AAR 100 coach car leading, followed by the AAR 110 TLV and the AAR 120 tank car during the dynamic test. There is no directional requirement when performing static measurements. The operating railway will provide a storage location for the TLV at the conclusion of each testing day.
3. There is no speed restriction when moving the TLV consist in travel mode (load bogie and measurement frames retracted and locked in position). The only special handling requirement is that the 3 cars cannot be uncoupled or separated. The weights of the cars are as follows: AAR 100 - 130,479 lb, AAR 110 - 277,839 lb and AAR 120 - 108,299 lb.
4. A siding or spur track at least 350-feet long will be needed to store the TLV consist when not performing measurements.
5. The generators on the TLV and AAR 100 test car will require refueling at the end of the project. About 400 gallons of #2 Diesel fuel will be needed.
6. The TLV rail deflection measurement system and the VSI calculation is TTCI Intellectual Property. To the extent that any proprietary information is revealed to non-TTCI personnel during the course of this project, said personnel shall be instructed not to disclose this proprietary information to a third party.
7. Under no circumstances will the work be completed until at least 18 static measurements have been performed at separate locations. The TLV will not leave Guilford property before completing this work.

IV. Schedule

The proposed schedule is as follows:

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1. November 1 – November 18 – move TLV consist from Philadelphia to Wells Beach, ME via Norfolk Southern and Guilford
2. November 27 – TLV crew travels to Portland, ME.
3. November 28 – set up TLV for dynamic measurements and test between MP 225 and 272.9. This should take between 8 and 12 hours depending on availability of track time.
4. November 29 – December 1 – perform static measurements at least 18 locations between MP 225 and 272. Although 3 days are estimated, actual time to complete the static measurements will depend on track time and train crew availability.
5. December 2 – TLV is prepared for shipment to Colorado and the crew returns home.
6. December 3 – December 11 – analyze data.

V. Responsibilities

TTCI will be responsible for:

1. Setting up, operating, maintaining, and tearing down the TLV measurement system.
2. Arranging for transportation of the TLV consist to and from Guilford.
3. Coordinating all logistical and test operations requirements with Guilford. The lead TTCI Engineer on the TLV will be the primary point of contact with the appropriate Guilford person regarding day-to-day test requirements.
4. Collecting and analyzing the dynamic and static data and producing the test report.

NNEPRA will be responsible for coordinating the test schedule with Guilford.

VI. Price

TTCI will perform this project on a cost-driven plus fixed-fee basis for an estimated price of \$63,500. A breakdown of the cost components and pricing applicable to this Statement of Work is found in Attachment 3.

Not included in the estimated price are the following:

1. The cost of transporting the consist to Colorado at the end of the project which is part of the original contract price.
2. Guilford transportation costs which will be billed directly to NNEPRA.
3. TLV test operation costs for 1 day to perform dynamic measurements between MP 225 and 272.9, including labor, per-diem expenses and TLV use fee which is part of the original contract price.

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Attachment 3

Pricing Breakdown

In order to estimate the price, it was necessary to make certain assumptions concerning the level of effort (labor) and other direct costs required to meet the work scope defined above. A summary of the basic cost elements, which include the fixed fee (15%), along with assumptions made to derive the costs is as follows:

1. TLV consist transportation from Philadelphia to Mechanicville, NY – estimated cost \$5,750.
2. TLV test operation costs for 3 days to perform static measurements at 24 separate locations between MP 225 and 272.9 - estimated cost \$27,500. These costs include labor for the 4-person test crew at 12-hours per day, per-diem expenses and TLV use fee. This is an estimated level of effort for the test activity. Actual costs will reflect actual time worked. If the minimum 18 locations are measured in 2 days and the measurement effort ends at that point, the actual costs will reflect the one day reduction accordingly.

Breakdown of estimated test operation costs with fixed fee:

TTCI burdened hourly rate for 3-person TLV crew (Sr. Eng I, Eng. Associate, Test Eng) - \$398.25/hr. Total hours - 36.

TTCI subcontractor (Software Eng) hourly rate - \$59.8/hr. Total hours - 36.

TLV daily use fee - \$2,500.

Daily travel expenses including hotel, meals, and rental car for 4-person crew - \$644.

Administration and coordination - \$1,558.

3. Test crew travel costs from Colorado Springs to Portland including labor and transportation – estimated cost \$17,800.

TTCI labor and subcontractor hourly rates same as in item 2.

Total estimated travel hours - 24 @ \$458.05/hr = \$10,993.

Total estimated transportation costs including airfare, mileage and parking - \$6,800.

4. Four hundred gallons of diesel fuel – estimated cost \$575.
5. Data analysis – estimated cost \$11,875.

TTCI burdened average hourly rate for Senior Eng, Eng, and
Principal Investigator - \$156.25. Total estimated hours – 76.

This is a highly variable cost element due to the uncertainty of how
the additional static data points will affect the existing analysis.
This estimated cost represents a worst-case situation in which the
data reduction and analysis process already performed is re-done.
This is not anticipated but is possible.



**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

December 11, 2001

David A. Fink
Executive Vice President
Guilford Transportation Industries
Iron Horse Park
North Billerica, MA 01862

Dear David:

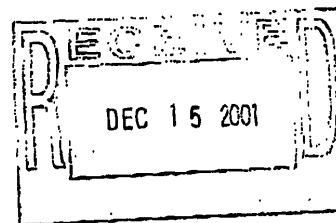
Enclosed are the deflection measurements and modulus calculations from the 28 static tests performed by the TLV on November 28, 29 and 30. The strip chart output from the TLV, showing the relative deflection and vertical strength indices, taken during the rolling dynamic test on November 28 is also included. Finally, enlarged graphical output plots from the rolling dynamic test are included for each of the static test sites. This information is the same as that provided after the first series of tests.

Sincerely yours,



Michael J. Murray, P.E.
Executive Director

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147



NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY

January 14, 2002

BY FACSIMILE AND FEDERAL EXPRESS

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing - TTCI Report

Dear David:

Enclosed for your review is a copy of the January 10, 2002 report prepared by TTCI, based on its track modulus and related track deflection testing of Guilford's Plaistow-Portland line performed during the periods September 26-29 and November 28-30, 2001.

As you will see, the TTCI report provides firm support for the 79-mph operating speed at which Amtrak proposes to conduct its passenger operations over designated segments of the Plaistow-Portland line. More specifically, the TTCI report shows that:

- the mean track modulus value for the line is 5,346 lb/in/in; and
- the track modulus exceeds 2,750 lb/in/in over more than 99.95% of the line where Amtrak operations are planned above 60-mph.

In light of the TTCI report, we are hopeful that Guilford will agree with us that 79-mph Amtrak operations are now warranted.

If Guilford has any questions regarding the TTCI report or Amtrak's plan for 79-mph operations, or if Guilford continues to take exception to such operations, we would be pleased to meet with you to discuss any such questions and to determine whether any such exception can be resolved by agreement, without resorting once again to the STB.

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NNEPRA Employee

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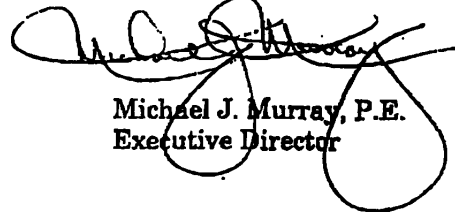
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Mr. David A. Fink
January 14, 2002
Page 2

Because we would like to implement Amtrak's plan for 79-mph operations as soon as possible, we would like to hold any such meeting soon. We suggest a meeting, in the Portland area, on January 22 or 23, 2002.

Please let me know how Guilford would like to proceed in this matter. I look forward to hearing from you.

Sincerely,



Michael J. Murray, P.E.
Executive Director

Enc.

JAN-22-2002 16:03

FARRELL ROSENBLATT RUSSEL

P.03/08

Jan 22 02 15:33

NNEPRA Employee

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P.3

01/18/02 16:48

ID:Guilford Rail System

FAX:978-863-6907

PAGE 2



BOSTON & MAINE CORPORATION
MAINE CENTRAL RAILROAD COMPANY
SPRINGFIELD TERMINAL RAILWAY COMPANY

IRON HORSE PARK
MO. BELLEVILLE, MASS. 01802

January 18, 2002

Mr. Michael Murray
Executive Director
Northern New England
Passenger Rail Authority
50 Fore Street
Portland, Maine 04101

Dear Mike:

I am in receipt of the TTCI's report "Vertical Track Deflection Measurements Using the TCU P-02-001."

A cursory review indicates that neither NNEPRA/Amtrak or TTCI has taken into consideration our letter of November 1, 2001, which I have attached. We are disappointed that the original testing performed in September did not follow the Amtrak testing regime proffered and accepted by the Surface Transportation Board (STB). We were shocked that the November testing went down the same path.

In order to properly analyze your tests, we request the following data that was collected be e-mailed from TTCI to Phil Brake at Guilford Rail: 1) Dynamic testing files in electronic format for the Sept. and Nov. test results, both at 2' and 25' averages; 2) Static test deflection measurements resulting from the 2,000-lb. vertical load. Upon securing the necessary data and at the conclusion of our study, we would be happy to sit down with Amtrak/ NNEPRA and TTCI to go over the results. But for us the facts still remain that the testing failed to follow the procedures accepted by the STB, thus the results are suspect.

Sincerely,

David A. Fink
Executive Vice President

CC: Jared I. Roberts, Senior Associate General Counsel, Amtrak,
80 Massachusetts Avenue, NE, Washington, DC 20002
David Reed, TTCI, P. O. Box 11130, 55500 DOT Road, Pueblo, CO 81001

JAN-22-2002 16:03

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NNEPRA Employee

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ID:Guilford Rail System

FAK:978-663-6907

PAGE 3



BOSTON & MAINE CORPORATION
MAINE CENTRAL RAILROAD COMPANY
SPRINGFIELD TERMINAL RAILWAY COMPANY

IRON HORSE PARK
40, BILLENICA, MASS. 01002

EXECUTIVE DEPARTMENT
(978) 663-1186

November 1, 2001

Michael J. Murray
Executive Director
Northern New England Passenger Rail Authority
55 Fore Street
Building 30
Portland, ME 04101

Re: Track Modulus Testing

Dear Mike:

I am in receipt of your letter dated October 23, 2001, in which Amtrak and NNEPRA dispute our assessment that the recent track modulus testing has not satisfied the criteria established by the Board for passenger operations at speeds of up to 79 miles per hour. In support of this position, you claim that, "...the data generated during the TLV's runs, which was provided to Guilford's engineers, indicate that the deflection criterion (.28 inches or less) was satisfied on well over 99% of the line."

Although the test results provided to GRS do not support this blanket statement, we should address some preliminary issues before discussing our analysis of this data. First, I was somewhat surprised that NNEPRA has now taken on the role of spokesman for Amtrak, since NNEPRA supposedly had no direct involvement in the proceedings before the STB. Accordingly, NNEPRA's assumption of this role under the present circumstances is particularly troubling because our concerns arise from the fact that the recent testing had little or no relation to the program presented for approval by Amtrak at the STB. Consequently, since NNEPRA has historically claimed to have little direct involvement in the STB proceedings, I do not believe that NNEPRA is the proper party to explain: (a) the significant discrepancies between the proposed testing program and the actual testing performed; or (b) the failure to perform static testing at a substantial number of those locations where both the proposed and the revised deflection criteria were exceeded. Nevertheless, since NNEPRA has apparently elected to finally assume a leadership role, I would ask that you review the following and provide me with your thoughts as soon as possible. In addition, since your letter appeared to be based upon information that GRS has yet to review, I would appreciate a copy of the reports/data relied upon in reaching these conclusions, including the report promised by the TTCI Scope of Work within 15 days of completion of the testing.

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NNEPRA Employee

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ID:Guilford Rail System

FAX:978-663-6907

PAGE 4

As you should know, the need to perform the recent testing originally arose as a result of the disagreement over our belief that 132-pound rail was necessary to support safe passenger operations, and NNEPRA's belief that the use of this weight of rail would be prohibitively expensive. To resolve this disagreement, the parties agreed to present the following issue to the Board:

Applying the engineering standards agreed to by NNEPRA and Railpad (Guilford) in the Rehabilitation Agreement, with particular reference to the engineering standards of the American Railway Engineering Association (now AREMA) specified therein, what is the appropriate weight of rail to be installed on the Rail Line in order to ensure safe, consistent and continuous operation of Amtrak trains at speeds of up to 79 miles per hour? (*emphasis added*)

As a result, throughout the Board proceedings to decide the speed at which Amtrak trains could operate on this line, the AREMA standards were the basic premise underlying each party's submissions, including the following representations by Amtrak in the latest round at the STB:

1. Deflection data gathered the first two days are used as a guide for where to test for track modulus because there is a high correlation between the two. *A location with significant track deflection can generally be expected to have a comparatively low track modulus.*
2. The AREMA maximum deflection criteria of .25 inches will be used as the limiting value at which a follow up track modulus measurement will be performed. Where the TLV detects deflection greater than this amount, it will place a paint mark at the location in question.
3. Analysis of the TLV's output deflection data, combined with subsequent track inspection to spot the paint marks left by the TLV, will identify where the limiting deflection criterion has been exceeded and where follow up inspections are required.
4. The test plan also provides for testing any suspected low modulus areas by static means. *This testing provides an additional way of assuring that the overall results are of sufficient accuracy.*
5. TTCI has developed the TLV so that the relative track deflection that it measures closely correlates with absolute track deflection. *The best test of this will occur when stationary measurements are made at locations where the relative track deflection data recorded by the TLV indicates that an absolute measurement should be made (because preset relative deflection limits are exceeded).*
6. In fact, the limit should be .28 inches, but TTCI will use .25 inches to be conservative.

Based upon these representations, the Board found the following:

1. But as FRA points out, using the dynamic test at 10 miles per hour to locate parts of the line with lower than average track modulus will demonstrate the particular points at which a static test needs to be performed.
2. As FRA points out, the test procedure that Amtrak has proposed is both reasonable and practical, and it should provide sufficient data to evaluate the average or nominal track modulus along the Plaistow-Portland line following rehabilitation.

Jan 22 02 15:34

NNEPRA Employee

207-780-1001

P. 6

01-18-02 16:49

ID:Guilford Rail System

FAX:978-663-6907

PAGE

5

- 3 We find: Track modulus testing on the Pleistow-Portland line through the use of the TLV in the manner described by Amtrak is a reasonable and practical method of testing the track to determine whether the level of rehabilitation described in our prior decisions has been met.

With this background in mind, as well as the limited information that has been provided to GRS to date, we do not believe that the recent testing performed by TTCI was done in accordance with the plan proposed to the STB. This position is based upon the following:

1. Based upon your October 23rd letter, the recent testing used a limiting value of .28 inches to identify areas where static testing should be performed, as opposed to the limiting value of .25 inches proposed by Amtrak. Despite this commitment to a specific limiting value, without any consultation with the STB, GRS or FRA, the value was unilaterally changed during the testing, which is unsupportable. Moreover, this limiting value exceeds the AREMA maximum deflection criterion, as defined by Amtrak in its submissions to the Board. Finally, Amtrak also had previously informed the Board that .28 inches is the appropriate limiting factor, but in any event .25 inches would be used during testing to be conservative and to ensure that all areas with potentially low track modulus would be identified for static testing. Apparently, this plan was abandoned somewhere along the way.
2. As represented to the Board, at each location where the TLV detected a deflection greater than .25 inches, Amtrak planned to apply a paint mark; and subsequent track inspection would spot where those marks were located so that the required follow up static inspections would be performed. Obviously, on this issue the recent testing failed miserably. First, very few paint marks were applied, even though approximately 464 locations over approximately 70 miles were identified as having a deflection greater than .28 inches. Second, despite the large number of locations identified, and the willingness of GRS to allow the TLV to remain on our lines for additional time, static testing was performed in only 12 "zones", covering feet, as opposed to the miles that were identified. Clearly, this is a depressingly small portion of the area that should have been tested.
3. There is also no justification for failing to perform static tests at all areas where the deflection was greater than .28 inches, much less .25 inches, because Amtrak's submission stated several times that: (a) this static testing would be required; (b) there is a high correlation between high deflection and low track modulus; and (c) the best method to ensure the accuracy of the TLV methodology would be to perform such testing.
4. Your letter also claims that NNEPRA is essentially ignoring those areas where low track modulus values were identified, because those areas are "very short (typically 10 feet or less)". We are not aware that the Board provided that "very short" areas of low track modulus were exempt from the Board's requirements, and we disagree that these locations should be ignored. Moreover, GRS would submit that these areas should be identified as being indicative of potentially larger problems, although the rather cursory testing performed to date makes it impossible to make a determination one way or the other.

Jan 22 02 15:35

NNEPRA Employee

207-780-1001

P.7

01-18-02 16:50

ID:Guilford Rail System

FAX:978-663-6907

PAGE 6

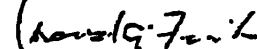
Notwithstanding our concerns that the recent testing effectively ignored the vast majority of those locations where the rail line likely fails to meet the required standards, the point of this letter is to make known our objections to the fact that the testing was not performed in the manner approved by the STB. In short, Amtrak, with the support of NNEPRA and Trainriders Northeast, requested that the Board decide that: (a) the proposed testing methodology was reasonable and practical; and (b) once an adequate track modulus is demonstrated using this method, no further track modulus testing would be necessary. While the Board did ultimately decide that this proposed testing was reasonable, NNEPRA then remarkably condoned the performance of the recent testing in a manner that had little or no relation to the method approved by the Board. As a result, today there are still two issues outstanding: (a) the testing has yet to be performed in the manner described by Amtrak, and approved by the Board; and (b) consequently, until the proper testing is performed, the criteria established by the Board to allow passenger service at speeds greater than 59 miles per hour have not been satisfied.

Based on the foregoing, GRS will not allow any passenger operations at speeds greater than 59 miles per hour until acceptable results are obtained by performing testing in the manner presented to, and approved by, the STB. While we appreciate NNEPRA's offer to bring back the TLV for more static testing in November, this offer simply misses the point; which is that static testing will not correct the fact that the initial TLV testing was not performed pursuant to the Board's decision. Accordingly, while NNEPRA is free to conduct additional static testing in the near future, we would suggest that NNEPRA also plan to conduct the appropriate testing sometime in the spring or summer (the optimal time for such testing, according to Amtrak) of 2002.

With regard to the movement of the TLV consist in regular freight service, we will agree to this request, provided that we do not have a repeat of the events that surrounded the original movement of this consist. As you may recall, Guilford spent a great deal of time and effort to track and locate this consist during the last movement, with little assistance from NNEPRA or TTCI. In fact, a full day and a half was wasted while this consist was turned to accommodate the needs of TTCI, which could have been avoided had NNEPRA provided the proper shipping and placement information. Moreover, despite the original plan to conduct testing for a maximum of three days, in reality this testing took six days, unnecessarily interfering with our freight operations. Finally, the relative lack of interest by NNEPRA personnel in such an important project continues to trouble Guilford. More particularly, we believe that NNEPRA should be more committed to monitoring the next round of testing, and should spend more than a brief visit on the consist. Otherwise, we risk a repeat of the insufficient testing that was performed during September, which will ultimately require even more testing in the future.

Thank you for your attention to this matter. Please feel free to contact me if you should have any questions or comments.

Sincerely,



David A. Fink
Executive Vice President

AN-22-2002 16:07

FARRELL ROSENBLATT RUSSEL

P.08/08

on 22 02 15:36

NNEPRA Employee

207-780-1001

P.8

01/18/02 16:51

ID:Guilford Rail System

FAX:978-663-6907

PAGE 7

cc: J. Carter
J. Melrose

5

**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

January 23, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing - TTCI Report

Dear David:

Thank you for your letter of January 18. I am asking TTCI to provide to Phil Brake the data you requested.

I would like to meet with you as soon as you have concluded your study of the data, but in any event no later than February 15, 2002. Please provide me with a copy of your study in advance of the meeting so that the meeting can be more productive. When we meet we can discuss the points you have raised with respect to the manner in which TTCI conducted its testing. NNEPRA and Amtrak both believe that the results of TTCI's testing show that the rail line (following rehabilitation) meets the condition set by the STB for 79-mph operations, and NNEPRA and Amtrak both hope that Guilford will agree that such operations are now warranted. Neither NNEPRA nor Amtrak considers the results of the testing to be in any way "suspect," as suggested in your letter.

Finally, your letter anticipates a meeting with "Amtrak/NNEPRA and TTCI" to go over the results of TTCI's testing. While representatives of Amtrak and NNEPRA will attend such a meeting, representatives of TTCI will not be present. I do anticipate that Dave Staplin, who is very knowledgeable regarding TTCI's

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Portland, ME 04101

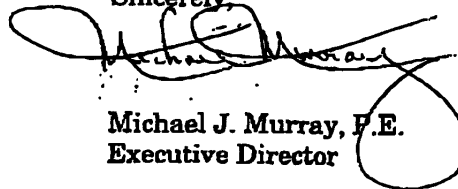
Tel (207) 780-1000
Fax (207) 780-1001

Mr. David A. Fink
January 23, 2002
Page 2

testing and methodology, will attend the meeting, and if a technical question arises that Dave cannot answer we can contact TTCI by telephone.

I look forward to hearing from you as soon as you are able to schedule a meeting.

Sincerely,



Michael J. Murray, P.E.
Executive Director

29 02 14:08

NNEPRA Employee
ID: Guilford Rail System

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P. 2

FAX: 978-663-6907

PAGE 2



BOSTON & MAINE CORPORATION
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SPRINGFIELD TERMINAL RAILWAY COMPANY

IRON HORSE PARK
NO. BILLERICA, MASS. 01802

1/25/02

Mr. Michael Murray, P.E.
Executive Director
Northern New England Passenger Rail Authority
58 Fore Street
Building 30
Portland, ME 04101

Re: Track Modulus Testing - TTCI Report

Dear Mr. Murray:

Guilford Rail System (GRS) would be amenable to meeting with NNEPRA/Amtrak and TTCI upon the completion of our review of all of the information requested. However, GRS will not be subjected to imposed deadlines while the information that has been requested has yet to be provided and analysis of same has been completed. Be assured that GRS is analyzing the existing data in its possession in an expedient manner. May I also remind you that upon completion of the TTCI testing in November, GRS did not receive a copy of their final report until January 15.

Furthermore, please be advised that the information that has been requested in point two of the Guilford letter is an electronic version of the data provided to GRS at the conclusion of the testing of this line. The paper version that was provided is limited in scale and as such is limiting GRS' ability to conclude its analysis.

When GRS completes its analysis, we would welcome the above stated parties to our Billerica, MA offices to discuss the matter. In order to expedite this meeting, please provide all of the requested information as soon as possible.

In regard to your suggestion that Mr. Staplin be an appropriate surrogate for TTCI, GRS disagrees. As you are well aware, Mr. Staplin and Amtrak presented a testing plan to the Surface Transportation Board (STB) that differs significantly from the actual testing performed. Therefore, because TTCI performed testing that was substantially different from the plan approved by the STB, please arrange for TTCI to be present at any meeting to discuss their results. We will leave it to NNEPRA to explain why Amtrak's proposal, as approved by the STB, was not followed.

Sincerely,

David A. Fink
Executive Vice President

**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

January 30, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing - TTCI Report

Dear David:

In response to your January 25 letter, I am pleased that Guilford is amenable to meeting to discuss the results of TTCI's testing of the Plaistow-Portland line, and the view shared by NNEPRA and Amtrak that these results support 79-mph Amtrak operations over the line. We are agreeable to your suggestion that the meeting be held at Guilford's North Billerica offices.

In your letter, you mention various materials related to the TTCI testing which Guilford has requested be provided to it. As I understand it, to the extent that these materials were not given to Guilford some time ago, they have now all been forwarded to Guilford with one exception - errata pages just provided by TTCI which correct certain milepost information in the TTCI report. A copy of the errata pages is enclosed.

With respect to our request that the meeting be held not later than February 15, we were not trying to impose an artificial deadline on Guilford. Rather, we wanted to underscore our desire to resolve promptly any dispute we may have with Guilford over TTCI's testing and the conclusions to be derived from it, or to learn that resolution is not possible. We continue to be interested in an early meeting, although we understand Guilford's desire to complete its analysis of the TTCI test data. If Guilford is not in a position to meet by

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NNEPRA Employee

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p. 3

Mr. David A. Fink
January 30, 2002
Page 2

February 15, we would be grateful if the meeting could be set as soon as mutually convenient after February 15.

It continues to be our plan to have representatives of NNEPRA and Amtrak, including David Staplin, attend the meeting. You indicate that you want TTCI to participate in the meeting as well, rather than simply to be available by phone to respond to technical questions (as we had suggested). Although we do not have the funds to arrange for TTCI personnel to travel from Colorado to attend the meeting in person, we will arrange for TTCI to participate in the entirety of the meeting by conference call.

Your letter challenges the testing performed by TTCI as departing in certain respects from the testing described to the STB, suggesting that this somehow makes the test results unreliable. Suffice it to say that NNEPRA and Amtrak, like TTCI itself, consider the test results to be entirely reliable. Rather than prolong a discussion of the matter here, however, this is a subject we can take up at the meeting if Guilford so desires.

As soon as you are in a position to tell me when Guilford can meet, please let me know and we will work out the necessary details. I look forward to hearing from you.

Sincerely,



Michael J. Murray, P.E.
Executive Director

B-05-2002 13:21

FARRELL ROSENBLATT RUSSEL

P.02/02

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NNEPRA Employee

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P-2

02/04/02 17:06

ID:Guilford Rail System

FAX:978-663-6907

PAGE 1



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IRON HORSE PARK
NO. BELLEVILLE, MASS. 01862

2/4/02

Mr. Michael Murray, P.E.
Director
NNEPRA
58 Fore St.
Bldg. 30
Portland, ME

Fax: (207) 780-1001

Re: Track Modulus Testing

Dear Mr. Murray,

As discussed in our telephone conversation, please arrange for TTCI to provide the undersigned with the following information:

1. The maximum relative deflection value and location for the 25 foot dynamic average that corresponds to the highest deflection measured at each static zone. Please provide this information for both September and November.
2. A copy of the digital photos for static tests performed in September (November has already been provided).

Please expedite as soon as possible in order to prepare for our upcoming meeting.

Thank you,

Phillip D. Burke, P.E.
Asst. Vice President - Engineering

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NNEPRA Employee

207-780-1001

P.2



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RECEIVED FEB 06 2002

February 4, 2002

Michael J. Murray, P.E.
Executive Director
Northern New England Passenger
Rail Authority (NNEPRA)
58 Fore Street
Portland, Maine 04101

Dear Mike:

I am in receipt of your letter of January 30, 2002. We are also in receipt of the additional data as well as the errata that was sent late last week.

We propose to meet with you, Amtrak and TTCI on February 22, 2002 in North Billerica at 10:00 AM.

Sincerely,


David A. Fink
Executive Vice President



**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

February 8, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing - TTCI Report

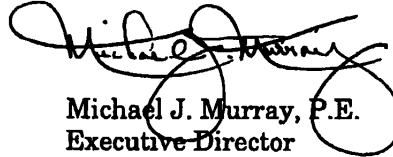
Dear David:

In response to your February 4 letter, in which you propose a February 22, 2002 meeting among the parties, I am writing to suggest that we move the meeting to the following week.

I just learned that the author of the TTCI report, Dave Read, will be out of the country in mid-February, but expects to return to his office on or about Monday, February 25, assuming no travel delays or change of plans. Since it would make sense for Dave to participate (by telephone) in the meeting to discuss the TTCI report, I would like to suggest that the meeting be held during the week of February 25 to March 1. The best dates during that week for NNEPRA, Amtrak and TTCI are February 27 and February 28. Let me know if either of these dates is convenient for Guilford. As you note, the meeting will be at your offices in North Billerica.

I look forward to hearing from you.

Sincerely,



Michael J. Murray, P.E.
Executive Director

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Portland, ME 04101

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**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

February 8, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Phillip D. Brake, P.E.
Asst. Vice President - Engineering
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing - TTCI Report

Dear Phil:

In reply to your February 4 letter, I have looked into the information you requested and have the following responses:

1. You asked for "[t]he maximum relative deflection value and location for the 25 foot dynamic average that corresponds to the highest deflection measured at each static zone." Although I am not absolutely sure what you are seeking in this request, I believe that the information you want is summarized in Table 2 and Appendix B of the TTCI report. The backup for this summary information is contained in the underlying test data which TTCI provided you. I am not aware of any other information pertaining to the request you have made.

2. As to your request for the digital photos for static tests performed in September, I have made arrangements to obtain a set for you and will forward them as soon as they come. I understand that the format is similar to the format of the digital photos we have already provided you with respect to the static tests performed in November.

If you have any questions, please let me know.

Sincerely,

Michael J. Murray, P.E.

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BOSTON & MAINE CORPORATION
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SPRINGFIELD TERMINAL RAILWAY COMPANY

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EXECUTIVE DEPARTMENT
(978) 663-1186

February 11, 2002

Michael J. Murray
Executive Director
Northern New England Passenger Rail Authority ("NNEPRA")
58 Fore Street
Building 30
Portland, ME 04101

Re: Platform Leases

Dear Mike:

Thank you for your response of February 7, 2002 addressing the ongoing safety concerns arising from the station platform leases. While I am encouraged that you have finally assumed a personal role in this matter, your response quite simply misses the point. As explained in my letter of February 6th, these repeated safety problems arise directly from the lease procedures negotiated and agreed to by NNEPRA's counsel, and NNEPRA should therefore be taking the lead role to ensure compliance with these procedures.

Unfortunately, your latest correspondence seems to take the position that NNEPRA need not do any more than provide marginal support for our efforts to train and educate the municipalities, which is not the case. In short, so far NNEPRA has done precious little to address the repeated breaches of the lease terms, and it is now time for NNEPRA to move beyond "facilitating" and "coordinating" to provide meaningful leadership to resolve the safety concerns arising from the leases. Guilford has done its part by offering training and education to the various municipalities, but so far these efforts have been in vain because NNEPRA has not been willing to provide the necessary level of support for these activities. As a result, unless NNEPRA indicates a willingness to resolve these issues soon, the only prudent course of action would be for Guilford to terminate the leases.

Accordingly, please note once again that, while we were at one point willing to provide training and education to the municipalities, we are no longer willing to perform this function. Rather, we expect that NNEPRA will finally show some real initiative and either (a) guarantee that there will be no additional breaches of the lease terms; or (b) agree to amend to the leases to designate Amtrak as the party responsible for snow and ice removal within the Exclusionary Zone.

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NNEPRA Employee

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p. 3

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ID:Guilford Rail System

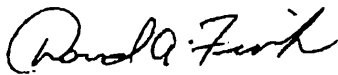
FAX:978-663-6907

PAGE 2

As a final note, I understand that our meeting of February 22nd will have to be postponed because some of the representatives from TTCI will be unavailable. Similarly, we will not be available on either February 27th or the 28th, and I would therefore propose that we meet on a day during the week of March 4th at 10:00 a.m. here in North Billerica. Please let me know of your availability during that week.

Thank you for your attention to this matter. Please feel free to contact me if you should have any questions or comments.

Sincerely,



David A. Fink
Executive Vice President



**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

March 4, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Speed Table for Plaistow-Portland Line

Dear David:

In anticipation of our March 7 meeting, we have prepared a speed table which sets forth by track segment the speeds at which Amtrak proposes to operate over Guilford's Plaistow-Portland line in light of the findings made in the January 10, 2002 TTCI Report. We hope to obtain Guilford's agreement to the speeds reflected in this speed table.

In that connection, I am enclosing a spreadsheet which sets forth by milepost segment the following speed information related to Amtrak's operations over Guilford's Plaistow-Portland line:

Column 1 – the speeds agreed to by the parties in the speed table which contemplated a maximum Amtrak operating speed of 60 mph, as set forth in Appendix I to the July 10, 1998 Terms and Conditions for Operation Between Massachusetts/New Hampshire State Line and Portland, Maine entered into between Guilford and Amtrak;

Column 2 – the speeds currently governing Amtrak's operations pursuant to Guilford's timetable for the line (which reflects a maximum Amtrak operating speed of 60 mph);

Column 3 – the speeds agreed to by the parties in the speed table which contemplated a maximum Amtrak operating speed of 79 mph, assuming that the STB found 115-pound rail adequate to support Amtrak 79 mph operations, as set forth in revised Appendix I in Attachment 3 (c) of the January 6, 1999 Agreement Among Northern

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Mr. David A. Fink
March 4, 2002
Page 2

New England Passenger Rail Authority, National Railroad Passenger Corporation, and Springfield Terminal Railway Company, Boston and Maine Corporation, and Portland Terminal Company Concerning Resolution of Disagreement Regarding Train Speeds; and

Column 4 – the speeds Amtrak now proposes to operate over the line, taking into account operating considerations and the track modulus findings reflected in the January 10, 2002 TTCI report.

As you will see, certain of the speeds at which Amtrak proposes to operate as set forth in Column 4 are slower than the speeds agreed to by the parties in Column 3. Although TTCI's track modulus testing and Amtrak's track geometry testing of the line support the faster operating speeds reflected in Column 3 (and we reserve the right to implement these faster speeds at a later date if appropriate at that time), certain operating considerations suggest that the slower speeds reflected in Column 4 should be governing for the time being.

Set forth below is a summary of the locations where Amtrak proposes to operate at speeds slower than those set forth in the agreed-to 79 mph speed table, and an explanation of the considerations prompting implementation of the slower speeds.

South Portland area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 60 mph between MP 198.4 and MP 198.49, Amtrak proposes to operate at 40 mph. This trackage is just outside of Rigby Yard (which ends at CPF 199, located at MP 198.49), and Guilford's current timetable restricts speeds on this trackage to a maximum of 40 mph. Amtrak is agreeable to this maximum speed.

Old Orchard Beach area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 40 mph between MP 206.77 and MP 207.8, and at 79 mph between MP 207.8 and MP 208.2, Amtrak proposes to operate at a maximum speed of 25 mph over both segments during the summer tourist season and 40 mph over both during the remainder of the year. There is significant pedestrian traffic in this area in the summer, and the Old Orchard Beach station is located at

Mr. David A. Fink
March 4, 2002
Page 3

approximately MP 207.2. Amtrak trains will be stopping at this station during summer months, resulting in speed deceleration as the station is approached and gradual speed acceleration as it is left.

Saco area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 79 mph between MP 210.55 and MP 211 and at 50 mph between MP 211 and MP 211.5, Amtrak proposes to operate at a maximum speed of 60 mph over the former segment and 30 mph over the latter. The Saco station is located at approximately MP 211.35. Because of normal deceleration and acceleration of Amtrak's trains serving the Saco station, Amtrak is agreeable to these lower speeds which conform to the current Guilford timetable speeds.

Biddeford area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 79 mph between MP 213.1 and MP 213.6 and MP 214.2 and MP 214.8, Amtrak proposes to operate at a maximum speed of 60 mph over both segments. In Amtrak's judgment, additional superelevation work needs to be performed on both segments to comfortably accommodate 79 mph speeds; when this superelevation work is performed, Amtrak anticipates increasing its speed to 79 mph over the segments.

Kennebunk area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 79 mph between MP 220.3 and MP 221, Amtrak proposes to operate at a maximum speed of 30 mph. Although rehabilitation work has been performed to address substructure support deficiencies, it is currently unclear whether additional work in this regard will be required. Pending resolution of this issue, Amtrak will operate at the proposed speed.

Berwick/South Berwick area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 65 mph between MP 238.9 and MP 239.6, Amtrak proposes to operate at a maximum speed of 50 mph. In Amtrak's judgment, additional superelevation work needs to be performed on the segment to comfortably accommodate 65 mph speeds; when this superelevation work is performed, Amtrak anticipates increasing its speed to 65 mph over the segment.

Mr. David A. Fink
March 4, 2002
Page 4

Dover area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 79 mph between MP 243 and MP 243.6, at 45 mph between MP 243.6 and MP 243.8, and at 75 mph between MP 244 and MP 244.2, Amtrak proposes to operate at a maximum speed of 60 mph over the first segment, 30 mph over the second segment, and 50 mph over the third segment. Dover station is located at approximately MP 243.93, and deceleration of trains entering the station along with gradual acceleration of trains leaving the station warrant the slower speeds. In addition the rehabilitated track in the Dover area affords a rough ride quality, such that slower speeds will contribute to passenger comfort until the track roughness can be corrected.

Newmarket area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 60 mph between MP 253.35 and MP 254.1, Amtrak proposes to operate at a maximum speed of 50 mph. In Amtrak's judgment, additional superelevation work needs to be performed on the segment to comfortably accommodate 60 mph speeds; when this superelevation work is performed, Amtrak anticipates increasing its speed to 60 mph over the segment.

Newfields area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 79 mph between MP 256.6 and MP 257, Amtrak proposes to operate at a maximum speed of 50 mph. We understand that New Hampshire DOT will be reconstructing the overhead bridge on this segment; when this work is completed, Amtrak proposes to operate at 79 mph over the segment.

Exeter area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 65 mph between MP 260.27 and MP 261, Amtrak proposes to operate at a maximum speed of 30 mph over this segment. The Exeter station is located at approximately MP 260.8. Because of normal deceleration and acceleration of Amtrak's trains serving the Exeter station, Amtrak is agreeable to this lower speed which conforms to the current Guilford timetable speed.

East Kingston area – Whereas the agreed-to 79 mph speed table calls for Amtrak to operate at 79 mph between MP 266 and MP

Mr. David A. Fink
March 4, 2002
Page 5

266.3, Amtrak proposes to operate at a maximum speed of 60 mph. In Amtrak's judgment, additional superelevation work needs to be performed on the segment to comfortably accommodate 79 mph speeds; when this superelevation work is performed, Amtrak anticipates increasing its speed to 79 mph over the segment.

In reviewing the enclosed spreadsheet, you will note that Amtrak does not propose to operate over any line segment at speeds greater than those agreed to by the parties in the 79 mph speed table, with the exception of (i) MP 1.92 to MP 1.64 in the Portland area, (ii) MP 243.8 to MP 244 in the Dover area, and (iii) the siding between CPF 256 and CPF 258 in the Newfields/Exeter area, where Amtrak's proposed 25 mph, 50 mph and 30 mph speeds, respectively, are consistent with Guilford's current timetable.

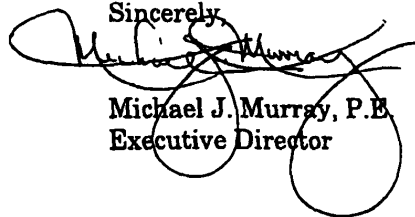
On a related issue, we understand that Guilford has a bulletin order in place for MP 272.89 to MP 274.65 in the Plaistow/Atkinson area, which serves to restrict Amtrak to a maximum operating speed of 40 mph over these segments. Amtrak proposes to operate at 60 mph over these segments, consistent with the speeds set in the 79 mph speed table. We do not understand the basis for the bulletin order, and request that it be lifted.

* * * *

We have attempted to make the enclosed spreadsheet as self-explanatory as possible, and have undertaken to elaborate on it in the discussion above. If, however, you have any questions, please do not hesitate to contact me.

I look forward to seeing you on March 7.

Sincerely,



Michael J. Murray, P.E.
Executive Director

START	END	1 80 MPH SPEED TABLE	2 TIME TABLE	3 79 MPH SPEED TABLE	4 79 MPH PLAN	LOCATION	REMARKS
MP	MP	TABLE	TABLE	TABLE			
263.4	263.8	60	55	70	70	East Kingston	
263.8	264.1	60	60	70	70	East Kingston	
264.1	266	60	60	79	79	East Kingston	
266	266.3	60	60	79	80	East Kingston	
266.3	272.89	60	60	79	79	East Kingston/Kingston/Newbury/Palstow	
272.89	273.5	60	60	60	60	Palstow	
273.5	274.3	60	55	60	60	Palstow/Alderson	
274.3	274.55	60	60	60	60	Alderson/Palstow	
274.55	274.55	60	40	60	60	Palstow	
#2 TRACKS/SIDINGS							
CPF 209	CPF 211	30	30	30	30	Old Orchard/Saco	
226	228	30	30	30	30	Wells	
CPF 241	CPF 243	30	25	30	10	Rollinsford/Dover	
CPF 256	CPF 258	20	30	20	30	Newfields/Exeter	
272.9	273.5	60	60	60	60	Palstow	
273.5	274.3	60	55	60	60	Palstow/Alderson	
274.3	274.55	60	60	60	60	Alderson/Palstow	
274.55	274.55	60	40	60	60	Palstow	
3/3/02							

**NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY**

March 11, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: March 7 Meeting Among Guilford, NNEPRA and Amtrak

Dear David:

I am writing to thank Guilford for hosting the March 7 meeting with representatives of NNEPRA and Amtrak, and to express regret that Guilford does not agree with NNEPRA and Amtrak that in light of the findings made in TTCI's January 10 report, Amtrak should be permitted to operate at speeds up to 79 mph over Guilford's Plaistow-Portland line.

I was hopeful that by giving Guilford an opportunity to discuss and ask questions regarding the TTCI report with the author of the report, Dave Read, and the other TTCI personnel who participated in the March 7 meeting by conference call, Guilford would come around to the view expressed in the report that the Plaistow-Portland line has a track modulus that will support 79 mph Amtrak operations.

During the meeting, we and TTCI undertook to answer every question posed by Guilford, explaining among other things that:

- The methodology employed by TTCI in conducting the deflection and track modulus testing necessarily evolved over time, based on improvements in the TTCI testing equipment, further analysis combined with practical experience, and considerations related to the Plaistow-Portland line itself. This evolution explains why a 0.28 deflection benchmark was employed rather than a 0.25 inch benchmark, why only certain locations were tested for track modulus, and various other modifications to the TTCI testing methodology. Guilford appears to take the position that this

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Portland, ME 04101

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Mr. David A. Fink
March 11, 2002
Page 2

evolution was inappropriate and somehow violative of the STB's June 29, 2001 decision. We think that Guilford is wrong on both counts. The charter provided to Amtrak and NNEPRA by the STB was to use TTCI's TLV to conduct track modulus testing in a manner that will generate reliable results (which is what TTCI did); it was not that the testing must be conducted in adherence to a particular, inflexible methodology where subsequent developments demonstrated that the methodology could be improved.

- We shared with Guilford prior to the testing the information provided to us by TTCI as to how it planned to conduct the testing. Guilford representatives accompanied the TTCI TLV consist throughout the time it was engaged in testing, and thereby obtained first-hand knowledge as to how the testing was being conducted. We provided Guilford with the results obtained through the TTCI testing, both the TTCI report and all underlying data gathered by TTCI during its testing. Despite all this, Guilford claims that it was somehow left in the dark as to how TTCI performed its testing. We think that Guilford's claim is groundless.
- Guilford challenges the manner in which TTCI correlated vertical deflection data it gathered with track modulus measurements it took. Guilford seems to assert that this correlation is not statistically significant. We believe that TTCI has demonstrated otherwise.
- Guilford places great emphasis on interim deflection data generated by TTCI based on a two-foot moving average, ignoring TTCI's explanation that this data is not relevant to assessing the track support characteristics of the Plaistow-Portland line. Rather, as detailed by TTCI, the relevant data is the final deflection data generated using a twenty-five foot moving average. This data shows conclusively that the line has a track modulus that will support 79 mph Amtrak operations.

Mr. David A. Fink
March 11, 2002
Page 3

- Despite Guilford's assertions to the contrary, track modulus is not a safety consideration. Rather it is a design and maintenance consideration, as both the STB and FRA have noted. Although we pressed Guilford to elaborate on its safety claim, it never did so.

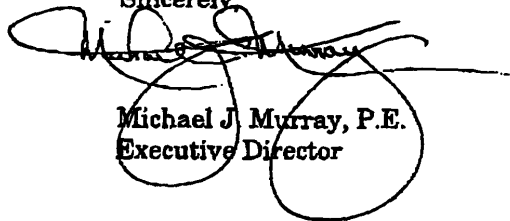
During the course of the meeting, I believe that we and TTCI responded fully to the various issues raised in your November 1, 2001 letter to me. As far as I know, we have left none of Guilford's questions unanswered, whether raised during the meeting or in prior correspondence.

* * * * *

Because Guilford has declined to permit Amtrak to conduct operations at speeds up to 79 mph, in accordance with the speed table forwarded to you in my March 4 letter, Amtrak (supported by NNEPRA) will again have to return to the STB for relief.

I am sorry that the parties have reached this impasse. I had thought that TTCI's credibility as an institution and the strength of its report would convince Guilford to reach an accommodation with NNEPRA and Amtrak. Since this has not occurred, we regrettably have no choice but litigate the matter.

Sincerely,



Michael J. Murray, P.E.
Executive Director

MAR-18-2002 04:43PM
W10VE 10745

FROM-

BOSTON & MAINE CORPORATION

PH1876-000-0007

T-018

P.003/006

F-036

PAGE

2



BOSTON & MAINE CORPORATION
MAINE CENTRAL RAILROAD COMPANY
SPRINGFIELD TERMINAL RAILWAY COMPANY

IRON HORSE PARK
NO. MILLERICA, MASS. 01552

**EXECUTIVE DEPARTMENT
(978) 663-1186**

3/18/02

Michael J. Murray, P.E.
Executive Director
Northern New England Passenger Rail Authority ("NNEPRA")
38 Fore Street, Building 30
Portland, ME 04101

Re: Track Modules Testing

Dear Mike:

Thank you for your letter of March 11, 2002 detailing the position of Amtrak and NNEPRA with regard to the track modulus testing performed during September and November of 2001. I was somewhat surprised to hear from you directly regarding our meeting since you had no involvement with the discussion that took place on March 7th. Nevertheless, after reviewing your letter, I have the following comments in response to the specific items discussed:

1. As I reviewed in detail in my November 1st letter to you, we do not agree that the Board's June 29th decision provided Amtrak and NNEPRA with the discretion to significantly alter the testing plan presented to, and approved by, the Board. Rather, we believe that Amtrak was required at least substantially adhere to its representations that the testing plan presented would produce reliable results, and was not authorized to change this methodology after the Board proceedings were concluded. This unilateral change to the testing methodology is essentially an admission by Amtrak and NNEPRA that the testing would *not* produce reliable results, and we find your arguments to the contrary unconvincing. In short, if the manner of testing proposed to the Board were in fact reliable, there would be no need to significantly change it in the three months that elapsed between the Board's decision and the beginning of testing.

Remarkably, despite admitting that the representations to the Board with regard to the reliability of the initial testing plan were incorrect, Amtrak and NNEPRA would now have us believe that the manner of testing that was actually performed did produce reliable results. However, our review of the data provided by TTCI shows that the testing was performed arbitrarily to reach a predetermined conclusion, which resulted in several significant areas of

MAR-18-2002 04:44PM
03/18/02 15:14FROM:
DUGGILL TOPS RAIL SYSTEM

PH: 1875-000-0007

T-018 P.004/006 F-036
PAGE 3

low track modulus being missed. Therefore, we do not agree that the results satisfy the condition imposed by the Board in order to operate at speeds of up to 79 miles per hour. In support of this position, our objections to the testing methodology actually employed include, but are not limited to, the following:

- A. The information reviewed by Guilford shows that there were 26 locations over 14 miles that exceeded the deflection criteria ultimately utilized by TTCI. Unfortunately, TTCI in its report only identified 14 such spots, despite having access to the same data made available to Guilford, indicating that TTCI did not thoroughly review the testing data. Even more troubling, however, is that, of the 40 follow up static tests that were performed, only two were conducted at locations identified by TTCI as exceeding the deflection criteria of .27 inches. Accordingly, it is apparent that (a) the test results produced by TTCI are not reliable; and (b) this haphazard approach to static testing is a clear indication that TTCI, NNEPRA and Amtrak were more concerned with appearing to comply with the Board's order than actually determining reliable track modulus values along the line.
 - B. The reliance by TTCI solely upon dynamic deflection data and statistical relationships to identify areas of low track modulus not only contravenes the Board's order, but also shows the significant variation between results obtained from dynamic testing (which is relative) and static testing (which is absolute). As an example, the data produced by TTCI for testing Zone One shows that static measurements over this section of track resulted in a 25 foot average modulus value of 1,758 lb./in./in. By comparison, the results produced by TTCI using its regression analysis of the dynamic test data for the same stretch of track produced a 25 foot average modulus value of 2,926 lb./in./in., which led TTCI to omit this location from its list of Track Modulus Exceptions. Therefore, despite Mr. Staplin's and Dr. Chelmer's representations to the Board in their Verified Statements that the absolute data would control the determination of track modulus values, TTCI instead relied upon relative data only, even though the results of this approach resulted were statistical variations as high as 66%.
2. I find it somewhat ironic that NNEPRA and Amtrak dispute our claim that we were not informed of the manner in which the testing would actually be performed, particularly in light of the fact that the methodology continued to change during the actual testing. However, I also do not believe that this point is relevant, for the simple reason that we explained our concerns in my November 1st letter, yet the testing was done a second time in manner that was inconsistent with the Board's order. Accordingly, we did make it clear that we did not understand the basis for the revised testing methodology, and despite our objections no explanation for these discrepancies was forthcoming until our meeting of March 7th.
 3. With regard to your claims purporting to justify the use of a 25 foot averaging approach, please note the following:
 - A. Despite our objections to this approach, it is now known that TTCI identified 25 feet as the average value to be used because it represents the deflection basin resulting from the front two axles of a locomotive using a track modulus value of 2,750 lb./in./in.

MAR-18-2002 04:44PM
03/18/02 10:44FROM:
10:00:11 TOP RAIL SYSTEM

FARRELL ROSENBLATT RUSSEL

T-018 P.005/006 F-036
PAGE 4

However, the data generated during TTCI's testing was the result of a single axle load, which results in a deflection basin of 16.17 feet using a track modulus value of 2,750 lb./in./in. (The length of the deflection basins are exclusive of speed and magnitude of load.) Therefore, because the deflection data was produced with a single axle wheel load, TTCI should have used 16.17 feet as the value at which to average the recorded deflection data. The results of this error will be to dampen the effects of the deflection data, thereby reducing the number of locations that would be identified as not satisfying the applicable AREA criteria. Accordingly, to allow us to accurately assess the extent of the dampening caused by the use of this 25 foot average, please have TTCI provide me with a copy of the 16.17 foot average relative deflection data in electronic format for both the September and November testing.

- B. Amtrak also failed to disclose the full extent of the unreliability of the 25 foot averaging method in the Board, particularly the fact that this approach skews the test results by "averaging an average". In other words, using a 25 foot averaging serves to disguise locations of low track modulus, such as the ones at issue here. This result occurs because the modulus values have been obtained by field testing, both static and dynamic, and the actual deflection of the track already accounts for any variation in modulus in the influence zone of the test (i.e. the region where the track deflects under the test load).
 - C. The 25 foot moving average is fundamentally wrong when applied to analysis of rail stresses, since the rail failure (fatigue, fracture, etc.) is a point process. Rail failure develops and occurs at a single location on the rail, not over a 25 foot (or any other) length. Therefore, averaging the track modulus over 25 feet (when the measured modulus values are obtained by testing that already reflects any actual local variation in track modulus) results in a value that significantly distorts (and reduces) the calculated (but not the actual) stresses in the rail. Since modulus values of approximately 1,000 lb./in./in. or less result in rail stresses that are below the AREA allowable value of 25,000 psi, it is critical that these locations of high stress not be "averaged" out by an artificial averaging process that has no justification in either theory or in the published literature. Additionally, the importance of identifying locations of high stress is discussed below because of its relevance to track safety.
4. Given the items discussed in this letter, and our previous comments relating to our concerns with track safety, I am astounded that NNEPRA and Amtrak continue to question Guilford's commitment to the safe operation of its railroad. Simply put, we believe that the issue of track modulus is related to track safety, particularly because it is verifiable determinant of the ability of the track structure to support rail operations. Therefore, rather than callously disregard the Board's determination that the track structure must meet the necessary criteria to support speeds of up to 79 miles per hour, we continue to believe that NNEPRA and Amtrak must show conclusively that the Board's condition has been satisfied. To do this, NNEPRA and Amtrak are required to prove that the AREA criteria have been met to show that this line segment can safely, continuously and consistently support these increased speeds.

Unfortunately, the arbitrary and inconsistent manner in which Amtrak and NNEPRA have sought to satisfy this requirement does little to alter our belief that safety is not a priority to these organizations. In fact, Amtrak and NNEPRA seem to be committed to evading this

MAR-28-2002 02:45PM FROM-

T-055 P.002/005 F-536



NORTHERN NEW ENGLAND
PASSENGER RAIL AUTHORITY

March 29, 2002

BY FACSIMILE AND FIRST-CLASS MAIL

Mr. David A. Fink
Executive Vice President
Guilford Transportation Industries, Inc.
Iron Horse Park
North Billerica, Massachusetts 01862

Re: Track Modulus Testing

Dear David:

I am writing to reply to your March 18 letter, in which you express again Guilford's various objections to the track modulus testing performed by TTCI on Guilford's Plaistow-Portland line last September and November.

As you know, NNEPRA, Amtrak and TCOI addressed these objections during the March 7 meeting held at your offices, in hopes that agreement could be reached permitting commencement of 79 miles-per-hour Amtrak operations, as authorized by the STB in its October 21, 1999 Decision. As your letter confirms, Guilford continues to oppose such operations, despite track modulus test results demonstrating that the conditions for such operations set by the STB have been satisfied.

There is no value in repeating here each of the points NNEPRA, Amtrak and TTOI made during the March 7 meeting. Rather, replying in order to your numbered points, I have the following summary comments:

1. The track modulus testing which TTCI conducted of Guilford's Plaistow-Portland line was consistent with the testing approach approved by the STB, and the results produced are entirely reliable. There was nothing arbitrary or predetermined about the testing; TTCI performed the testing in adherence to the highest of professional standards and in conformity with its well-earned reputation for excellence in the railroad industry. Guilford's contentions regarding

Mr. David A. Fink
March 29, 2002
Page 2

allegedly missed locations that should have been tested are unfounded. Moreover, despite Guilford's claims to the contrary, TTCI's utilization of the statistical relationship between dynamic vertical deflection data and static track modulus test data was appropriate.

2. Guilford was kept fully informed as to the manner in which TTCI was conducting its testing, and Guilford cannot credibly claim otherwise. Indeed, Guilford personnel traveled with TTCI's TLV consist throughout the September and November testing, and thus learned first-hand how the testing was being performed.

3. TTCI's use of a 25-foot moving average of deflection data to assess whether there were locations on Guilford's Plaistow-Portland line that fell below the Board's track modulus standard was appropriate. This averaging methodology serves properly to temper the effects of aberrational deflection and track modulus readings at isolated locations, where these readings are not indicative of underlying track support that is operationally significant. Guilford's claim that a moving average of 16.17-foot deflection data should have been used is unfounded, and NNEPRA will not pay to have TTCI to conduct an analysis on this basis. If Guilford itself wants to pursue such a study, it has all the data necessary to do so.

4. Guilford persists in claiming that the track modulus findings developed by TTCI for the Plaistow-Portland line somehow relate to safety. Guilford chooses simply to ignore the fact, universally recognized in the railroad engineering profession and specifically noted by the FRA in connection Guilford's line, that track modulus is a design and maintenance consideration, not a safety consideration. Although NNEPRA and Amtrak pressed Guilford during the March 7 meeting to identify exactly what its safety concerns were, Guilford never responded. Your March 18 letter is similarly silent in identifying any safety issue related to track modulus.

Mr. David A. Fink
March 29, 2002
Page 8

Your closing comments -- suggesting that TTCI does not stand behind its track modulus study and that Amtrak's consultant and former Chief Engineer, David Staplin, does not believe that Amtrak operations at 79 miles per hour are warranted -- are groundless. During the March 7 meeting, TTCI strongly defended its study, and Mr. Staplin made clear his view that 79 miles-per-hour Amtrak operations are clearly justified and that Guilford's opposition to such operations is without merit. Indeed, Mr. Staplin points out that he has had personal experience with 79 miles-per-hour commuter and passenger operations on 115-pound rail. During his tenure with CSX, he led the planning effort on the rehabilitation of a line from Palm Beach to Miami, Florida, for Tri-Rail's then new commuter service. In that rehabilitation, CSX successfully used a combination of new and second-hand 115-pound continuous welded rail for 79 miles-per-hour operation of both Tri-Rail and Amtrak trains. The volume of commuter and passenger train traffic on that line far exceeds that being operated by Amtrak over Guilford's Plaistow-Portland line.

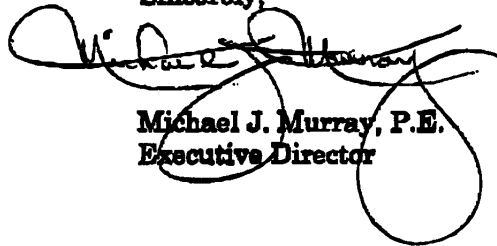
You repeatedly emphasize Guilford's commitment to safety. NNEPRA and Amtrak are no less committed to safety than Guilford. There are simply no safety concerns that grow out of TTCI's track modulus findings. The Plaistow-Portland line has been rehabilitated to safely support 79 miles-per-hour Amtrak speeds, and Amtrak's geometry car testing of the line confirms that it is ready to do so. The only impediment is Guilford's continuing refusal to allow Amtrak operations at these speeds.

Having heard Guilford's various objections to the track modulus testing conducted by TTCI, and considering Guilford's long-running efforts to block 79 miles-per-hour operations over the Plaistow-Portland line, I have reluctantly come to the view that any track modulus testing performed by NNEPRA and Amtrak, whatever its methodology and approach, would be deemed unsatisfactory by Guilford. Since Guilford refuses to accept the track modulus findings developed by TTCI -- findings that unquestionably support 79 miles-per-hour Amtrak

Mr. David A. Fink
March 29, 2002
Page 4

operations -- NNEPRA and Amtrak have no choice but to submit the
issue to the STB for resolution.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael J. Murray", is written over a circular stamp. The signature is fluid and cursive.

Michael J. Murray, P.E.
Executive Director

READ

VERIFIED STATEMENT OF DAVID READ

My name is David Read. I am a Principal Investigator for Transportation Technology Center, Inc. ("TTCI"), a subsidiary of the Association of American Railroads. A copy of my resume is appended as Attachment 1 to this statement.

TTCI was retained by the Northern New England Passenger Rail Authority to conduct vertical track deflection and track modulus testing of Guilford's 1/ Plaistow-Portland line, using TTCI's Track Loading Vehicle consist. This testing was conducted from September 26 to September 29, 2001, and from November 28 to November 30, 2001.

Following completion of this testing, I was responsible for reviewing the data collected and preparing a report based on that data which sets forth TTCI's findings. A copy of the report - entitled "Vertical Track Deflection Measurements Using the TLV", P-02-001, for Northern New England Passenger Rail Authority (Jan. 10, 2002) (including errata corrections to three pages) - is appended as Attachment 2 to this statement.

1/ Springfield Terminal Railway Company, Boston and Maine Corporation, and Portland Terminal Company are referred to collectively as "Guilford."

VERIFICATION

I, David Read, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

Executed on March _21, 2002.

A handwritten signature in black ink, appearing to read "David Read", is written over a horizontal line.

David Read

David Read

Profession:

Principal Investigator, Transportation Technology Center, Inc. (TTCI), a wholly owned subsidiary of the Association of American Railroads (AAR).

**Key
Qualifications:**

David Read has over 25 years railway engineering experience with emphasis on track design, inspection, construction, and maintenance and the execution and analysis of research experiments involving the behavior and interaction of railway track and equipment. He has managed numerous research and test projects for a variety of TTCI customers including the AAR, the Federal Railroad Administration (FRA), North American railroads and railroad suppliers, international railway organizations and other private and public concerns. Among projects he has managed is the Facility for Accelerated Service Testing Heavy Axle Load (HAL) Program. The HAL Program is recognized throughout the world as one of the principal research projects concerning railroad infrastructure and economic issues.

Mr. Read also has extensive knowledge of measurement and data acquisition technologies having managed the TTCI Instrumentation and Test Services group for nearly 4 years.

David has authored research reports and technical articles published by the AAR and FRA on topics such as railway substructure behavior, heavy axle load effects on railroad infrastructure, track maintenance, track stability and the effects of track geometry on vehicle performance. He has also co-authored and presented papers published by the Transportation Research Board, the International Heavy Haul Association, the World Congress on Railway Research and the American Railroad Engineering Association.

Education:

- 1972, Southern Colorado State College, major in History and Education.
- 1995, Railroad Engineering Short Course, University of Illinois.

**Experience
Record:**

- March 2002 - present
TTCI Principal Investigator - developing and managing railway research and test projects and providing consulting services for domestic and international customers.
- 1998 - March 2002
TTCI Manager of Instrumentation and Test Services - in charge of 23 to 25 engineers and technicians with responsibility for the design and implementation of measurement and data collection systems.
- 1995 - 1998
AAR Sr. Engineer II - project manager for railway related test and research projects including manager of the HAL program.
- 1990 - 1995
AAR Sr. Engineer I - project manager and engineer on railway research and test projects.

**VERTICAL TRACK DEFLECTION
MEASUREMENTS USING THE TLV
P-02-001**

**for Northern New England Passenger
Rail Authority**

**Prepared by
Dave Read**

**Transportation Technology Center, Inc.
A subsidiary of the Association of American Railroads
Pueblo, Colorado USA
January 10, 2002**

Disclaimer: This report was prepared for Northern New England Passenger Rail Authority (NNEPRA) by Transportation Technology Center, Inc. (TTCI), a subsidiary of the Association of American Railroads, Pueblo, Colorado. It is based on investigations and tests conducted by TTCI with the direct participation of NNEPRA to criteria approved by them. The contents of this report imply no endorsements whatsoever by TTCI of products, services or procedures, nor are they intended to suggest the applicability of the test results under circumstances other than those described in this report. The results and findings contained in this report are the sole property of NNEPRA. They may not be released by anyone to any party other than NNEPRA without the written permission of NNEPRA. TTCI is not a source of information with respect to these tests, nor is it a source of copies of this report. TTCI makes no representations or warranties, either expressed or implied, with respect to this report or its contents. TTCI assumes no liability to anyone for special, collateral, exemplary, indirect, incidental, consequential, or any other kind of damages resulting from the use or application of this report or its contents.

EXECUTIVE SUMMARY

Tests were performed between Portland, Maine, and Atkinson, New Hampshire, on the Guilford Rail System (Guilford) using Transportation Technology Center, Inc.'s (TTCI) Track Loading Vehicle (TLV) consist to continuously measure vertical track deflection and correlate the TLV in-motion data to static deflection measurements as a method of estimating track modulus.

Work was conducted by TTCI under contract to the Northern New England Passenger Rail Authority (NNEPRA) to determine if the track met the minimum track modulus criteria of 2,750 lb/in/in mandated by the Surface Transportation Board for 79 mph passenger service operation.

The analysis indicated that a TLV deflection of 0.27 inch would be equivalent to a track modulus of 2,750 lb/in/in. Exceptions were found at the following mile-post locations: 203.14, 205.45, 208.66, 213.24, 220.74, 220.80, 220.81, 220.83, 220.84, 220.92, 220.93, 240.08, 241.02, and 272.89. A total of 166 feet of track, or 0.05 percent of the total distance was found to have a modulus equal to or less than the specified 2,750 lb/in/in. Of the total exception distance, 107 feet were located between mile-post 220.74 and mile-post 220.93.

During the in-motion test, the TLV does not measure track modulus directly. Therefore, it was necessary to develop a statistical relationship between the relative track deflection measured by the TLV and static measurements of track modulus. The relationship was established using regression analysis, and the results showed an acceptable correlation between the TLV in-motion data and static track modulus results.

The TLV in-motion test was performed at 10 mph and the deflection data was recorded as the difference between a 40,000 lb loaded track profile and an unloaded profile measured under an empty tank car. The data was digitally

sampled approximately every 2 inches and each recorded data point was the average deflection for 2-feet of track. This was a moving average that moved forward by one data sample every 2 inches. The data was post-processed to expand the average deflection for 25 feet of track. The rationale for the 25-foot average was that it better represented the average or nominal track modulus condition. The exception determination was performed on the 25-foot average data.

Table of Contents

1.0	Introduction	1
2.0	In-Motion Test Methodology.....	2
2.1	Description of the TLV Consist Load and Measurement System	2
2.2	Data Collection.....	4
3.0	Description of the Static Measurement Test Procedure	6
4.0	Data Analysis	9
4.1	Correlation of TLV Relative Deflection Data with Static Track Modulus	9
4.2	Distribution of TLV Deflection and Track Modulus Data	12
5.0	List of Track Modulus Exception Locations	15
6.0	Summary.....	16
Appendix A: Distance History Plots.....		A-1
Appendix B: Static Measurements and Track Modulus Values.....		B-1

1.0 INTRODUCTION

Transportation Technology Center, Inc. (TTCI), a subsidiary of the Association of American railroads (AAR), performed vertical track deflection measurements between Portland, Maine, and Atkinson, New Hampshire, on the Guilford Rail System (Guilford) using TTCI's Track Loading Vehicle (TLV) consist. Work was performed under contract to the Northern New England Passenger Rail Authority (NNEPRA) from September 26 to September 29, 2001, and from November 28 through November 30, 2001.

The project was initiated by NNEPRA in response to the required minimum track modulus criterion of 2,750 lb/in/in established by the Surface Transportation Board for operation of 79-mph passenger service between Plaistow, New Hampshire, and Portland. The objective of the project was to continuously measure vertical track deflection with the TLV and then correlate the TLV in-motion data to static deflection measurements as a method of determining track modulus.

The TLV is a research tool developed and operated by TTCI. Over the past 10 years, it has been used to investigate gage widening, wheel flange climb, and track panel shift. It is currently configured to measure vertical track support and stiffness variation but does not measure track modulus directly nor does it measure the absolute vertical deflection of the rail that would be used to compute track modulus. The TLV measures relative rail deflection and this data can be correlated to track modulus values calculated from static tests at the same locations. This approach was used to develop a statistical relationship between the in-motion deflection data produced by the TLV and track modulus values calculated from static rail deflection measurements.

The measurements performed in September provided the TLV in-motion data that was used in the analysis and part of the static data set. Additional work was performed in November to augment the number of static data measurements.

This report describes the test, measurement, data analysis methodology, and presentation of test results. Appendices A and B are included as supporting information.

2.0 IN-MOTION TEST METHODOLOGY

2.1 Description of the TLV Consist Load and Measurement System

The TLV consist, shown in Figure 1, includes the TLV (AAR 110), empty tank car (AAR 120), and coach car (AAR 100). The TLV continuously measures the loaded track profile at a nominal speed of 10 mph. A vertical load is applied with hydraulic actuators attached to a load bogie at the center of the vehicle. Rail deflection is measured with laser position sensors attached to a rigid reference frame, as Figure 2 shows. The sensors measure the displacement of railhead relative to the frame creating a mid-chord offset measurement.

A 40,000-pound vertical load was used on this project to generate the loaded track profile.

A laser sensor system attached to a reference frame, similar to that used under the TLV, measured the unloaded vertical track profile under the empty tank car (Figure 3). The tank car is equipped with a center load bogie that uses pneumatic actuators to apply a vertical wheel load of 2,000 pounds. The 2,000-pound vertical load was applied to assure contact of the measurement frame wheels with the rail; its influence on the unloaded profile is considered negligible.



Figure 1. TLV Consist Showing Tank Car, TLV and AAR 100 Coach

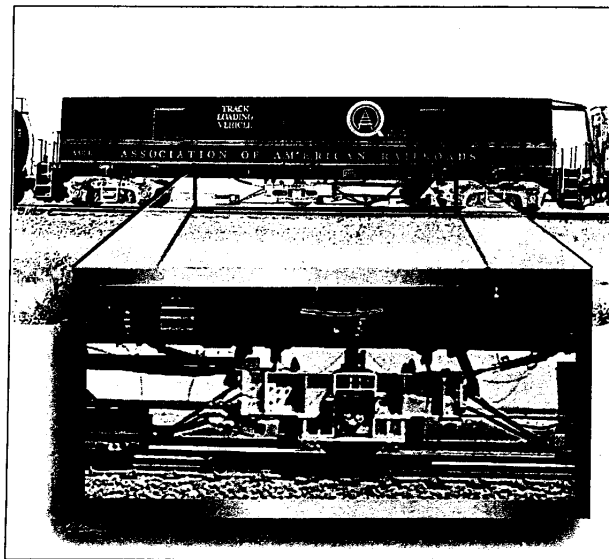


Figure 2. TLV with Center Load Bogie and Deflection Measurement Frame

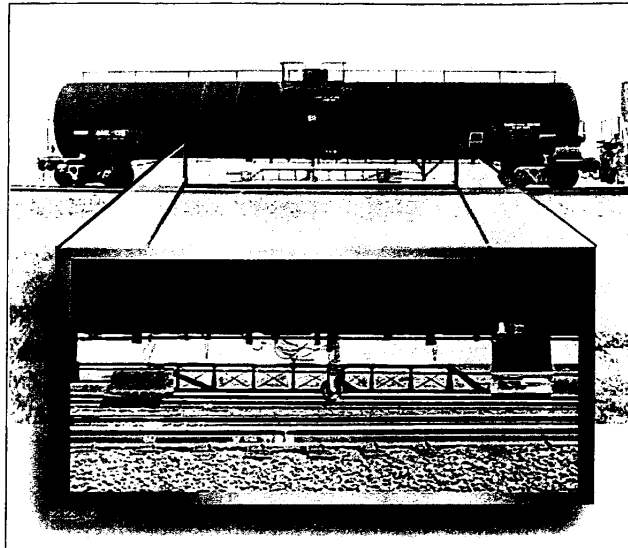


Figure 3. Tank Car with Close Up of the Deflection Measurement Frame

2.2 Data Collection

Data collection software subtracts the loaded and unloaded profile values to determine the relative rail deflection. Rail deflection measurements were taken only on the left side rail, facing the direction of travel.

The analog signals from the laser position sensors were digitized at 100 samples-per-second. The software generates loaded and unloaded deflection values based on an average of the data points taken over a distance of 2 feet. After accumulation of data points to fill the first 2-foot window (approximately 14 samples), the 14-sample window moves forward by one sample (approximately 2 inches) for each subsequent data point.

The 2-foot moving average was optimum during development of the TLV vertical measurement system for resolution of the deflection data to be used in the Vertical Strength Index (VSI) analysis. VSI is a parameter used to identify

track support variability and is one of the TLV data outputs. Weak track generally has more support variability than stiffer track and produces higher VSI values. The TLV paints the track at locations where the VSI exceeds 0.07 inch for subsequent visual inspection, or, as was the case during this project, for possible static measurements. Unlike other track inspection devices that use paint to identify conditions that are out-of-specification, the TLV paint marks do not correlate to a specific rail deflection, stiffness, or modulus value, and do not necessarily mark a track segment that is "out of spec." The paint marks were used to aid the TLV crew in pinpointing locations for inspection or possible subsequent static measurements.

However, for this project — per the Surface Transportation Board Decision of June 28, 2001 (STB Finance Docket No. 33697) — to "evaluate the *average* or *nominal* track modulus along the Plaistow-to-Portland line following rehabilitation," a moving average of 25 feet was specified in the TTCI/NNEPRA Statement of Work as the final TLV track deflection output. The 25-foot window was considered by TTCI to be a reasonable length in which to quantify the basic support condition while minimizing the effect of short-length surface irregularities such as rail joints and battered welds. The 25-foot moving average was processed from the 2-foot window data following the test.

The following parameters were presented as distance history plots during the in-motion tests:

- Curvature Indicator - used to indicate where curves or tangents begin and end
- Vertical Load
- Track Deflection - the difference between loaded profile (obtained under the TLV load bogie) and unloaded profile (obtained under the empty tank). This parameter indicates characteristics of vertical track support and represents track response under the applied test load of 40,000 pounds. Higher deflection indicates weaker track and lower deflection indicates stronger track. Note that this is a mid-chord offset-based

measurement, and therefore is a *relative measure* of track deflection under the test load.

- VSI Distance History
- Mile Post (MP) Markers entered manually

3.0 DESCRIPTION OF THE STATIC MEASUREMENT TEST PROCEDURE

As previously stated, it was necessary to correlate the TLV in-motion deflection data to track modulus values determined from static rail deflection measurements. The TLV load bogie was used to apply a vertical load of 2,000 pounds (considered 0 load), 10,000 pounds, and 33,000 pounds. Vertical deflection of the rail was determined at each load increment by measuring the rail elevation using a survey-level sighting a machinist scale attached to the rail (Figure 4). The track stiffness measured between applied loads of 10,000 and 33,000 pounds was used to calculate track modulus.

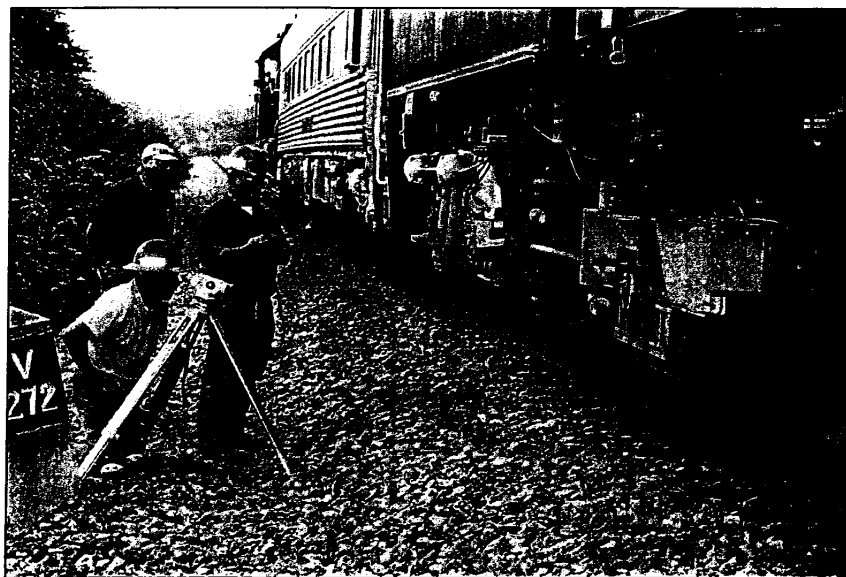


Figure 4. Static Measurement Procedure

Static measurements were performed at 40 separate locations. At each location, between 3 and 9 individual measurements were performed to determine the range of deflection and modulus within a 10- to 30-foot track length. In each case, the measurements were performed on every second tie, so a location with three static measurements would encompass six tie-cribs or a track length of about 10 feet. Locations where nine measurements were performed (18 tie cribs) encompassed about 30 feet.

The objective in selecting the static measurement locations was to provide a range of track stiffness to facilitate the in-motion to static data correlation analysis and to include a representative number of track features such as bridges, road crossings, and turnouts. Some locations were selected where the paint-spray system was triggered due to high in-motion VSI values. Other locations were selected where the in-motion data indicated high-track stiffness.

The static measurement locations are listed in Table 1. Zones 1 through 10 were measured in September; the remaining zones were measured in November.

Table 1. Summary of Static Measurement Locations

Zone	MP	Description
1	203.20	Road crossing w/ins jnt: Paint
2	203.43	203.2 + 1280' plain track: Paint
3	209.57	Bridge old orchard road: Paint
4	209.57	"
5	209.57	"
6	210	Open track
7 - 40'	249.63- 40'	Open track fill: Paint
7 - 20'	249.63-20'	"
7	249.63	"
8	256.5	Bridge approach: Paint
9	257	Turnout frog: Paint
10	257.02	Turnout: Paint
11	213.27	Switch: Painted on first and second tests
12	271.15	Cranes crossing: Paint
13	268.9	Partridge hill road - open track: Paint
14	267.35	Open track: No Paint
15	265.13	Farm crossing: No Paint
16	265.45	Route 107 crossing open track east: Paint
17	257.97	Switch: Paint
18	257.91	Cpf 258: Paint
19	259.47	Open deck bridge approach: Paint
20	260.49	300 feet before road crossing: Paint
21	261.37	Gas weld: Paint
22	262.35	130' from bridge back wall: No Paint
23	262.5	30' from road crossing: No Paint
24	262.6	Low deflection location: No Paint
25	256.54	Newfields, NH; Main St. Crossing: Paint
26	250.5	Low deflection location: No Paint
27	249.46	East side of bridge: No Paint
28	247.1	Knox marsh overhead bridge: Paint
29	241.48	Insulated joint: No Paint
30	241.2	Heel of switch: Paint
31	241.12	Low deflection location: No Paint
32	240.1	Failed tie: Paint
33	239.1	Cummings, Private Crossing: Paint
34	235.0	Low deflection location: No Paint
35	233.07	Turnout points: Paint
36	230.0	Low deflection location: No paint
37	228.13	Turnout - frog: No paint
38	225.82	Turnout - frog: Paint

4.0 DATA ANALYSIS

4.1 Correlation of TLV Relative Deflection Data with Static Track Modulus

The statistical relationship between the in-motion TLV relative deflection data and the track modulus calculated from the static deflection data was established using regression analysis.

The first step in the process was to determine the TLV in-motion deflection value that coincided with the track modulus value measured at each of the static measurement locations listed in Table 1. As noted, between 3 and 9 static measurements were performed at each location. The static measurement with the highest deflection at each location was paired with the maximum relative deflection value (2-foot window) recorded at the same location from the in-motion data.

Track modulus was calculated from the static deflection data using the equation (1) for a single-point load:

$$k = \frac{(P/y)^{4/3}}{(64EI)^{1/3}} \quad (1)$$

where

k = track modulus (lb/in/in)
 E = rail steel modulus of elasticity (psi) – 30,000,000
 I = rail moment of inertia (in⁴) – 65.6 for 115RE rail
 P = vertical load (lb) – 23,000 lb
 y = vertical rail deflection

In all cases, track modulus was calculated from the track stiffness (P/y) measured between applied loads of 10,000 and 33,000 pounds. Exclusion of the 0-10,000-pound rail deflection is the accepted practice to minimize the effect of track slack (gaps between the rail base and the tie plate) on the modulus value.¹

Table 2 lists the measurement locations along with the static deflection, track modulus and TLV in-motion deflection values used in the analysis.

¹ Hay, W. W. *Railroad Engineering*, 2nd Edition, John Wiley and Sons, Inc. 1982.

**Table 2. Listing of Static Measurement Locations
with Deflection and Modulus Values**

Zone	TLV Defl (in)	Static Defl (in)	Modulus (lb/in/in)	Comments
1	0.50	0.23	926	
2	0.30	0.11	2476	
3	0.30	0.10	2811	
4	0.27	0.08	3785	
5	0.23	0.08	3785	
6	0.14	0.06	5555	
7 -40'	0.29	0.13	1981	
7 - 20'	0.33	0.10	2811	
7	0.38	0.12	2205	
8	0.15	0.06	5555	
9	0.44	0.15	1635	Static measurements taken on turnout frog data not included in analysis
10	0.38	0.16	1502	
11	0.52	0.16	1500	
12	0.40	0.14	1792	
13	0.36	0.11	2472	
14	0.14	0.06	5555	
15	0.23	0.07	4516	
16	0.31	0.12	2205	
17	0.41	0.16	1500	
18	0.38	0.11	2472	
19	0.33	0.07	4516	Static measurements taken on rail opposite TLV deflection data not included in analysis
20	0.37	0.15	1635	
21	0.38	0.14	1792	
22	0.30	0.10	2807	
23	0.39	0.20	1114	
24	0.13	0.05	7073	
25	0.33	0.12	2201	
26	0.15	0.05	7073	
27	0.33	0.09	3230	
28	0.35	0.18	1282	
29	0.23	0.10	2811	
30	0.15	0.07	4516	
31	0.19	0.08	3780	
32	0.34	0.08	3780	
33	0.12	0.06	5555	
34	0.15	0.05	7073	
35	0.49	0.21	1044	
36	0.15	0.06	5555	
37	0.32	0.22	981	Static measurements taken on turnout frog data not included in analysis
38	0.36	0.08	3780	Static measurements taken on turnout frog data not included in analysis

Track modulus is plotted as a function of the TLV relative deflection in Figure 5. The data pairs in Figure 5 differentiate between the measurements taken in September and those taken in November. The results indicate that there was no significant difference between the two data sets in terms of their effect on the overall correlation.

The regression curve that gives the best fit to the measured data and conforms to the non-linearity of the modulus calculation is the power function

$$y = 575.82x^{-1.2069} \quad (2)$$

The coefficient of determination (r^2), or the degree of statistical relation in the data, is 0.821. This implies that 82 percent of the total variation in the static track modulus values is reduced, or "explained," when the TLV relative deflection is considered.² An r^2 value of 0.821; in this case, where track response to a dynamic 40,000 pounds load is correlated to modulus values calculated from static measurements, is considered acceptable to establish a valid relationship.

From equation 2, the TLV relative deflection equivalent to a track modulus of 2,750 is 0.274 inch.

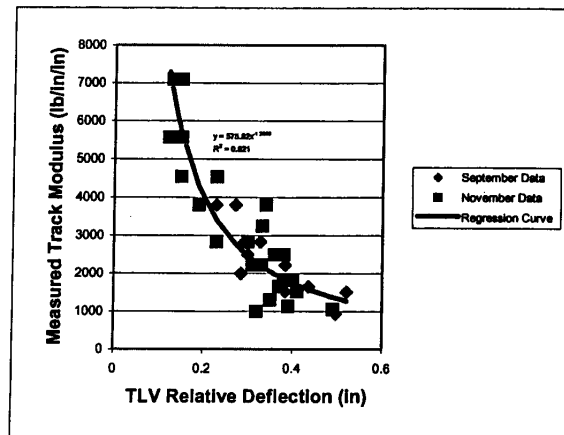


Figure 5. Relationship of TLV Relative Deflection Data to Track Modulus Values Calculated from Static Measurements

² Neter, J, W. Wasserman, G. A. Whitmore, *Applied Statistics*, Allyn and Bacon, Inc. 1978.

Of the 40 locations where static measurements were performed, 4 locations were excluded from the analysis as is indicated by the comments in Table 2. Zones 9, 37 and 38 were excluded because the static measurements were taken on frogs in turnouts. The shape of the frog causes errors in the laser position measurement and its stiffness and moment of inertia is significantly different from rail that effects the modulus calculation. Zone 19 was excluded because the static measurement was on the rail opposite from the TLV measurement due to limited access at a bridge approach.

4.2 Distribution of TLV Deflection and Track Modulus Data

The TLV deflection data recorded in September and processed to the 25-foot average is plotted as a frequency distribution in Figure 6 and as a cumulative distribution in Figure 7. Similar distributions of the track modulus values calculated from the September TLV data (25-foot average) are shown in Figures 8 and 9.

The distributions in Figures 6, 7, 8 and 9 include the following track segments identified for operations exceeding 60 mph:

- MP 201.0 – 206.77
- MP 207.8 – 211.0
- MP 212.7 – 243.6 (includes Kennebunk)
- MP 244.0 – 252.6
- MP 254.1 – 272.9

The analysis identifies 166 feet of the 355,186 feet of track measured generated deflections greater than 0.27 inch or modulus values lower than 2,796 lb/in/in. The 2,796 lb/in/in modulus differs slightly from the specified 2,750 lb/in/in, but corresponds to a measured deflection of 0.27 inch. It is beyond the accuracy of the TLV measurement system to resolve less than 0.01 inch; therefore, any measurement greater than 0.27 inch will be considered as not meeting the 2,750 lb/in/in modulus criteria.

The median (50th percentile) deflection value is about 0.16 inch or 5,258 lb/in/in track modulus. The mean modulus value is 5,346 lb/in/in.

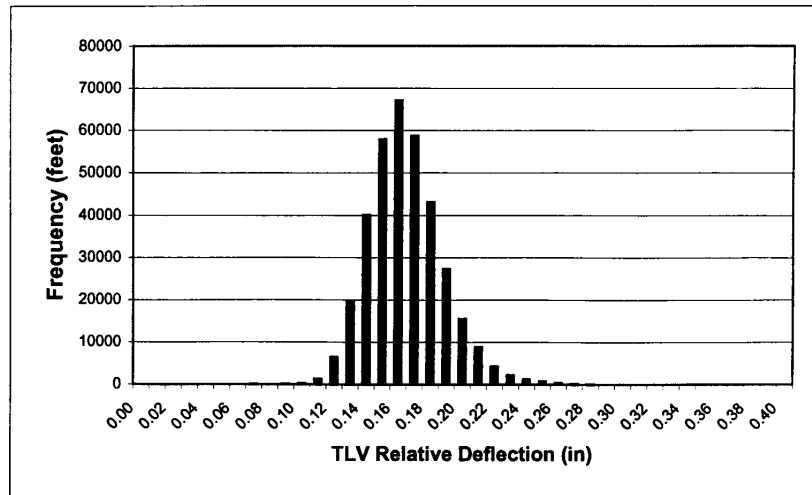


Figure 6. Frequency Distribution of TLV In Motion Deflection Data

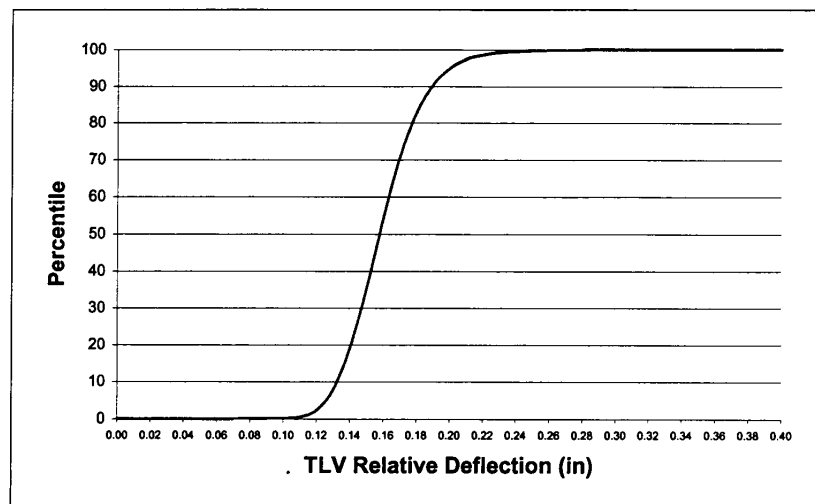


Figure 7. Cumulative Distribution of TLV In-Motion Deflection Data

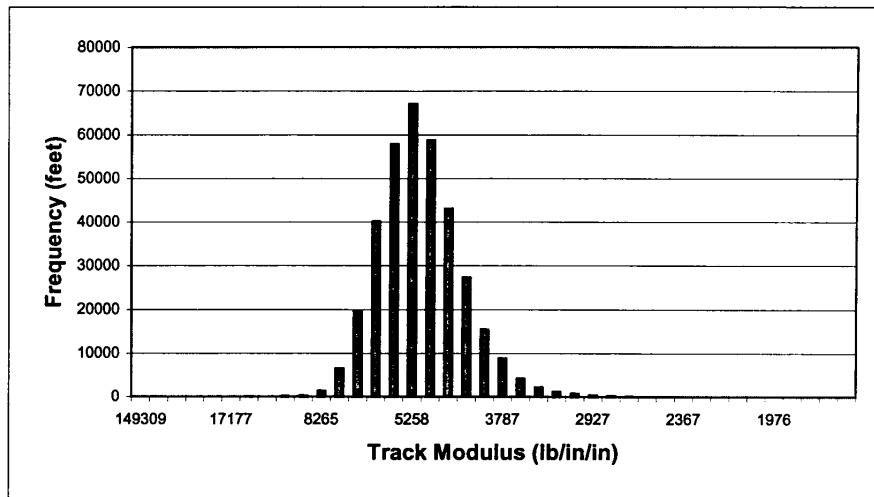


Figure 8. Frequency Distribution of Track Modulus Values Calculated from TLV In-Motion Deflection Data

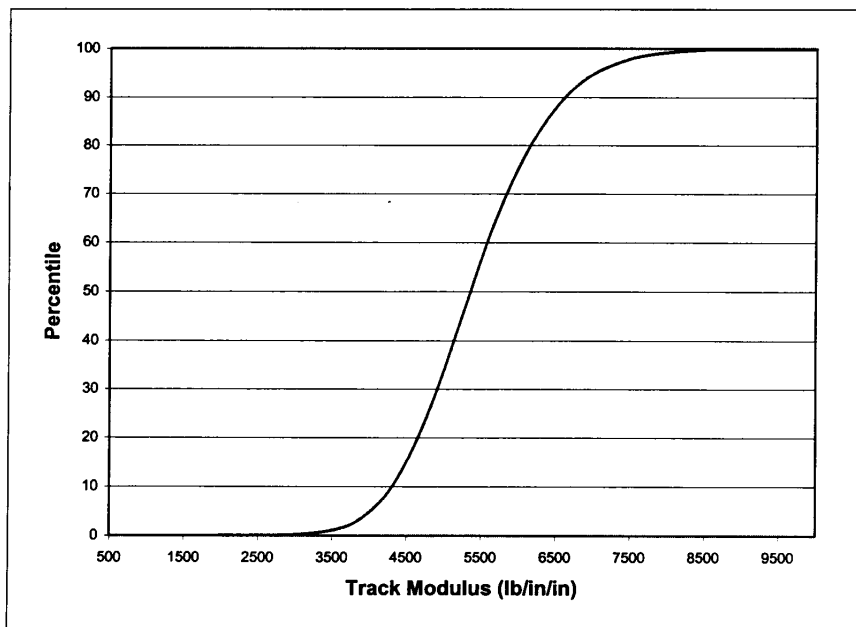


Figure 9. Frequency Distribution of Track Modulus Values Calculated from TLV In-Motion Deflection Data

5.0 LIST OF TRACK MODULUS EXCEPTION LOCATIONS

Following is the list of locations where TLV in-motion track deflections recorded in September and calculated from a 25-foot moving average were equal to or exceeded 0.27 inch:

- MP 203.14, maximum deflection – 0.28 inch, minimum modulus – 2,676 lb/in/in, length – 15.3 feet.
- MP 205.45, maximum deflection 0.27 inch, minimum modulus 2,796 lb/in/in, length – 2 feet.
- MP 208.66, maximum deflection 0.28 inch, minimum modulus – 2,676 lb/in/in, length – 3.3 feet.
- MP 213.24, maximum deflection 0.28 inch, minimum modulus 2,676 lb/in/in, length – 6.6 feet.
- MP 220.74, maximum deflection 0.27 inch, minimum modulus 2,796 lb/in/in *
- MP 220.80, maximum deflection 0.35 inch, minimum modulus 2,044 lb/in/in *
- MP 220.81, maximum deflection 0.28 inch, minimum modulus 2,676 lb/in/in *
- MP 220.83, maximum deflection 0.36 inch, minimum modulus 1,976 lb/in/in *
- MP 220.84, maximum deflection 0.32 inch, minimum modulus 2,278 lb/in/in *
- MP 220.92, maximum deflection 0.27 inch, minimum modulus 2,796 lb/in/in *
- MP 220.93, maximum deflection 0.30 inch, minimum modulus 2,462 lb/in/in *
- MP 240.08, maximum deflection 0.28 inch, minimum modulus 2,676 lb/in/in, length – 7 feet.
- MP 241.02, maximum deflection 0.30 inch, minimum modulus 2,462 lb/in/in, length – 18 feet.
- MP 272.89, maximum deflection 0.28 inch, minimum modulus 2,676 lb/in/in, length – 7.4'

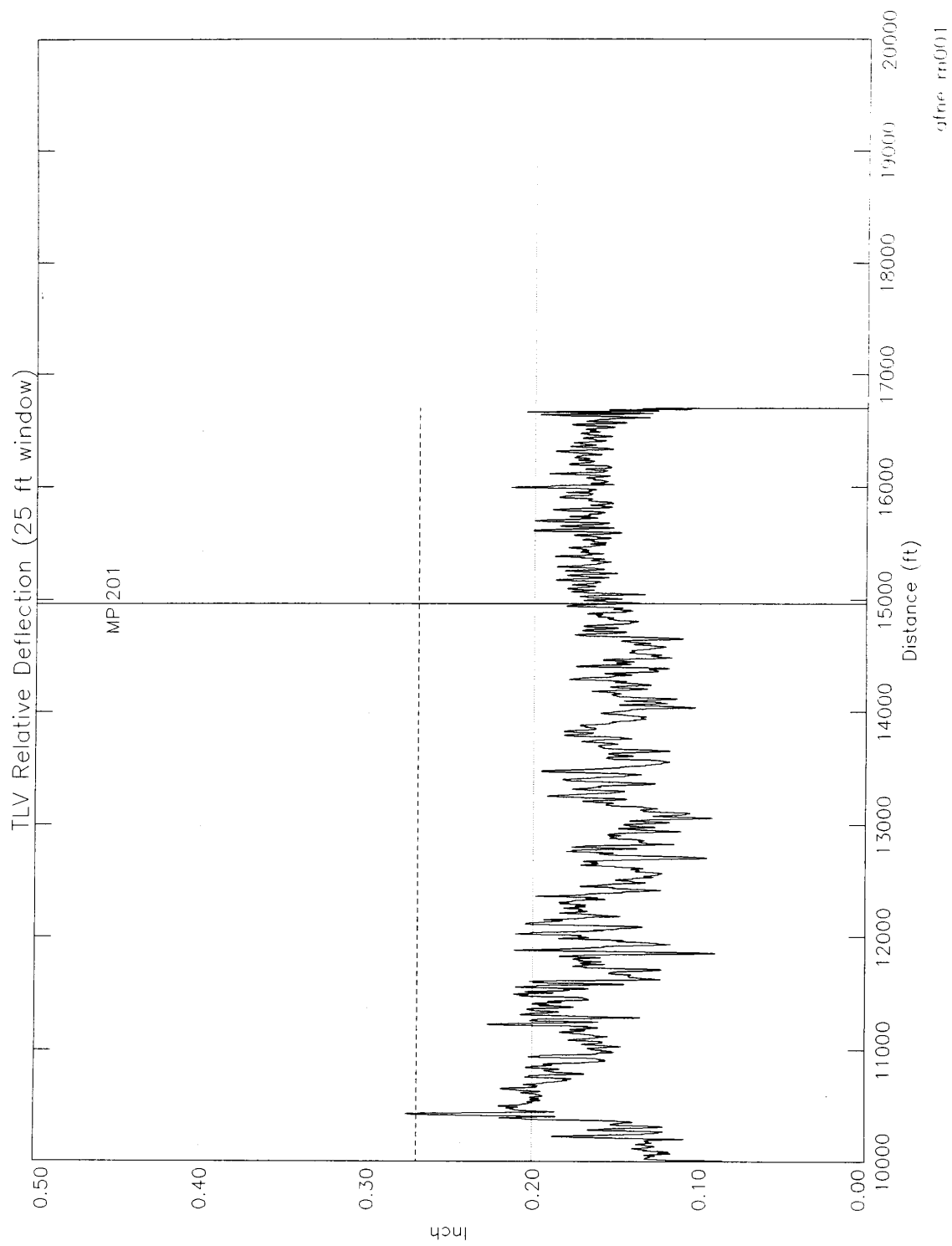
* Total length of exceptions between MP 220.74 and 220.93 was 107 feet.

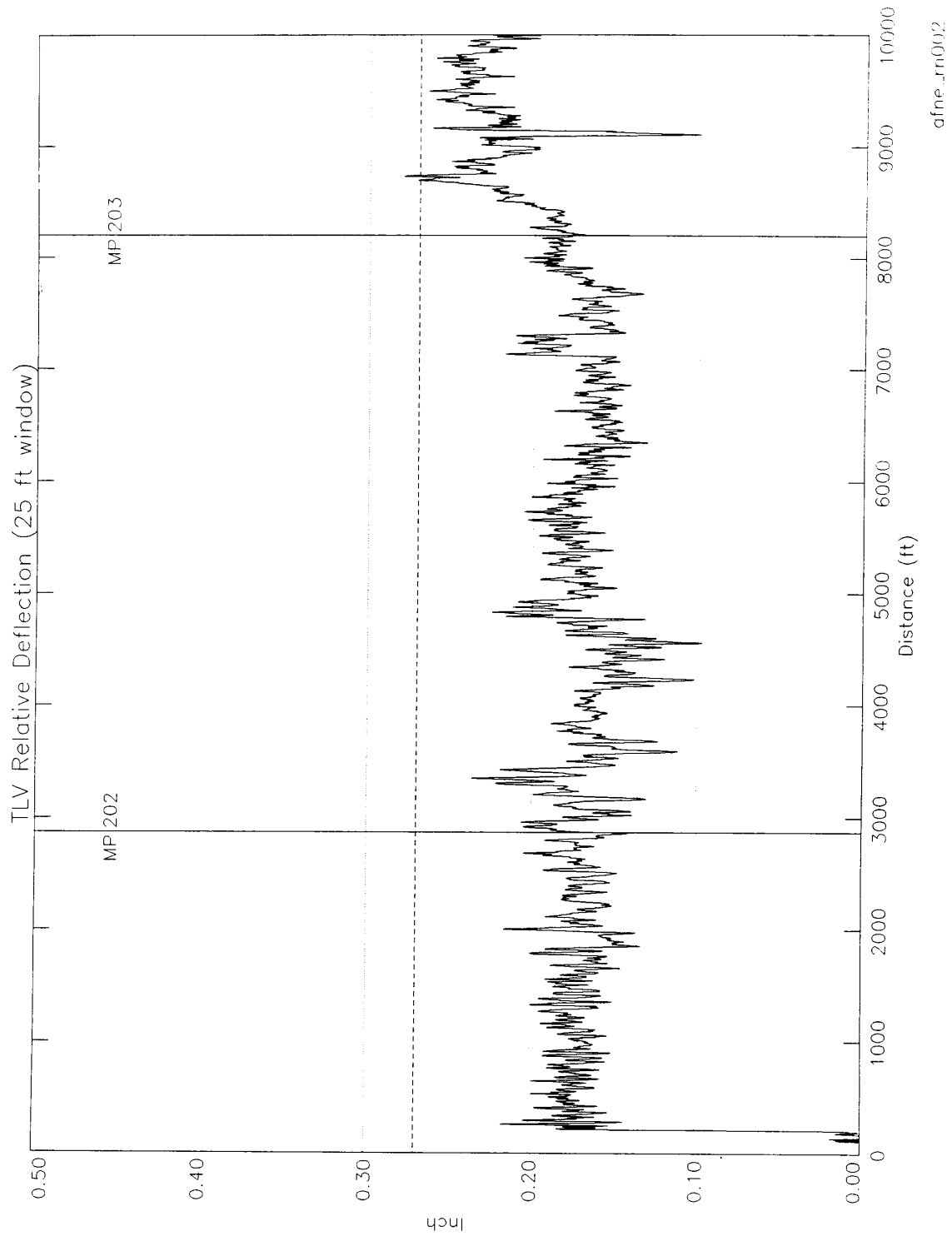
6.0 SUMMARY

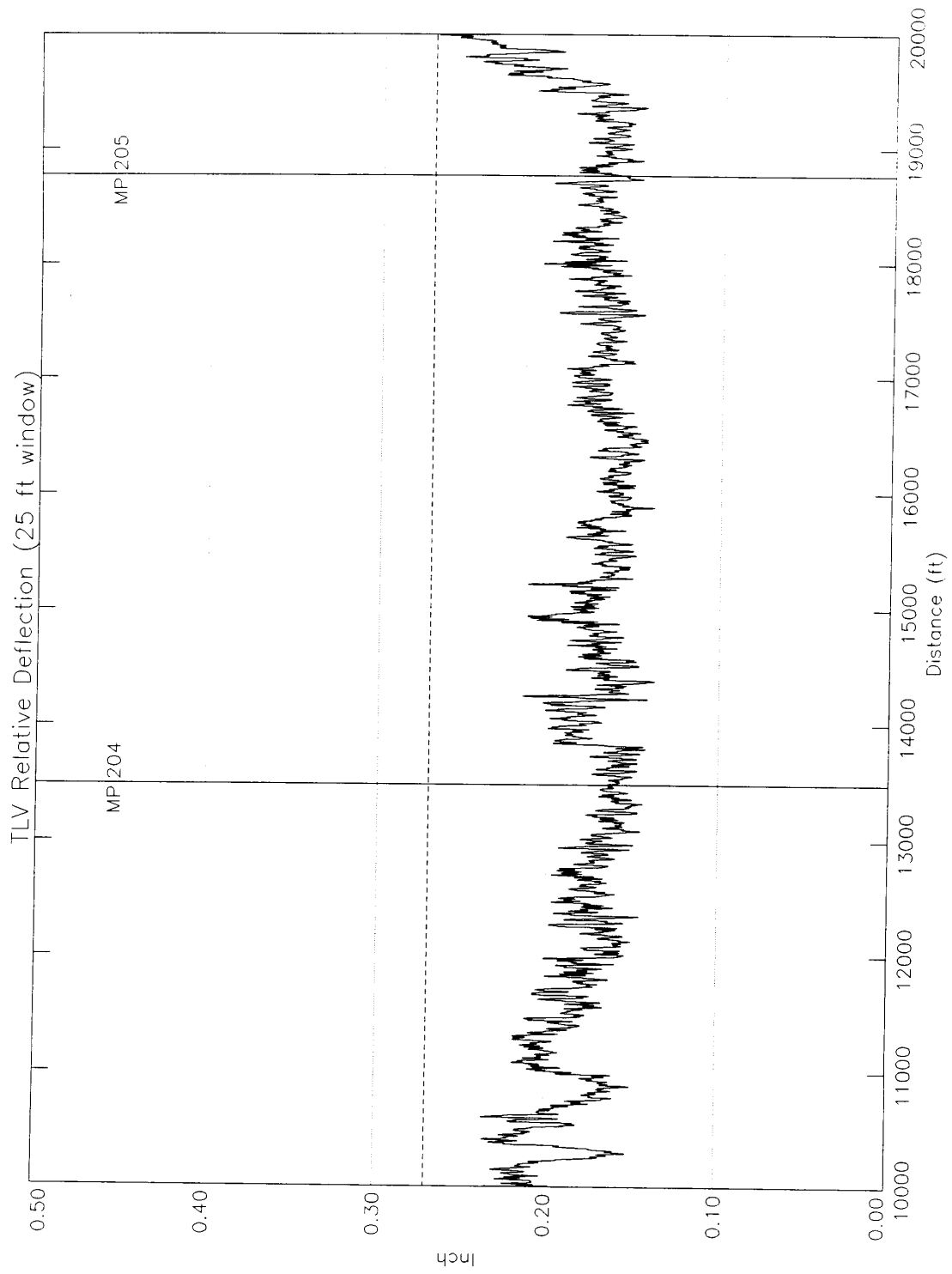
A statistical relationship was found to exist between the TLV relative deflection data and track modulus values calculated from static track measurements. The equation defining the relationship specifies a relative deflection of 0.274 inch as equal to a track modulus of 2,750 lb/in/in. The 0.274-inch threshold was rounded to 0.27 inch to conform to the measurement accuracy of the TLV. When applied to the in-motion deflection data that was recorded in September and processed to a 25-foot moving average, the above list of track locations was found to meet or exceed the specified 2,750 lb/in/in limit.

Appendix A

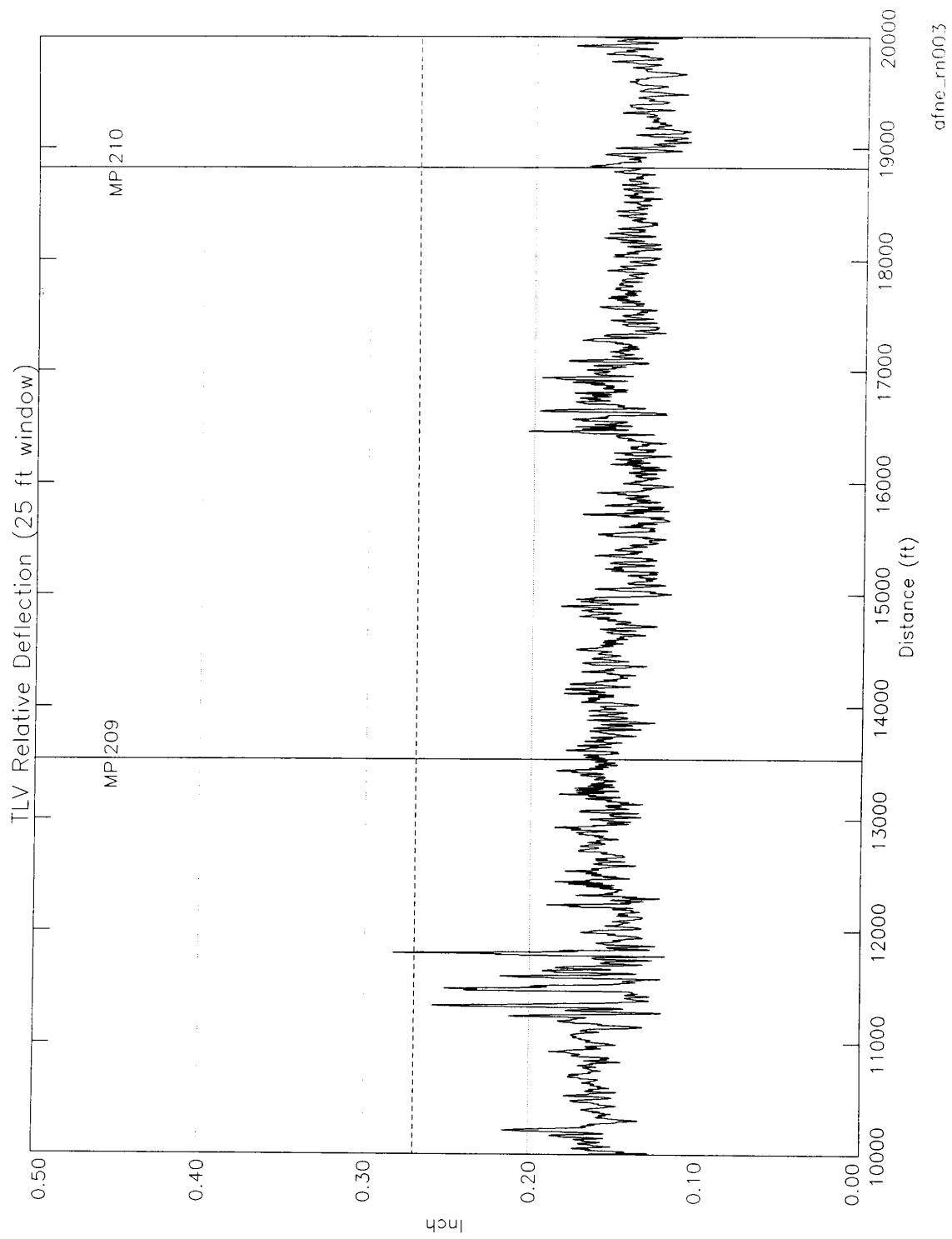
Distance history plots of the 25-foot average deflection data processed from the September in-motion test and used to determine the exception locations. A dashed line is included on the plots at 0.27 inch to mark the exception threshold.

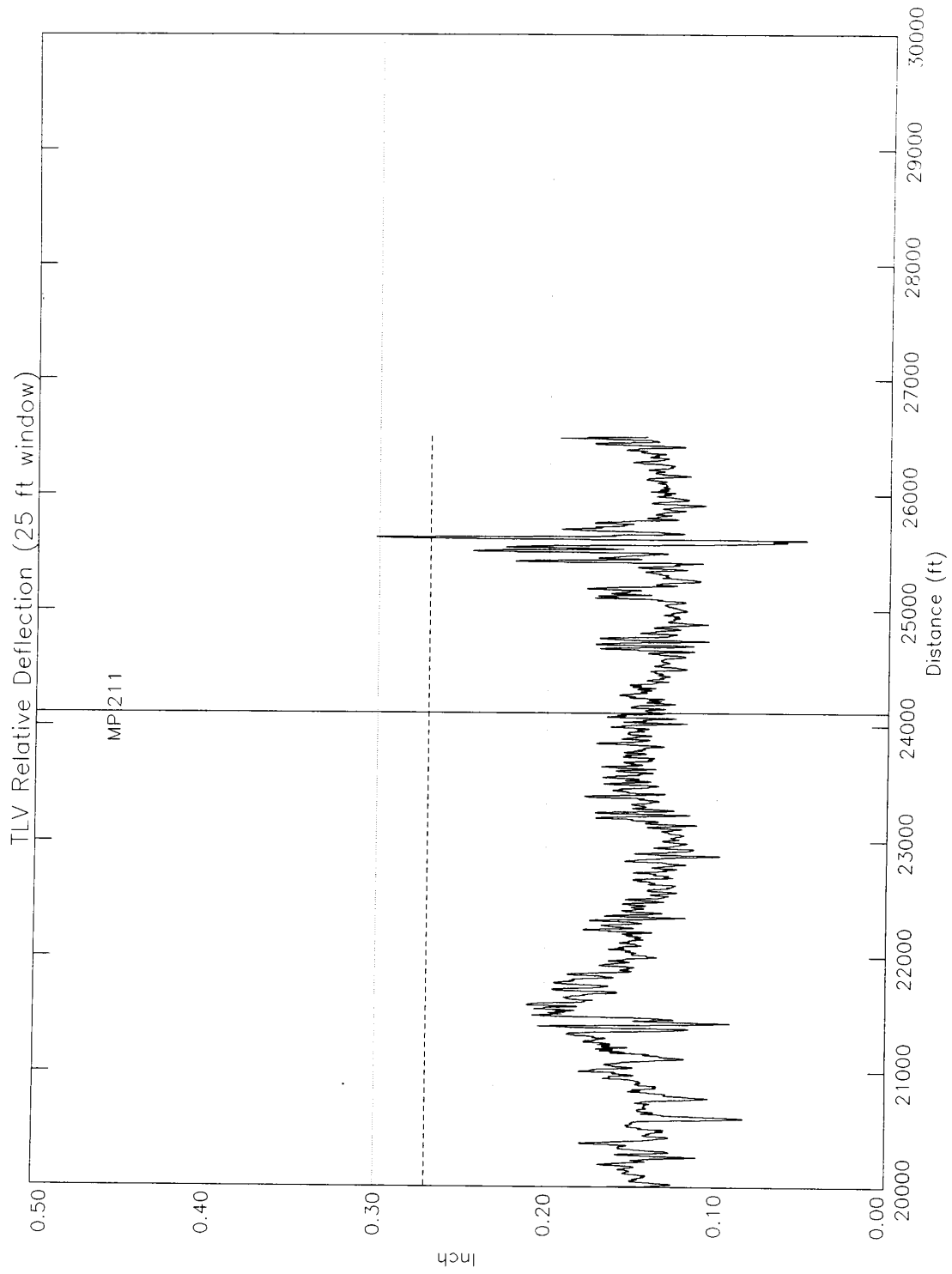


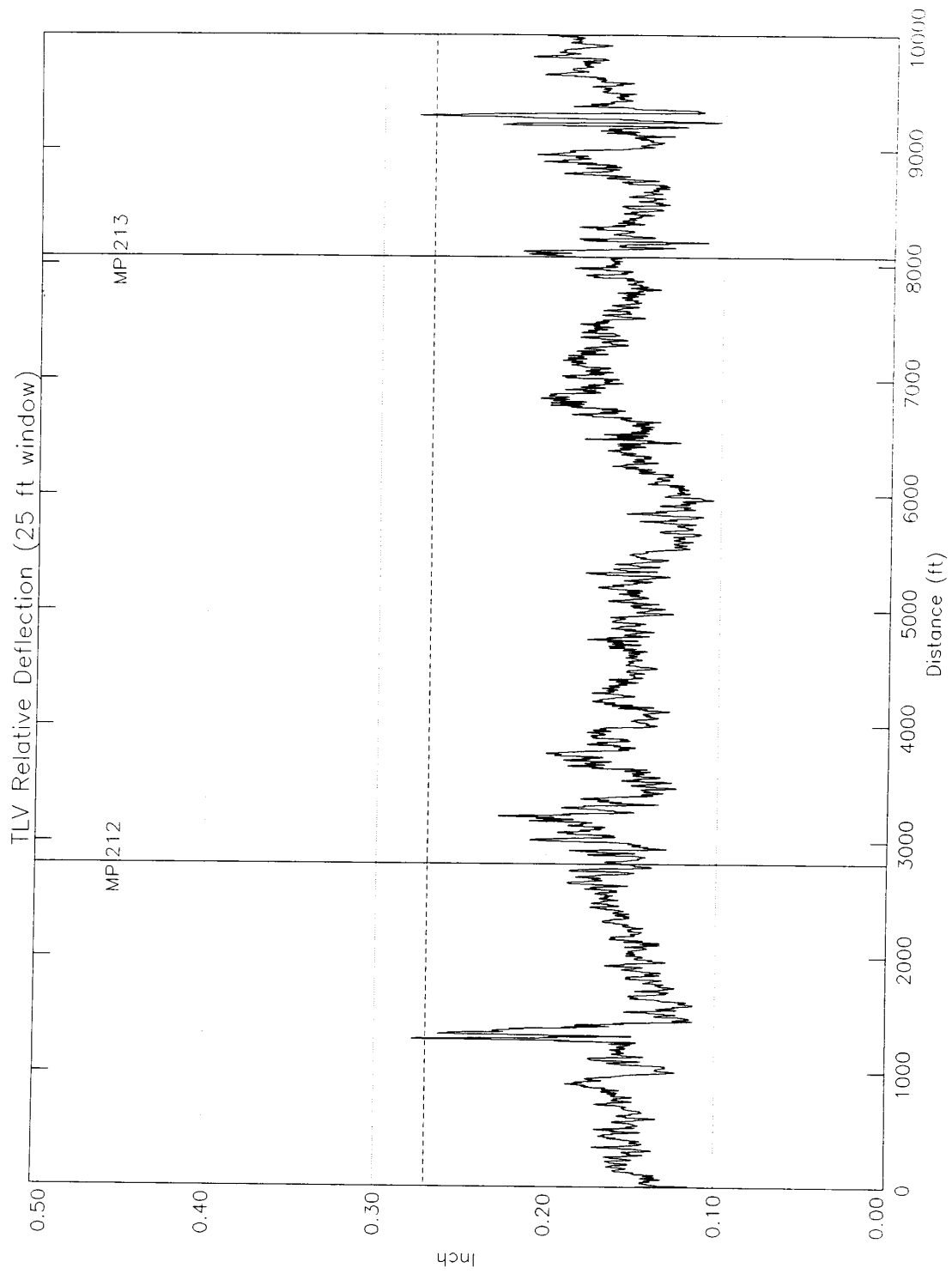


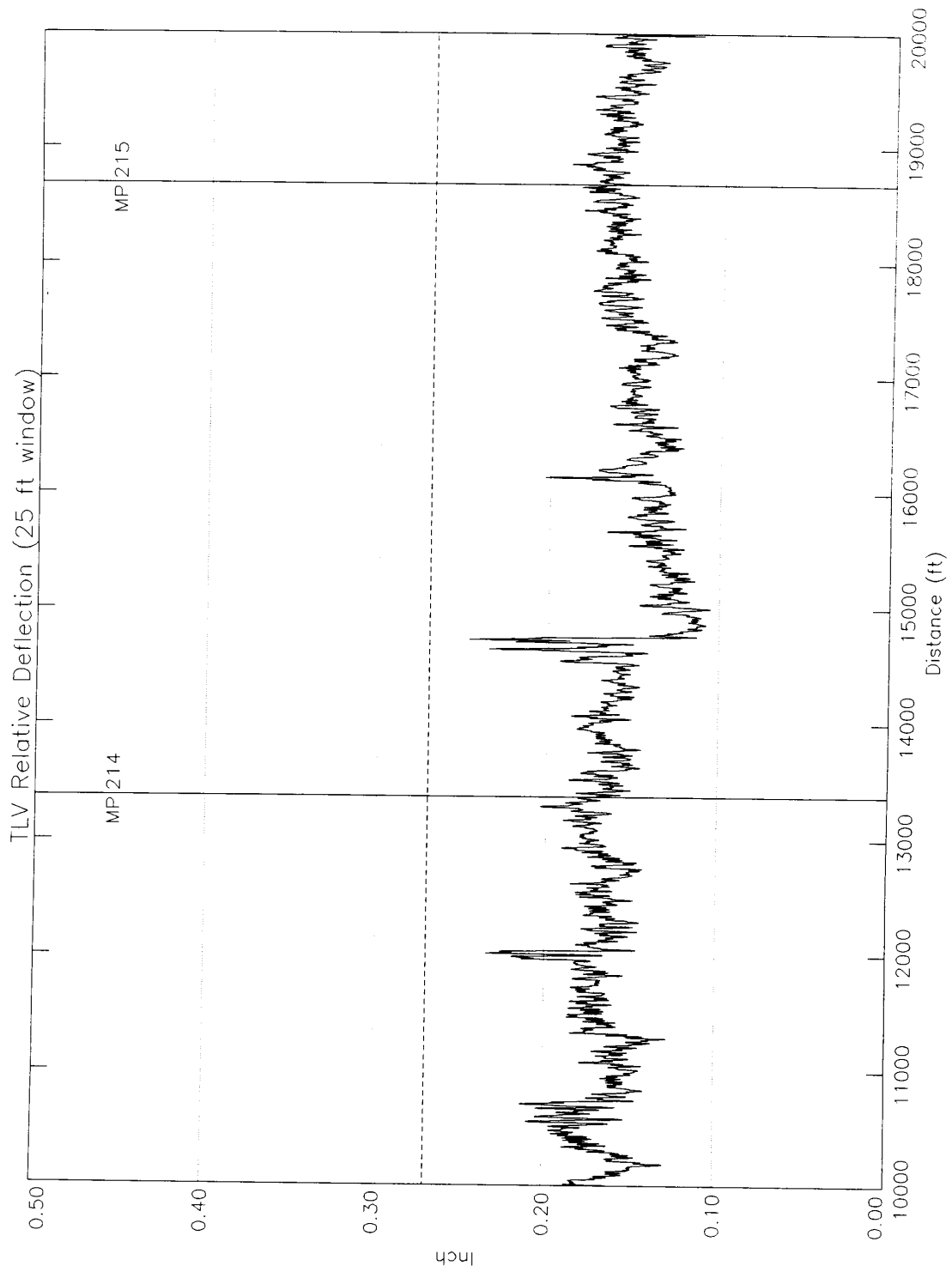


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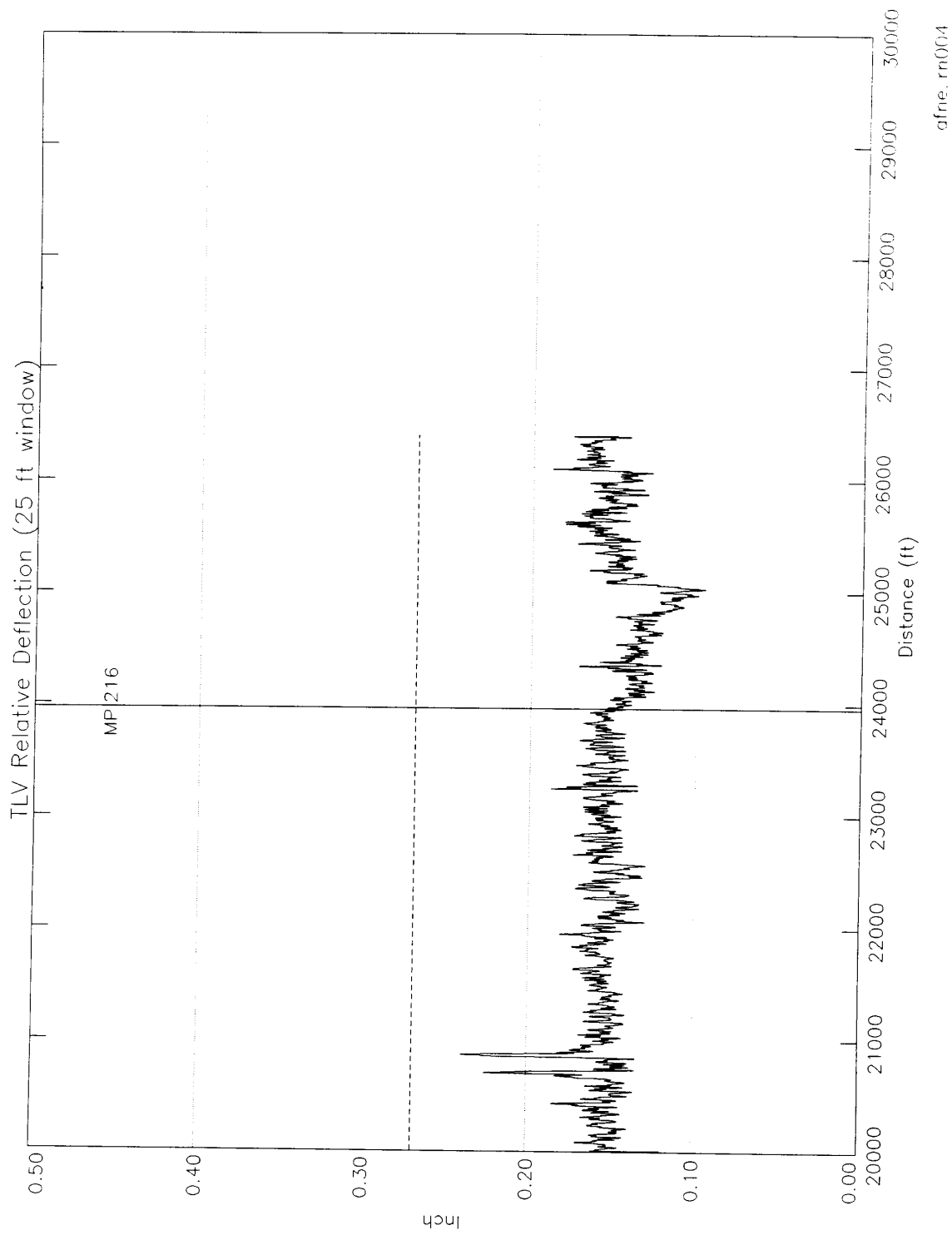


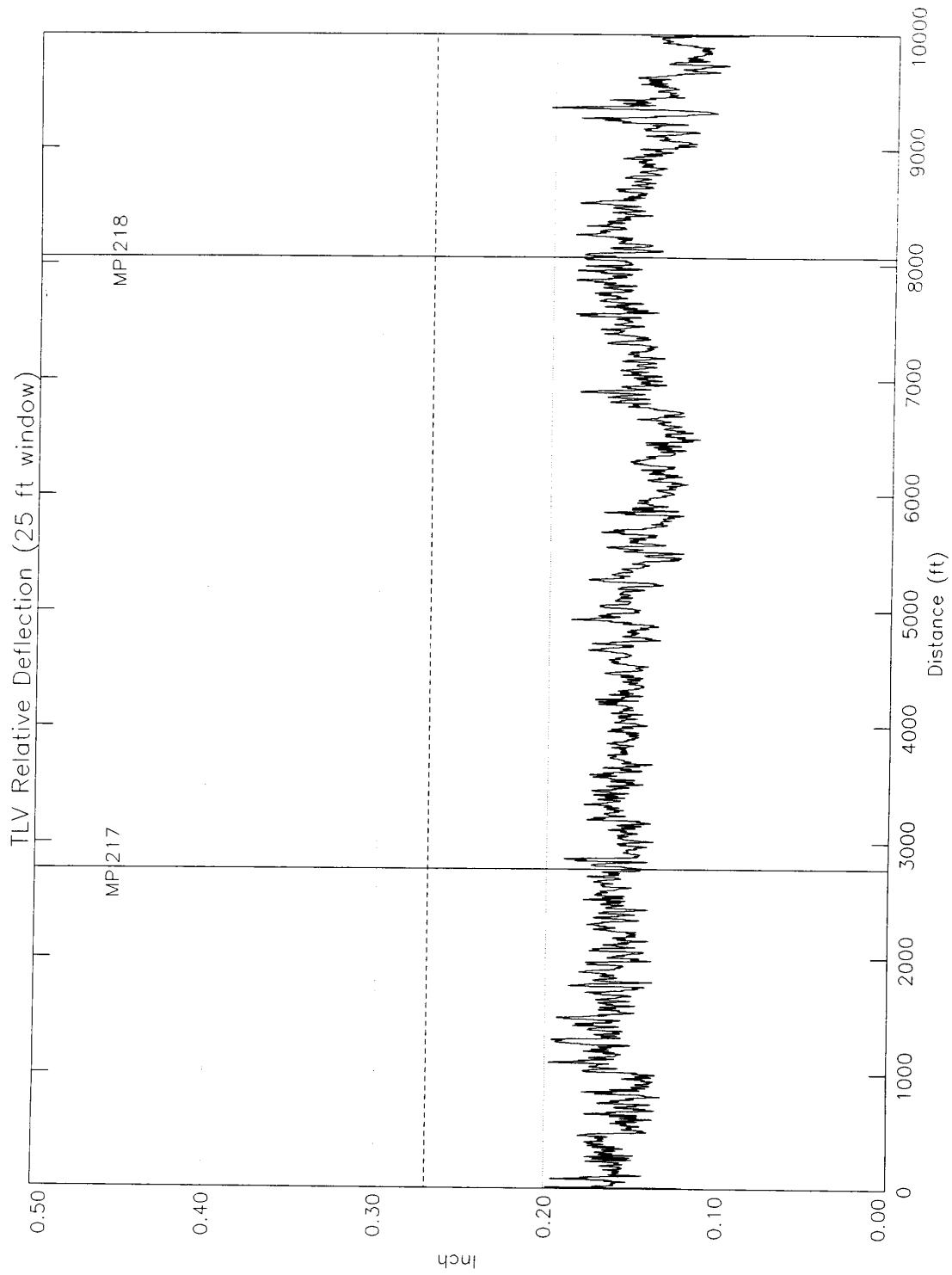




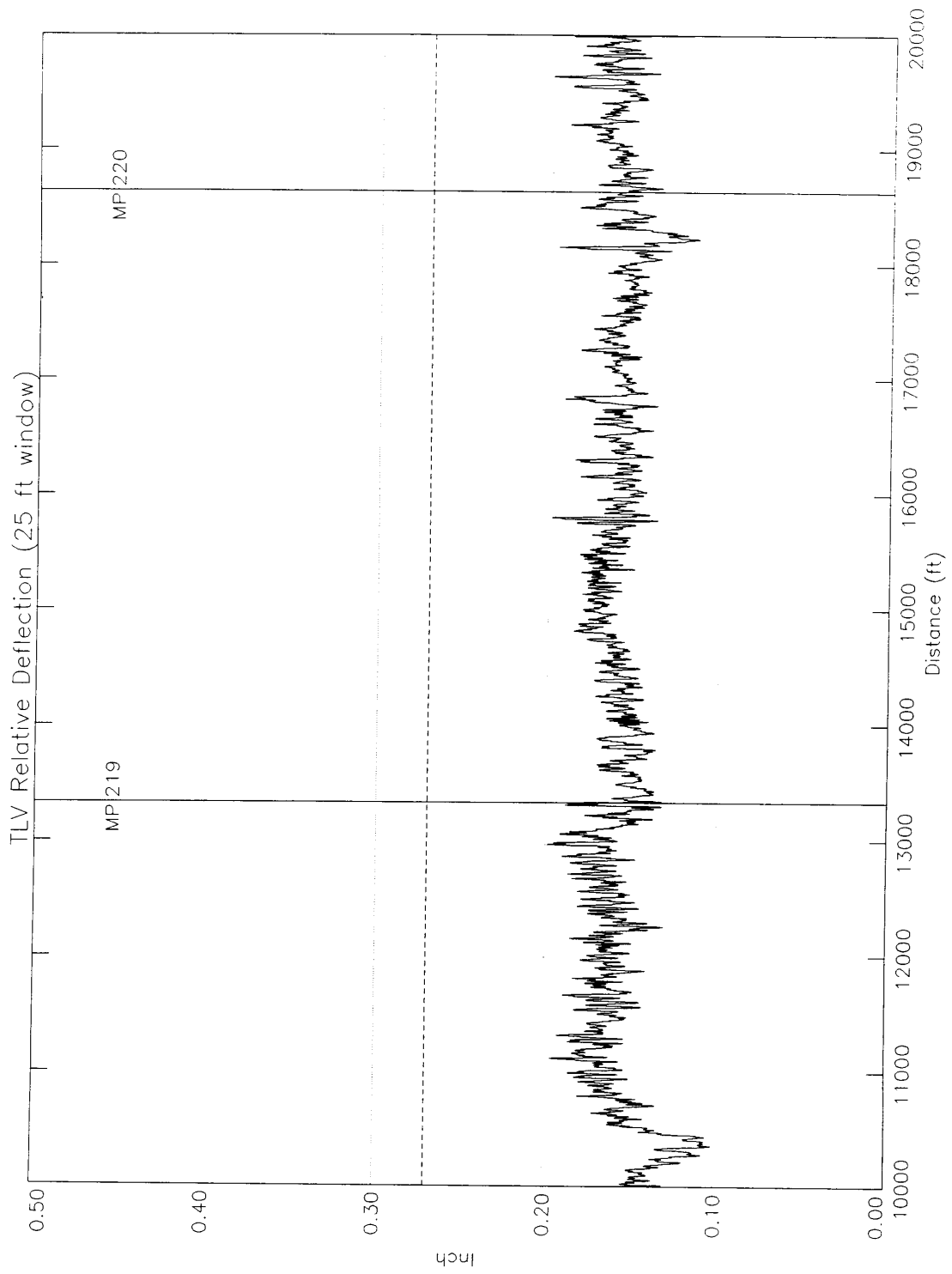


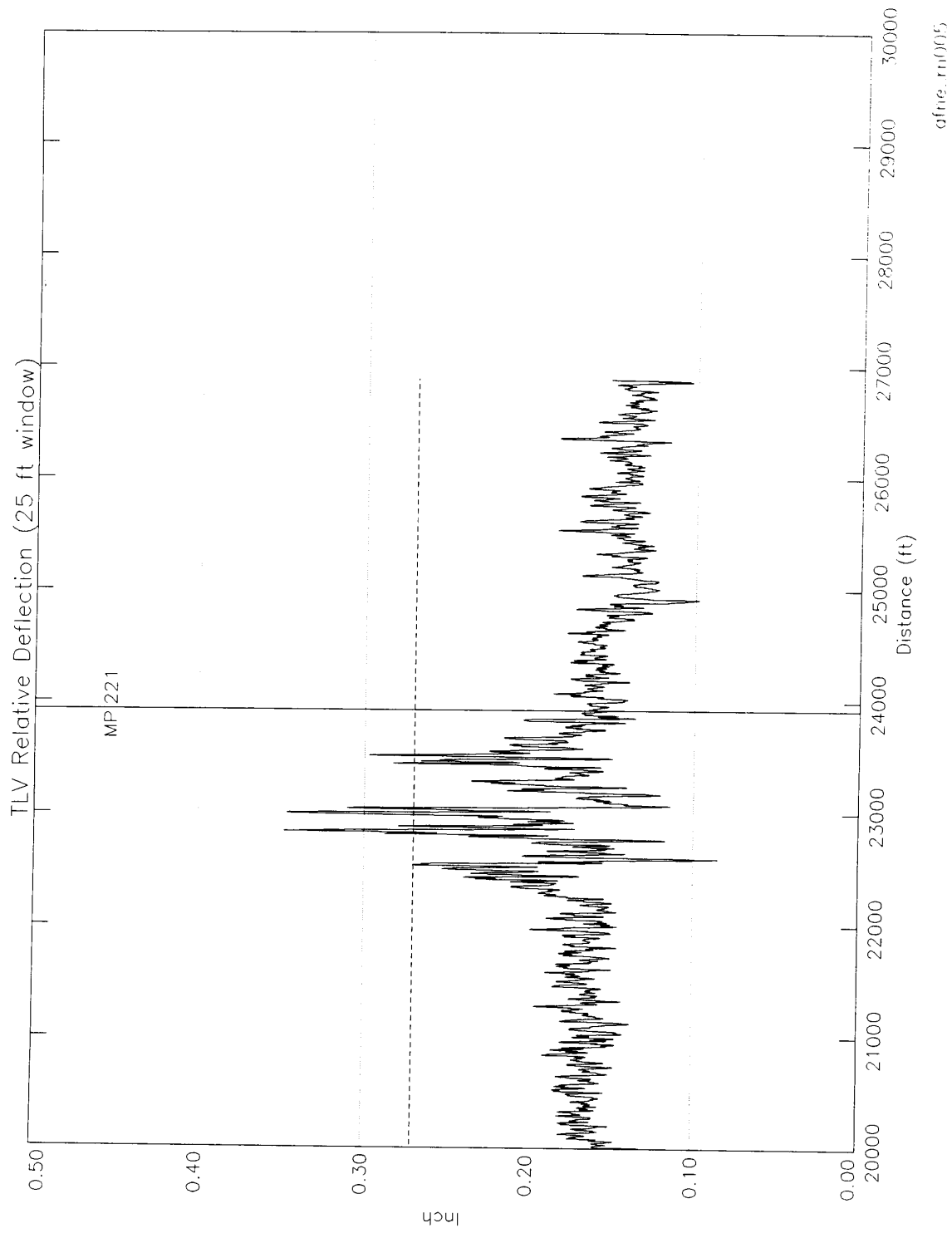
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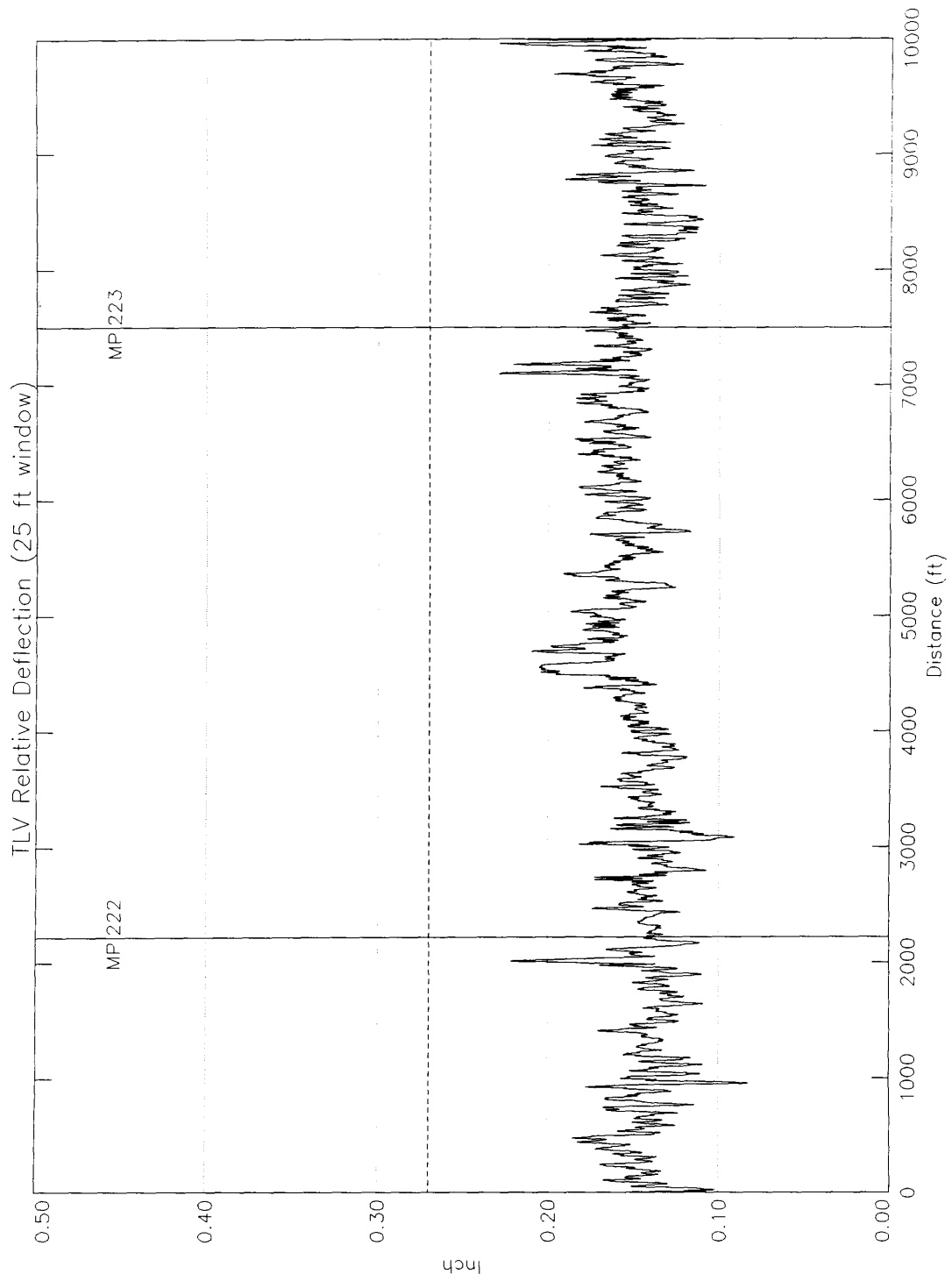


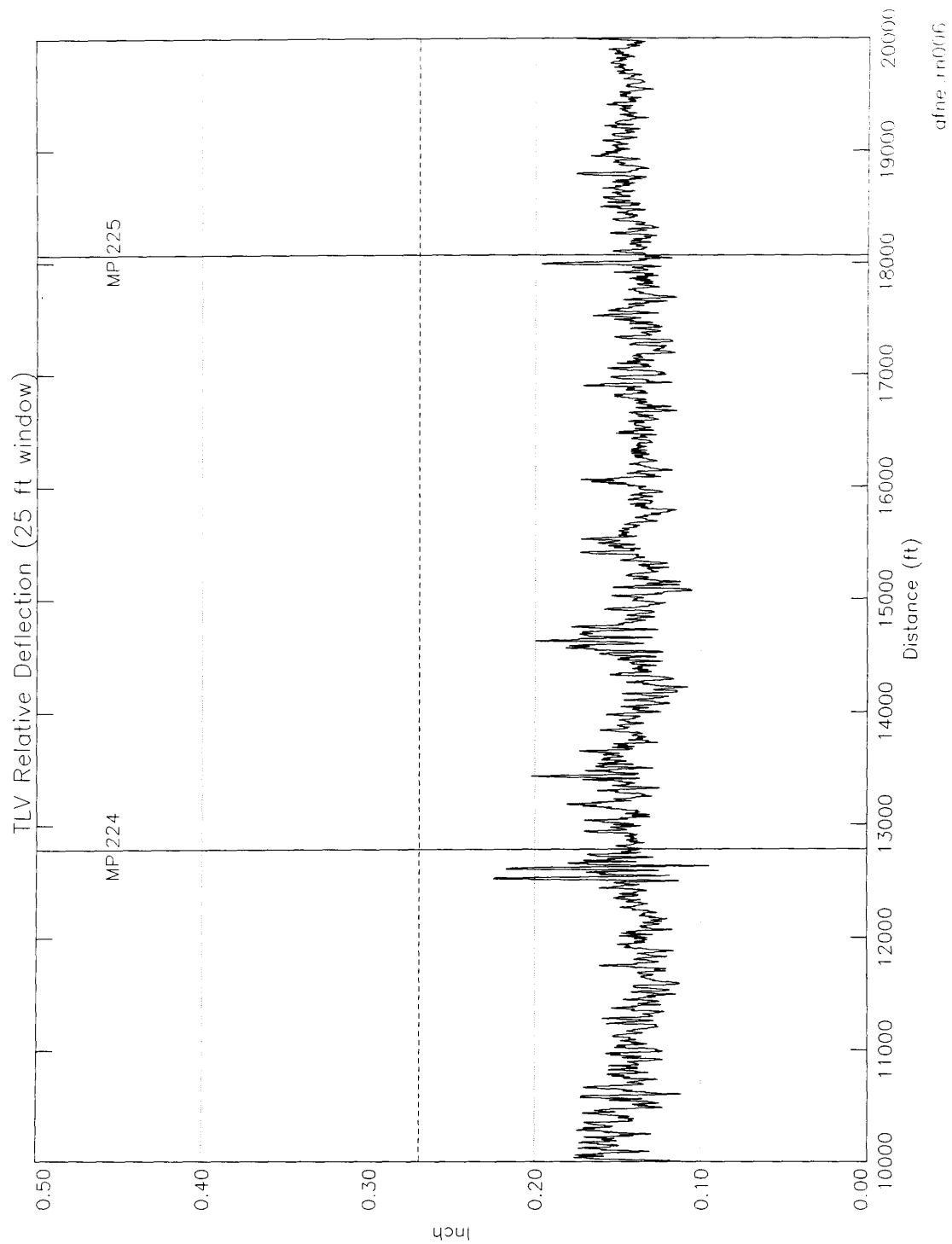


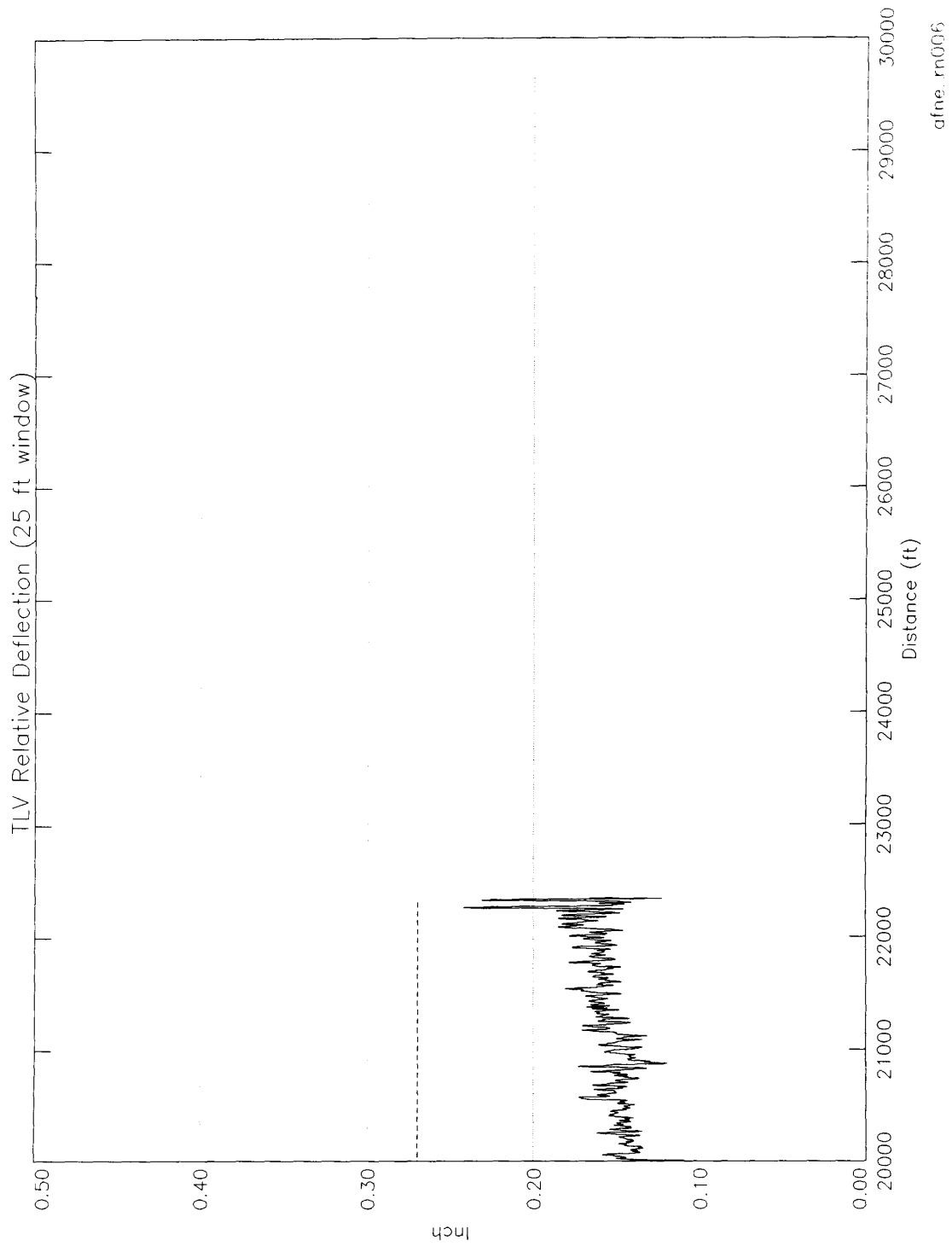
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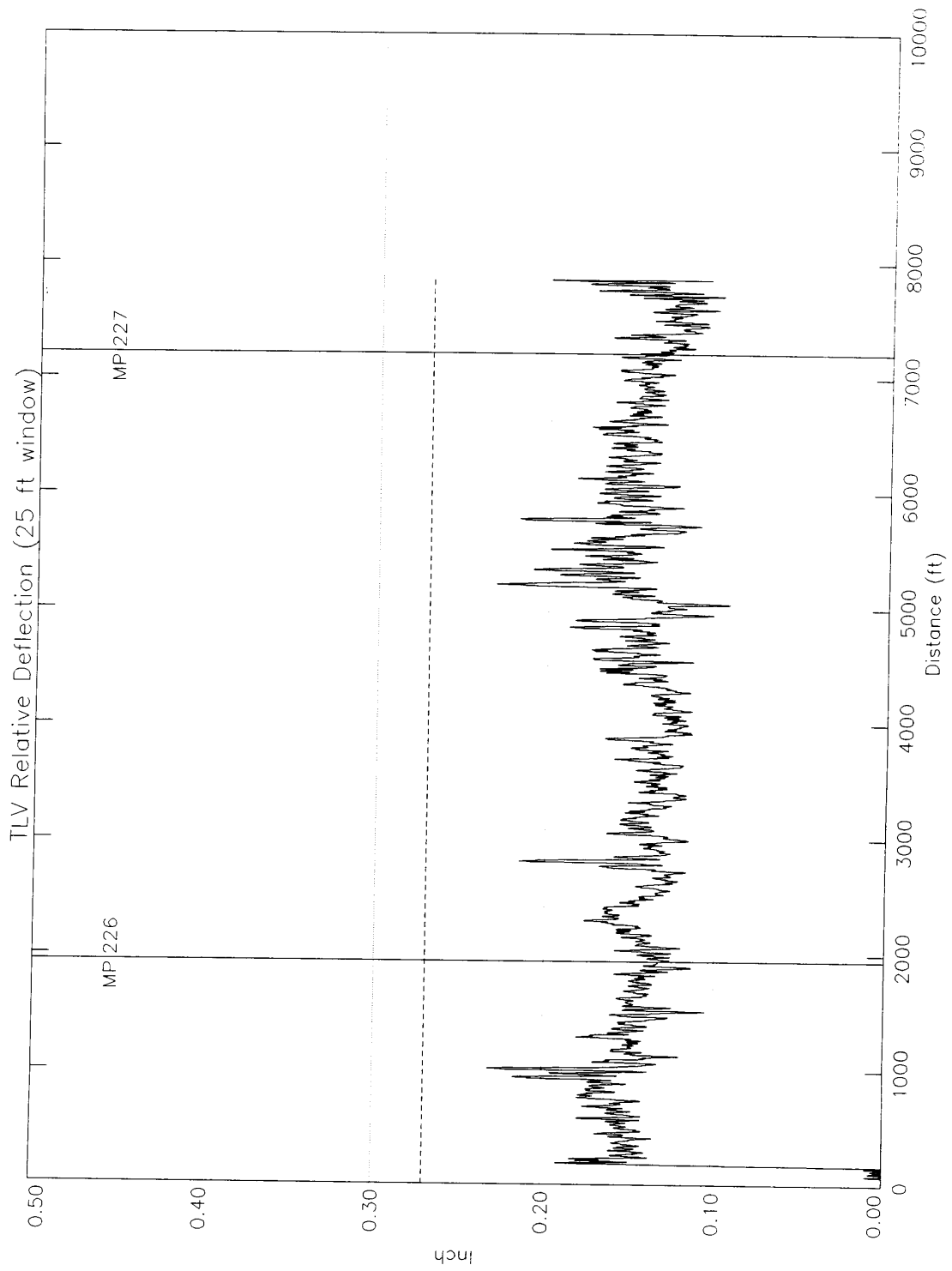


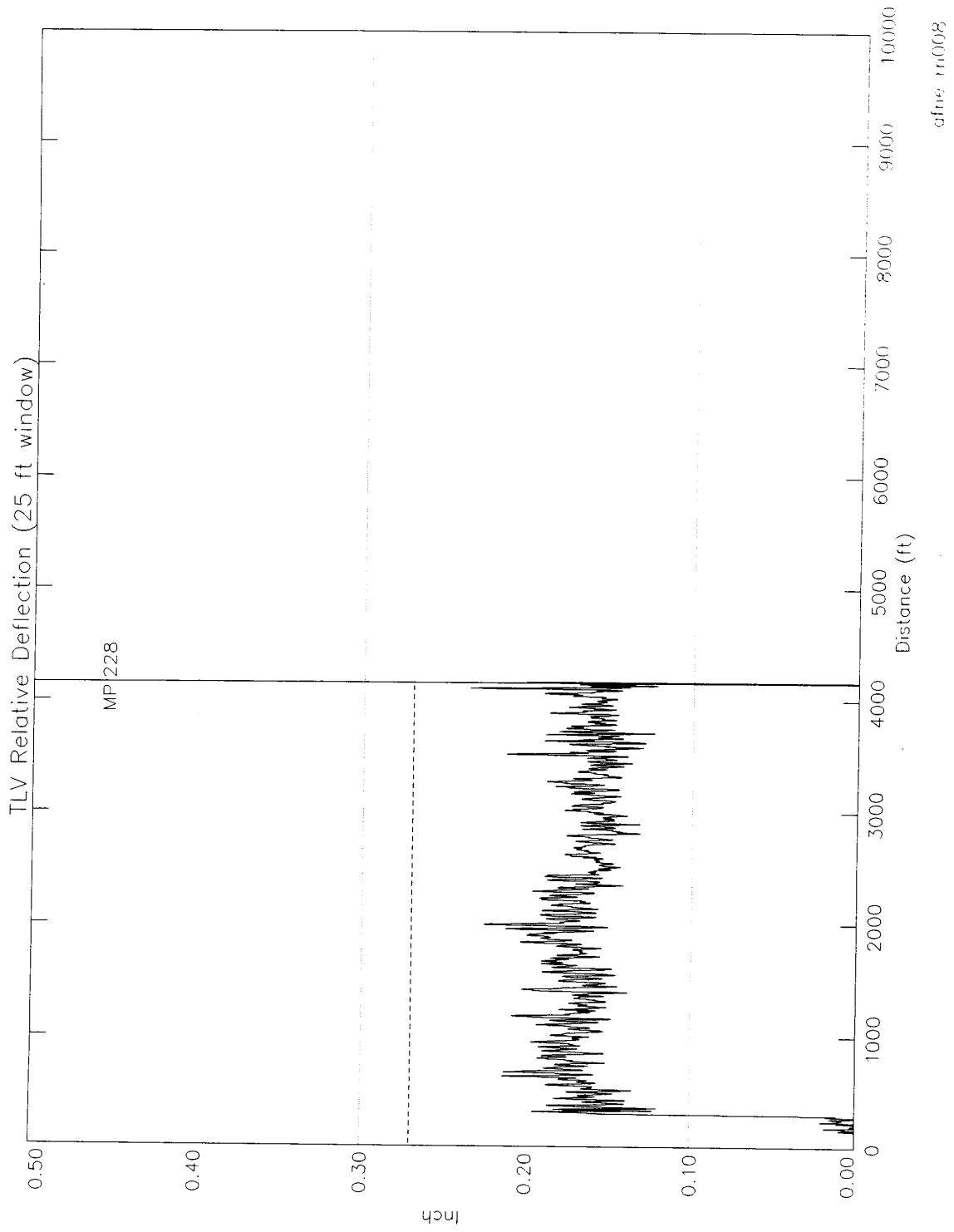


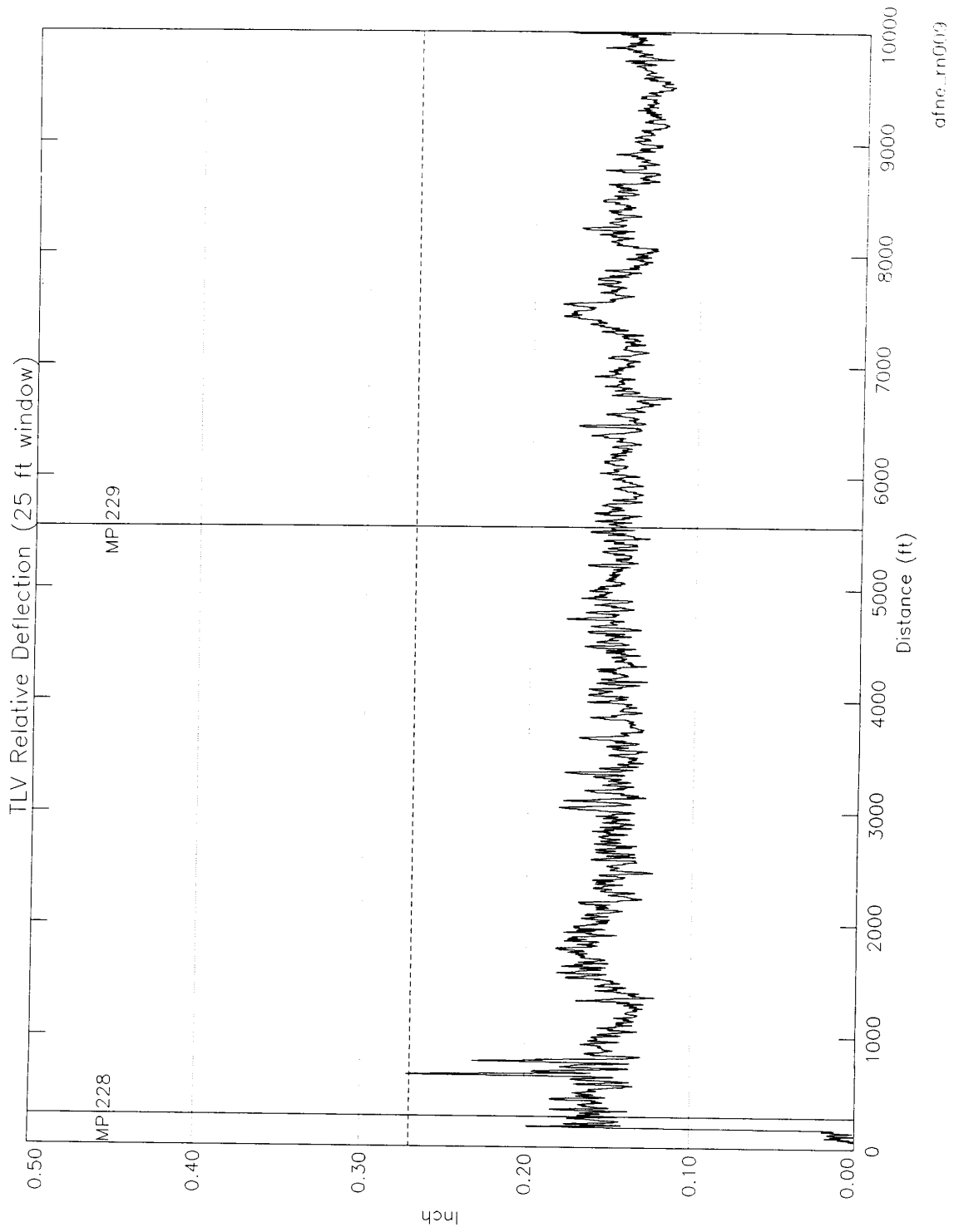


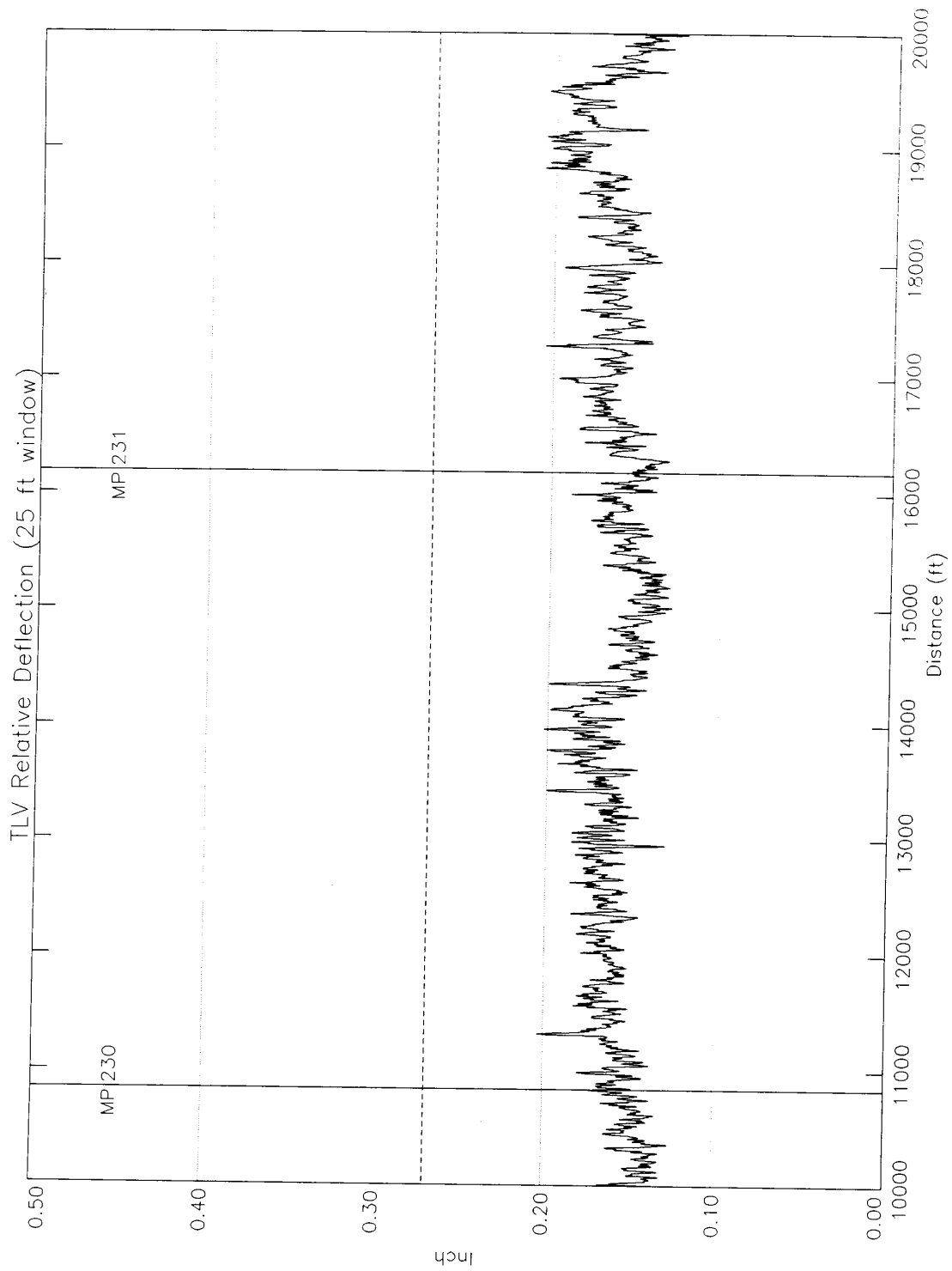


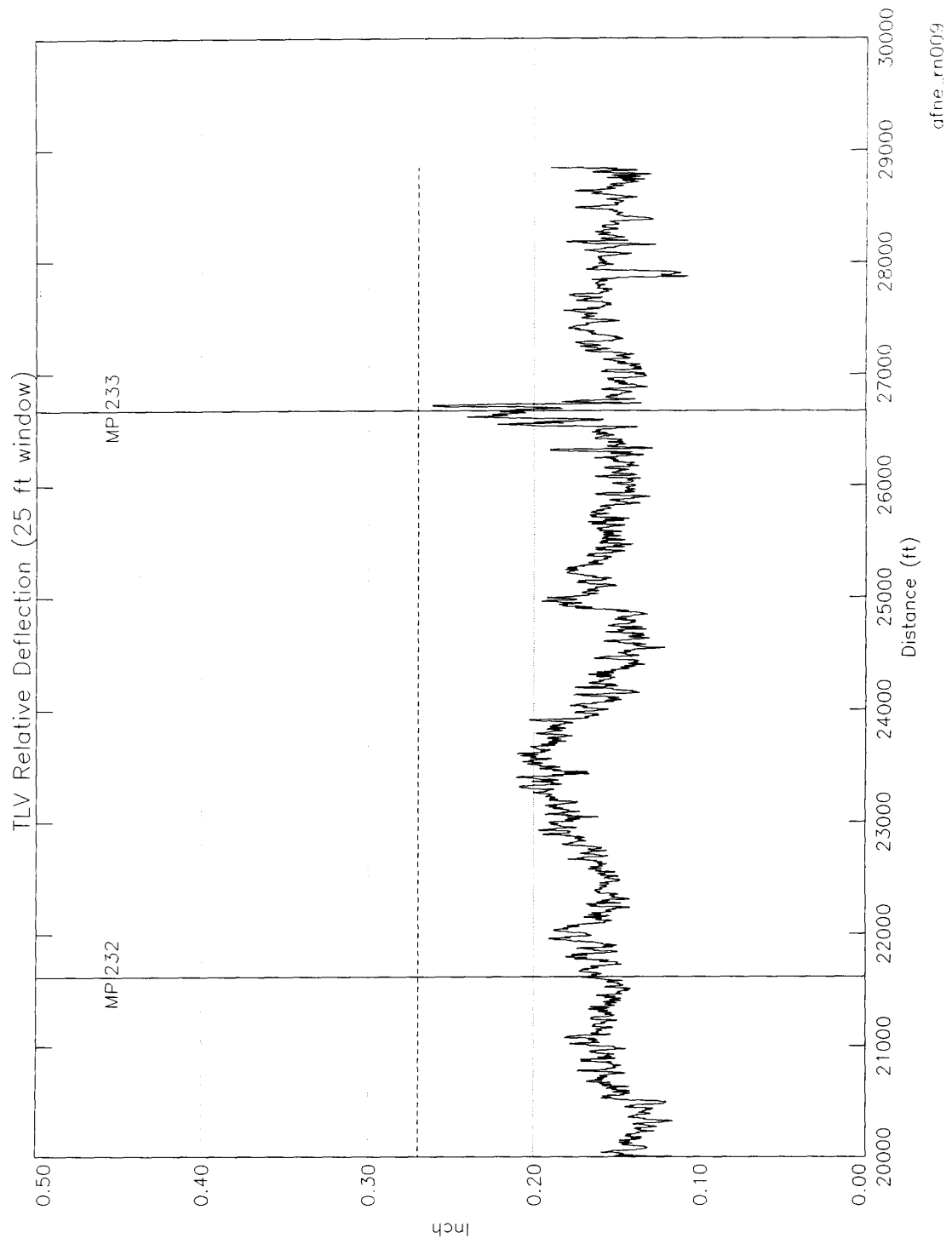


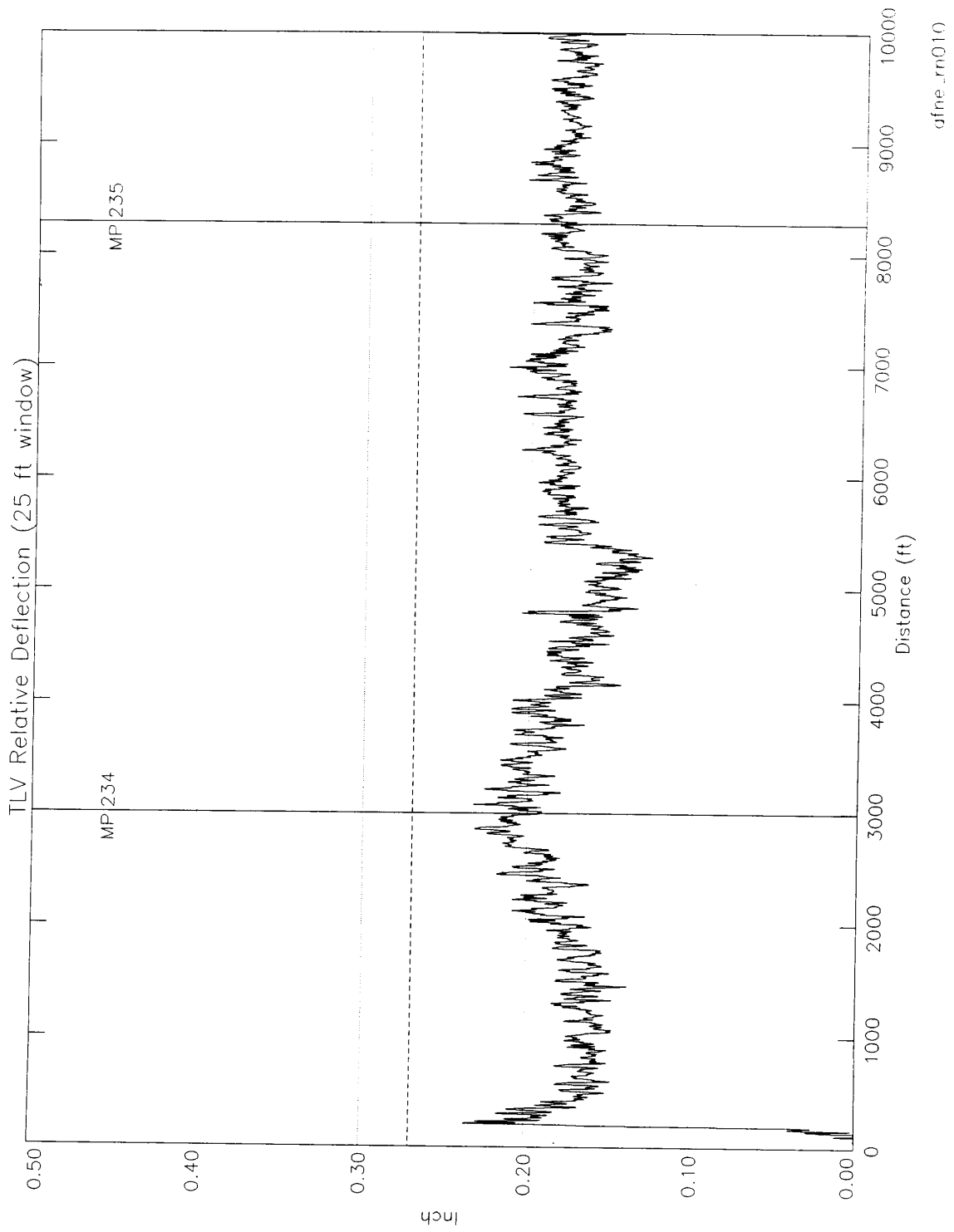


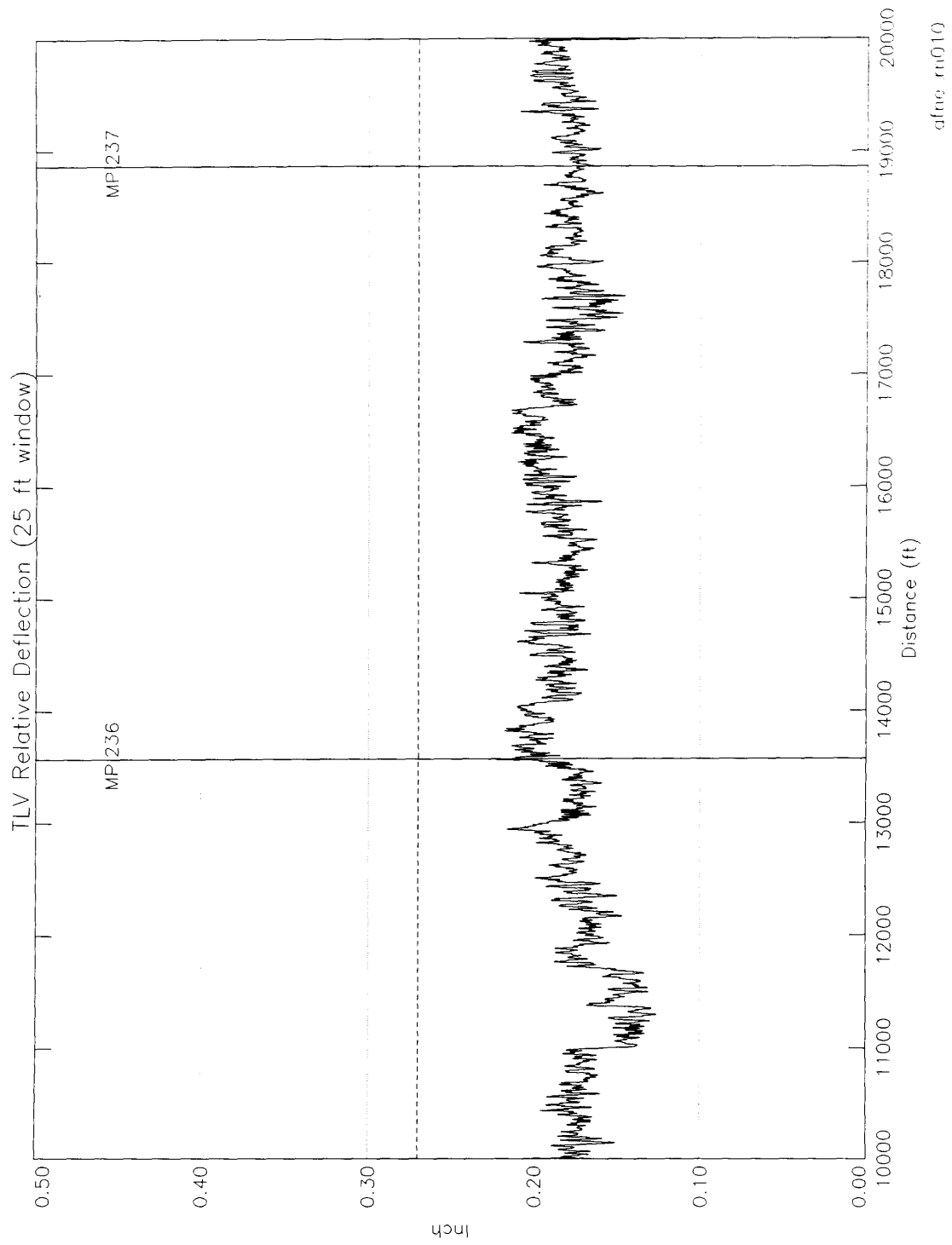


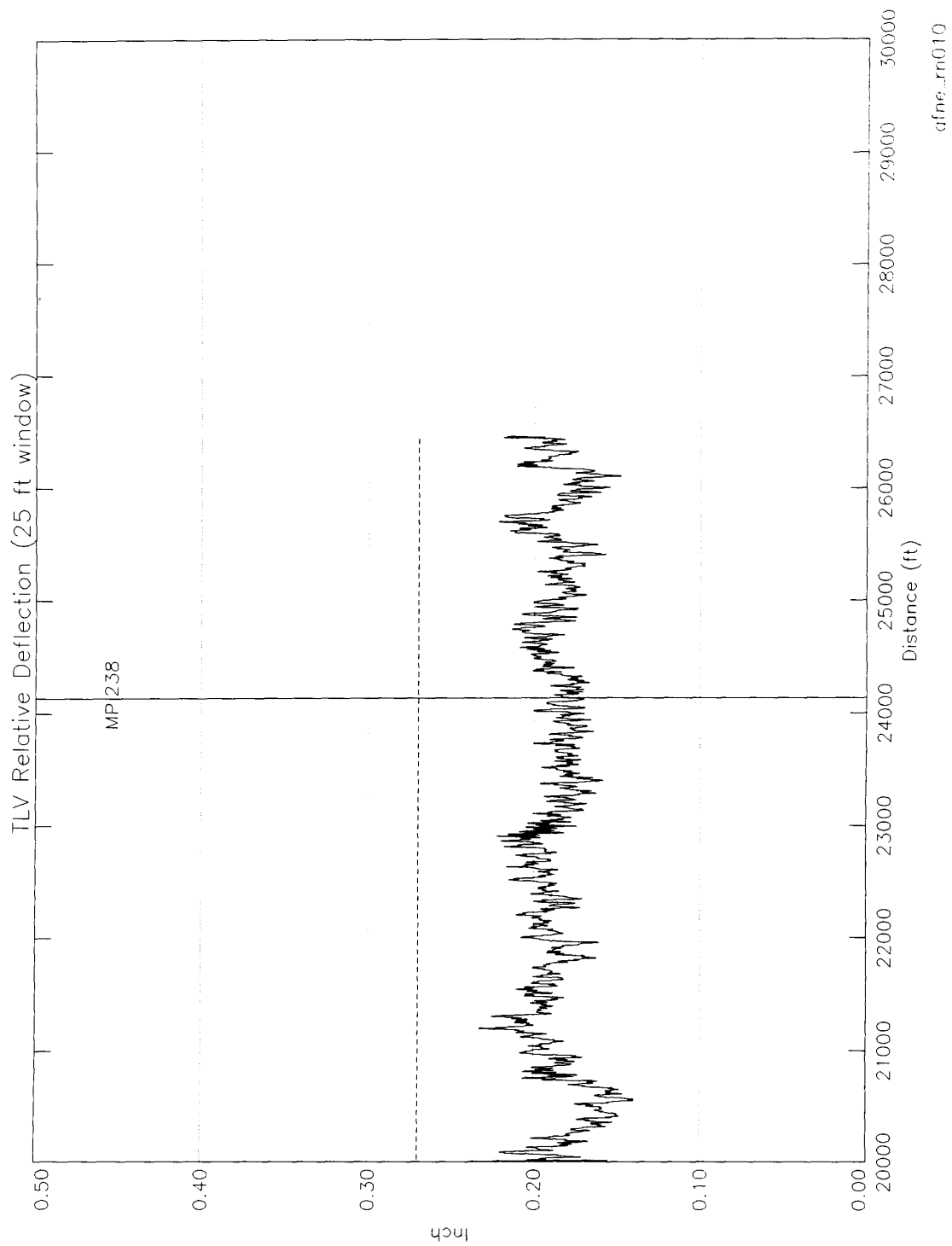


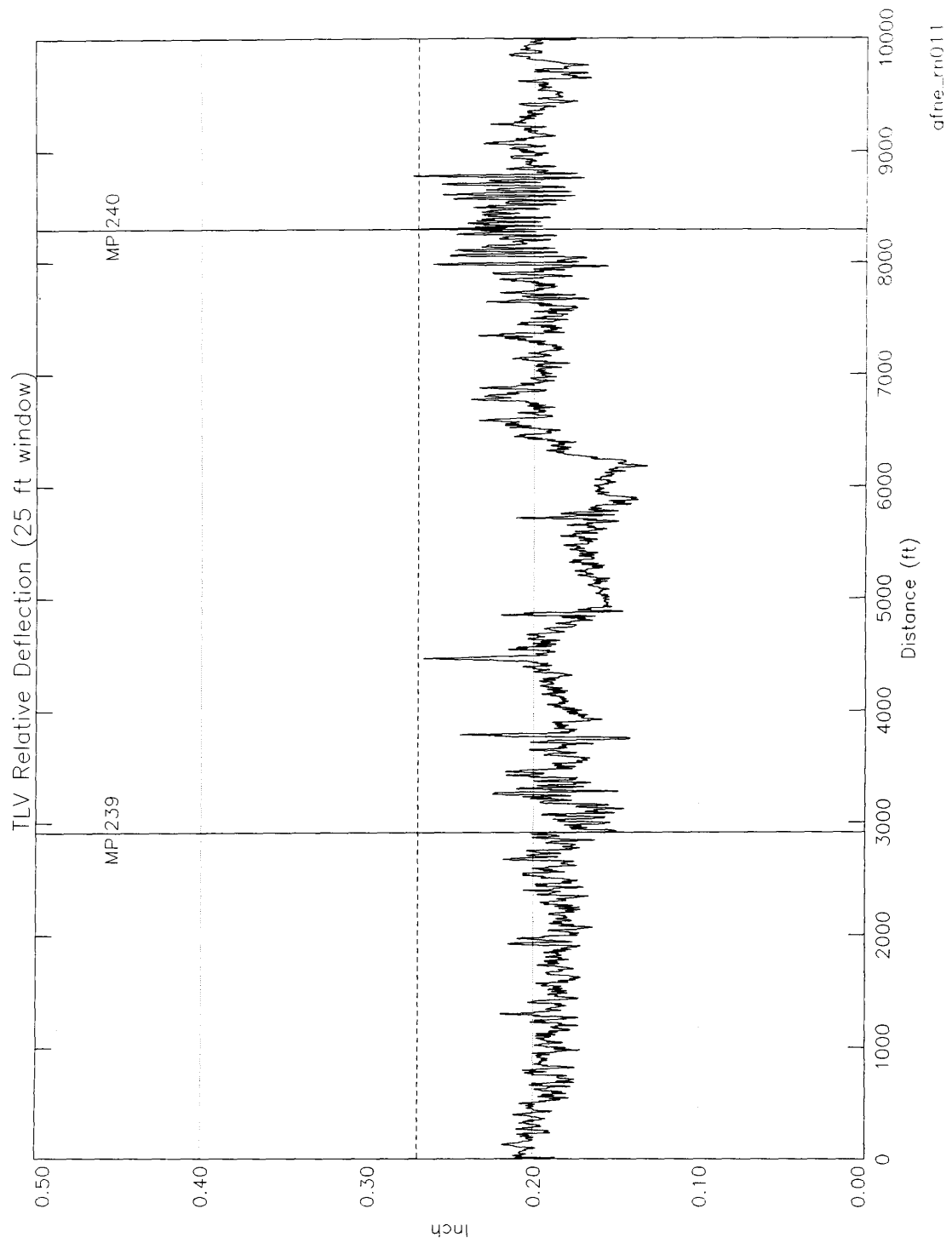


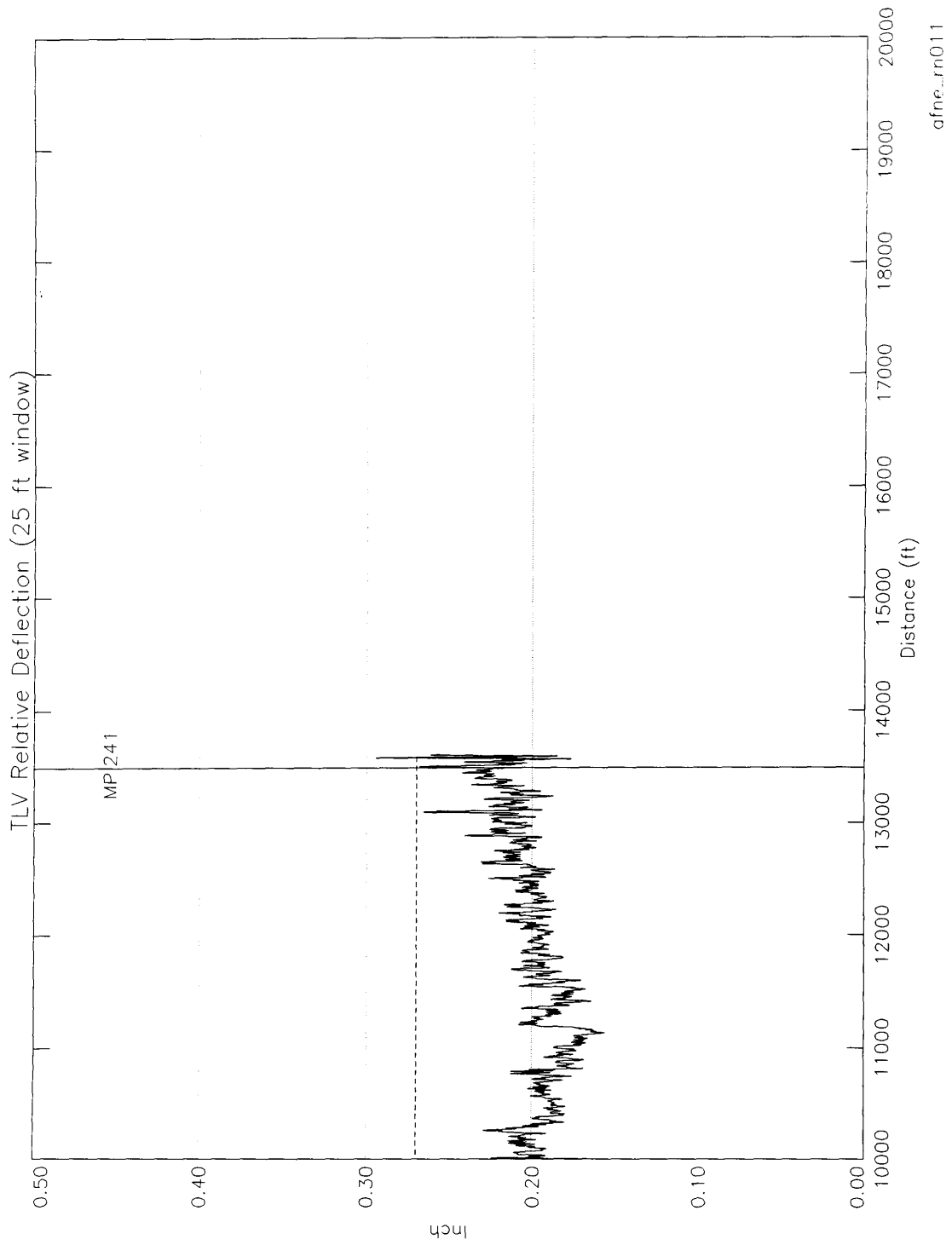


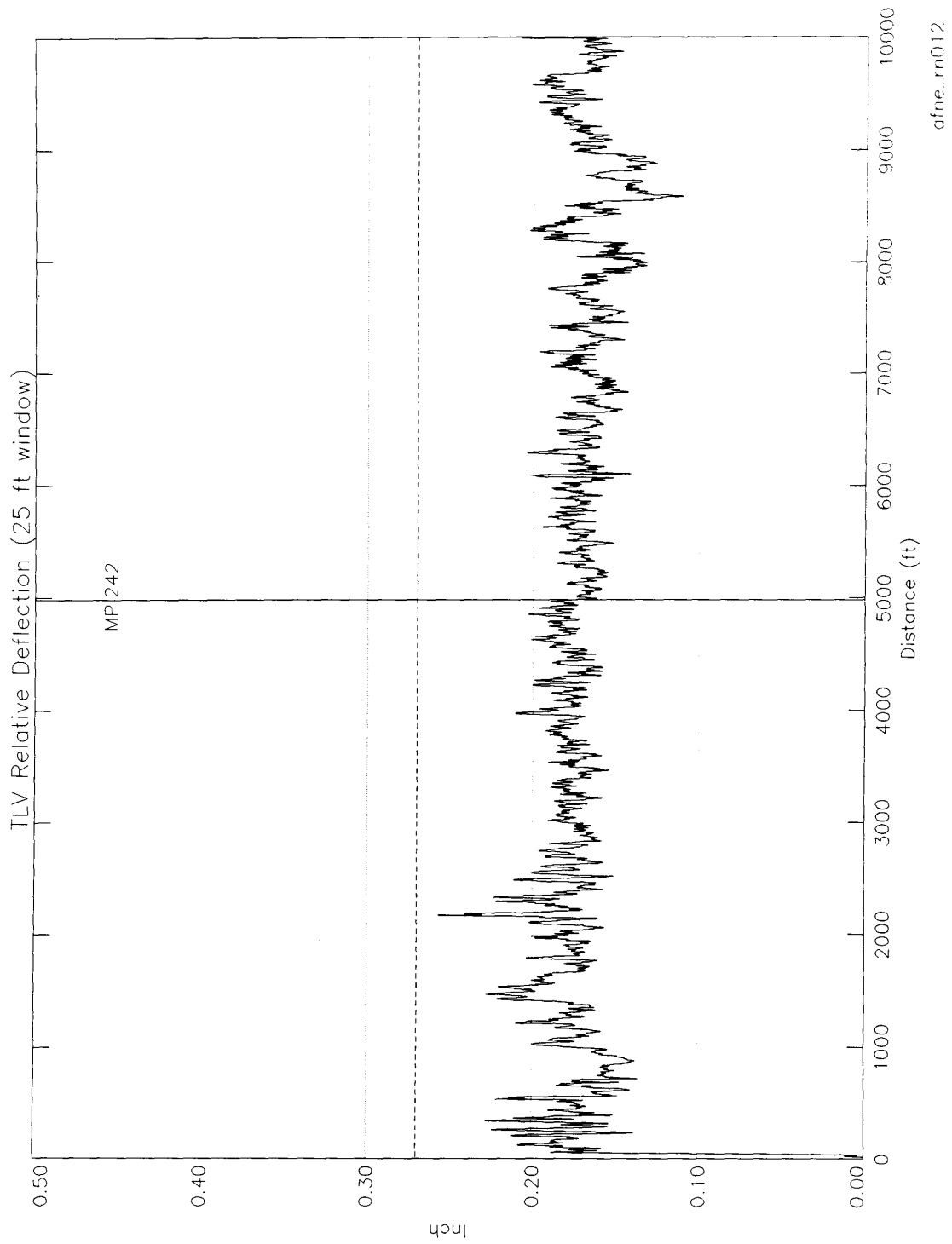


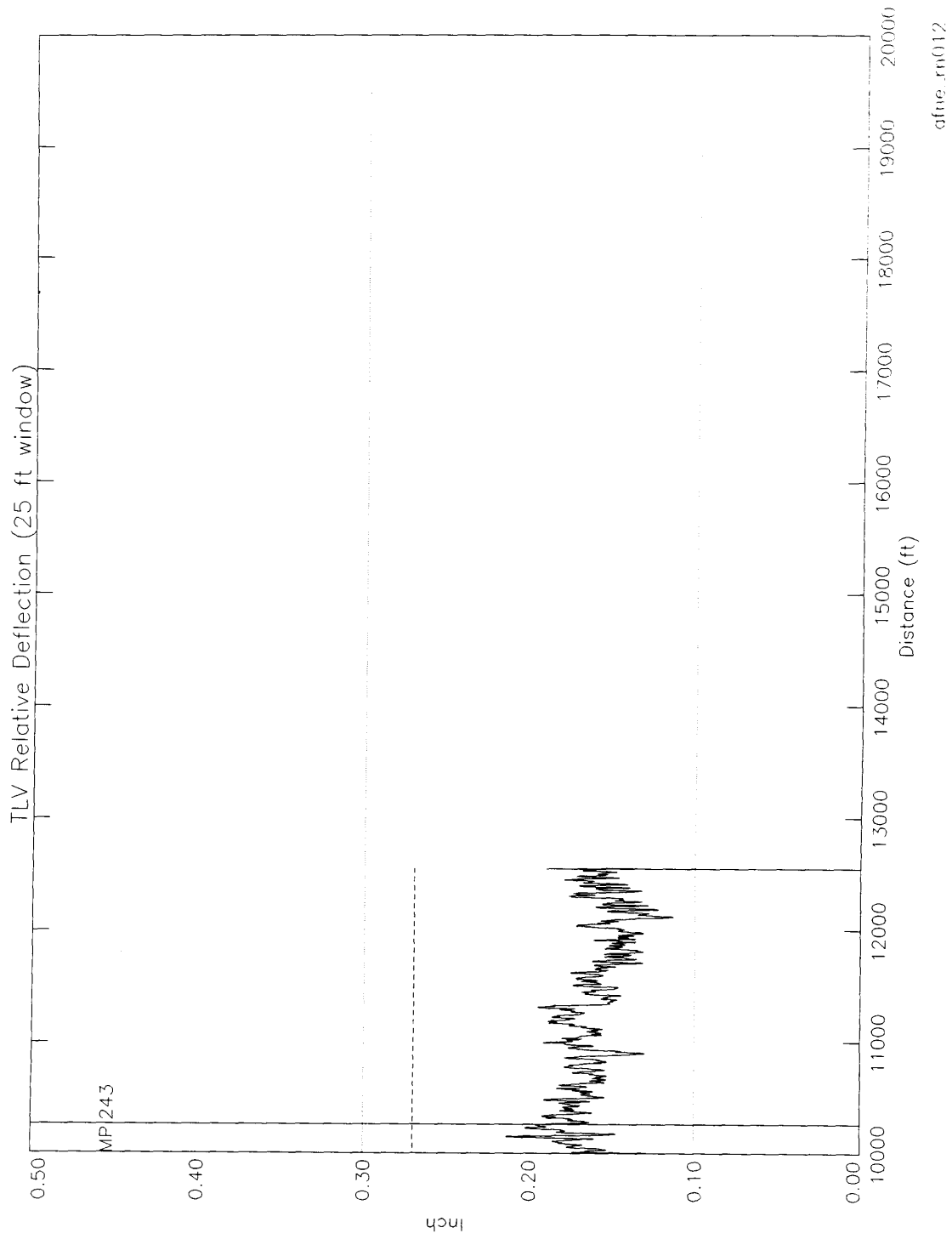


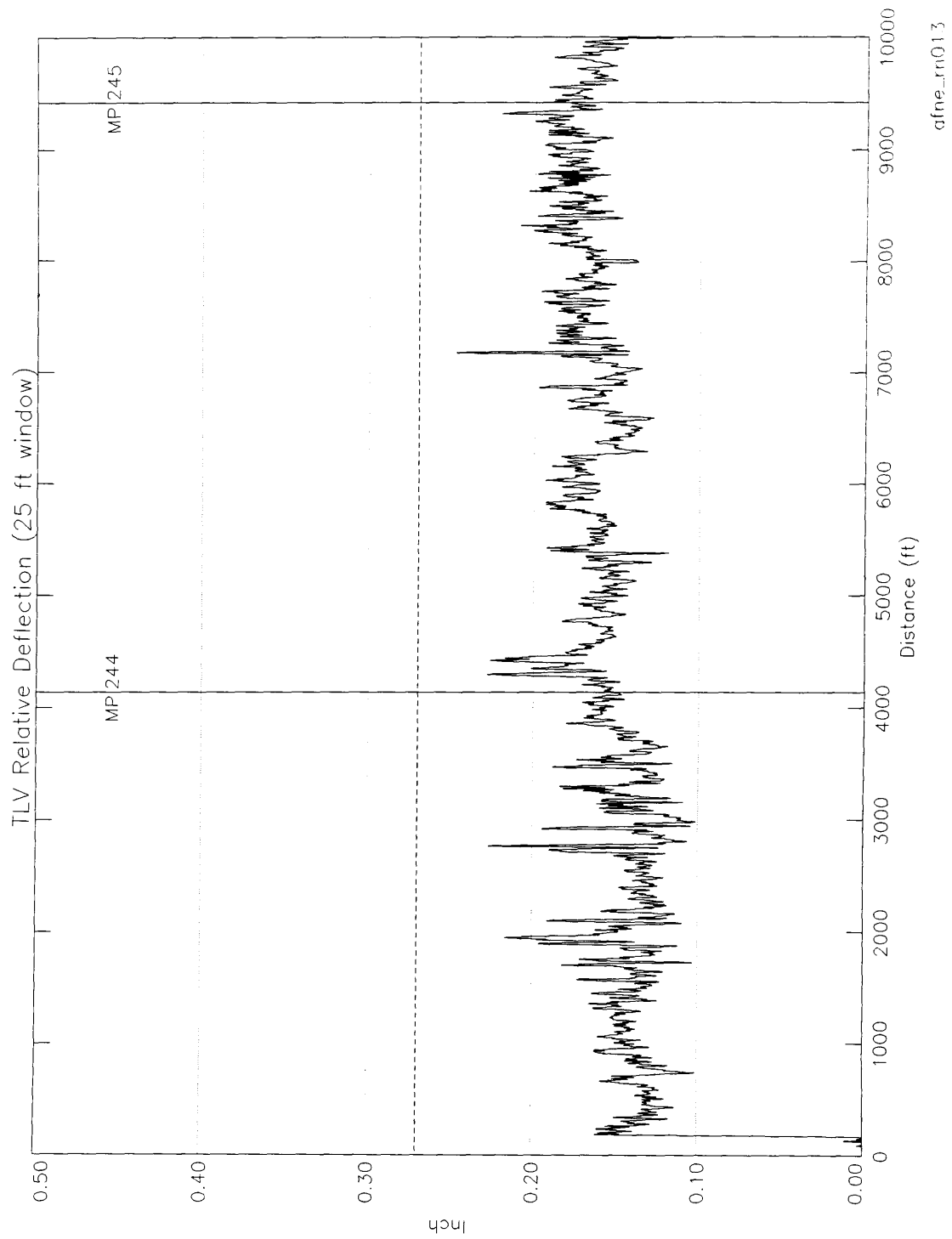


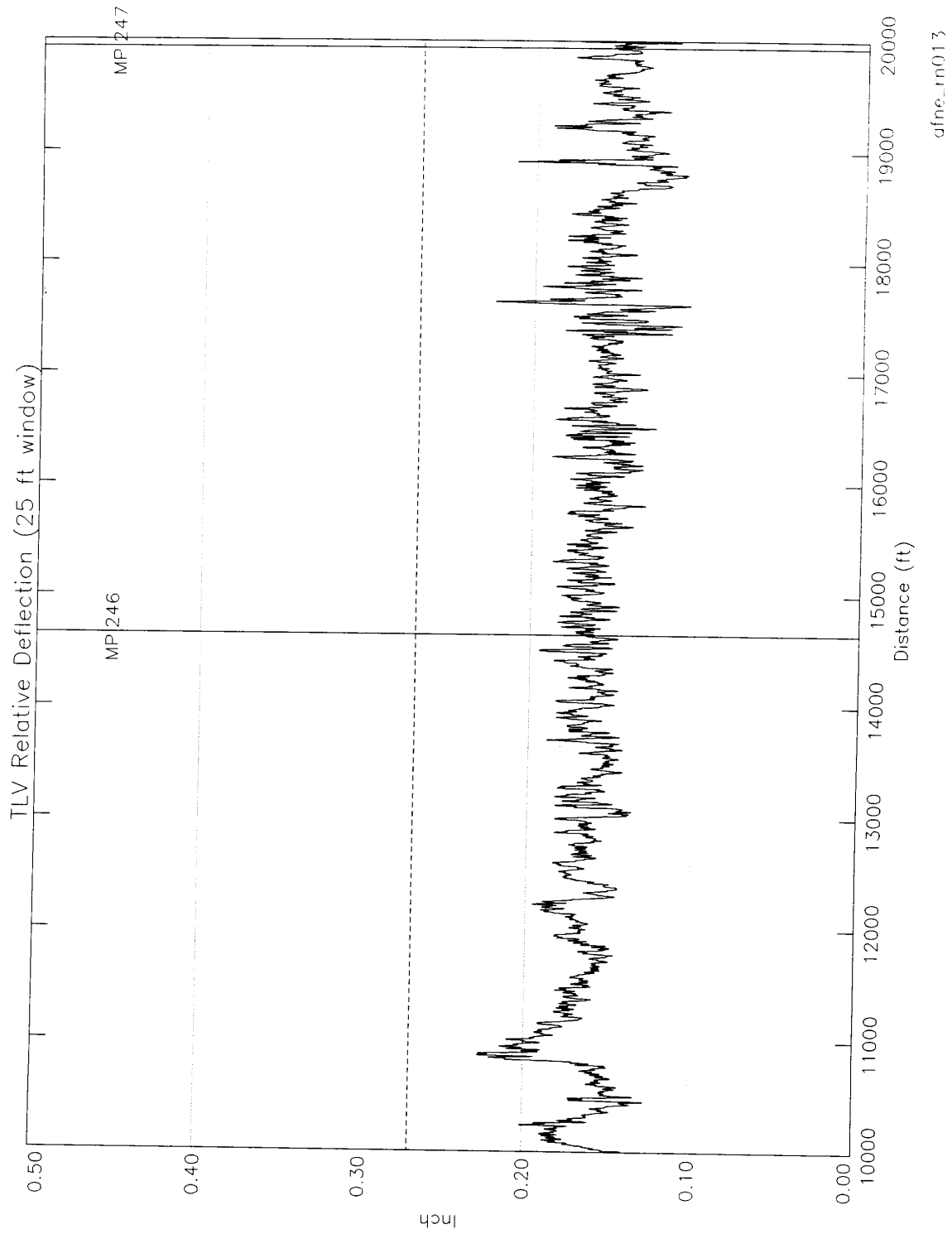


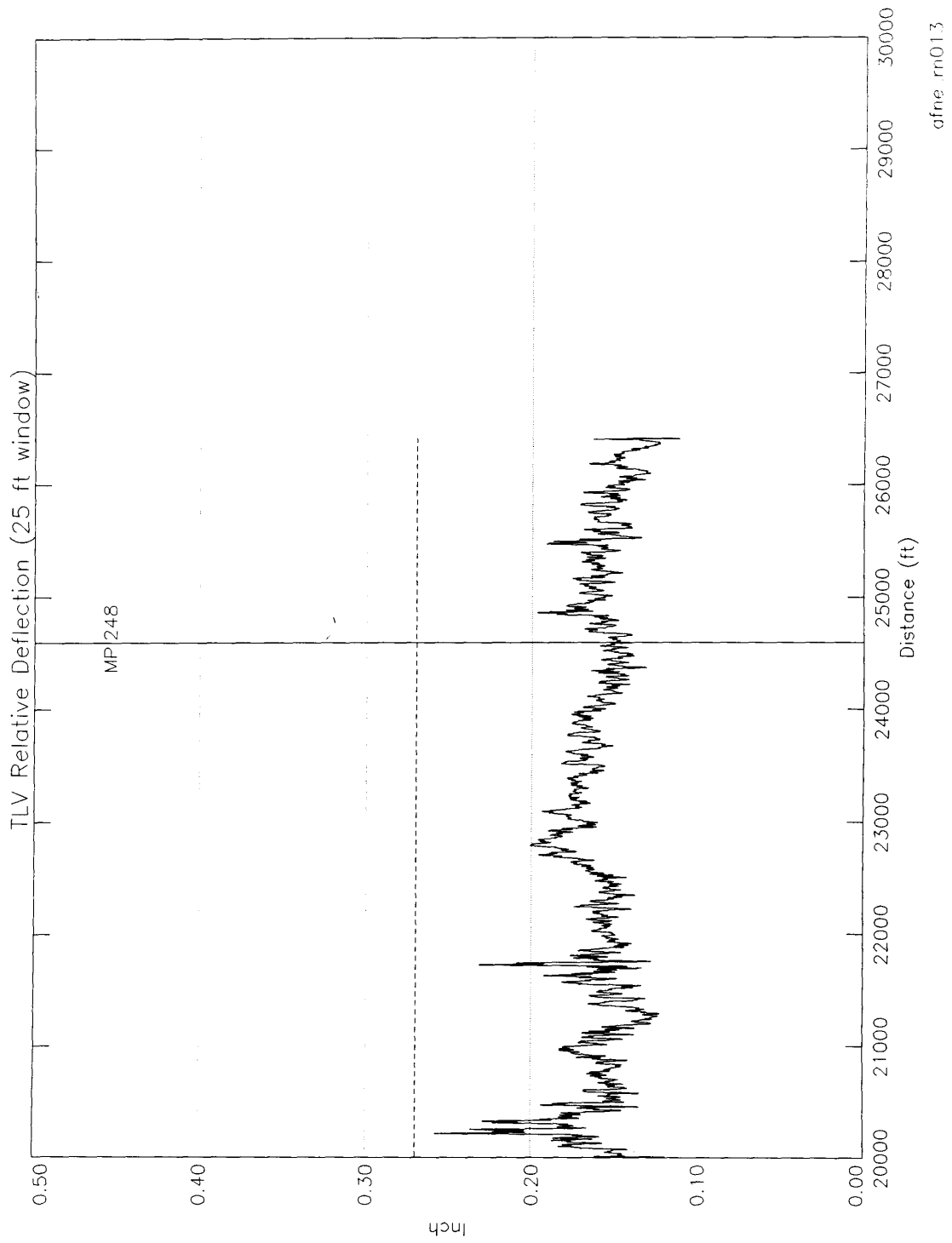


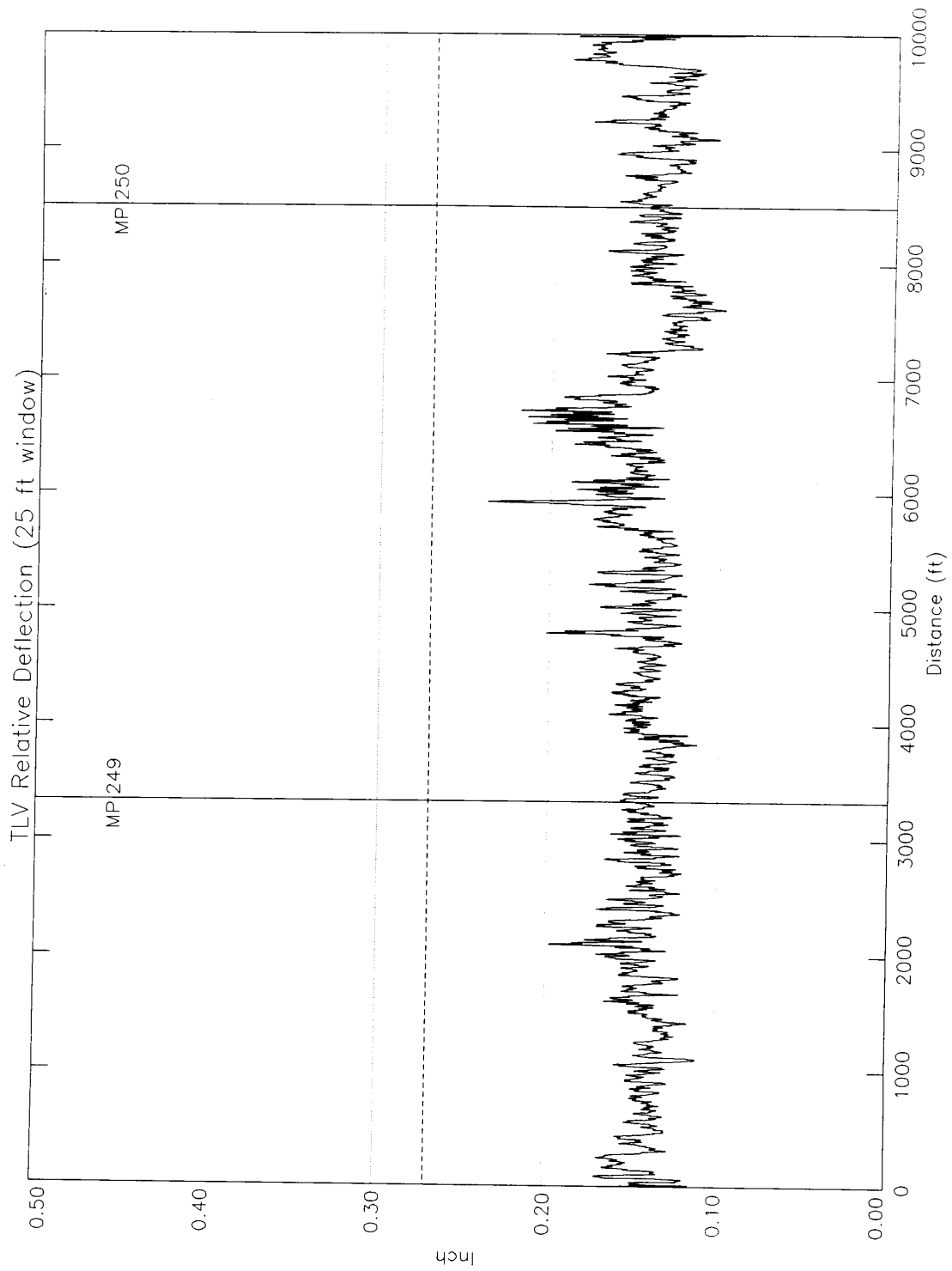


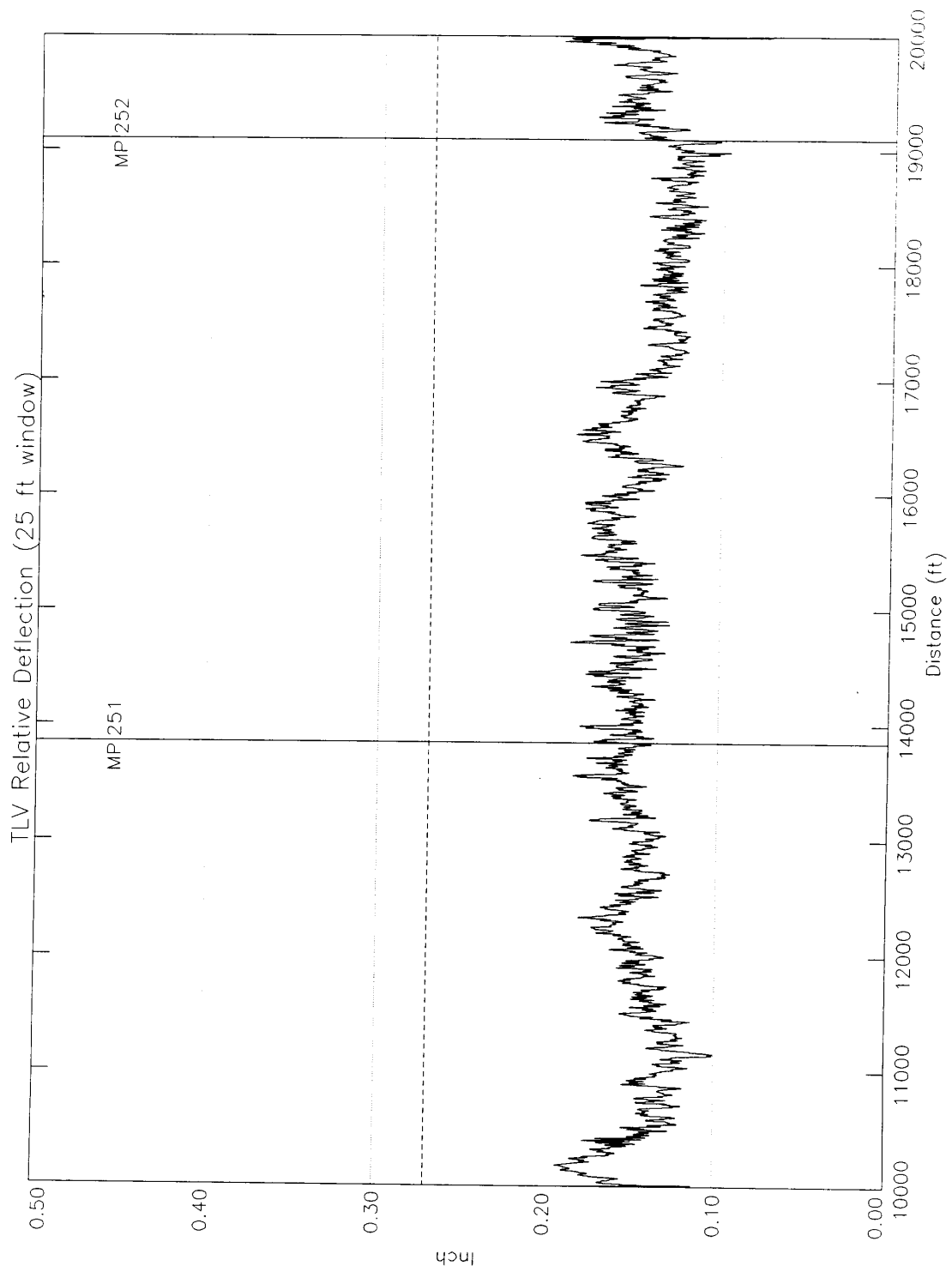


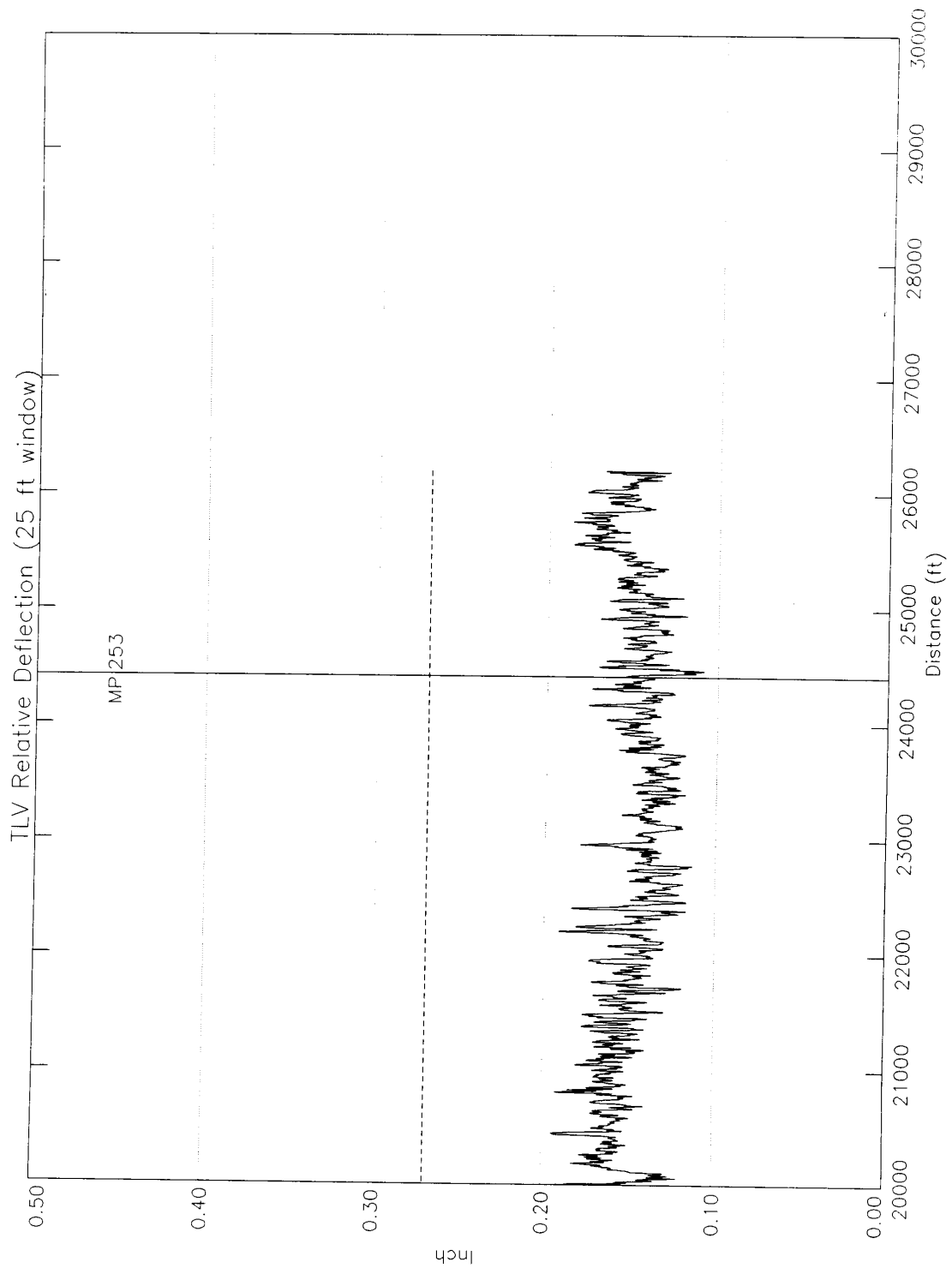




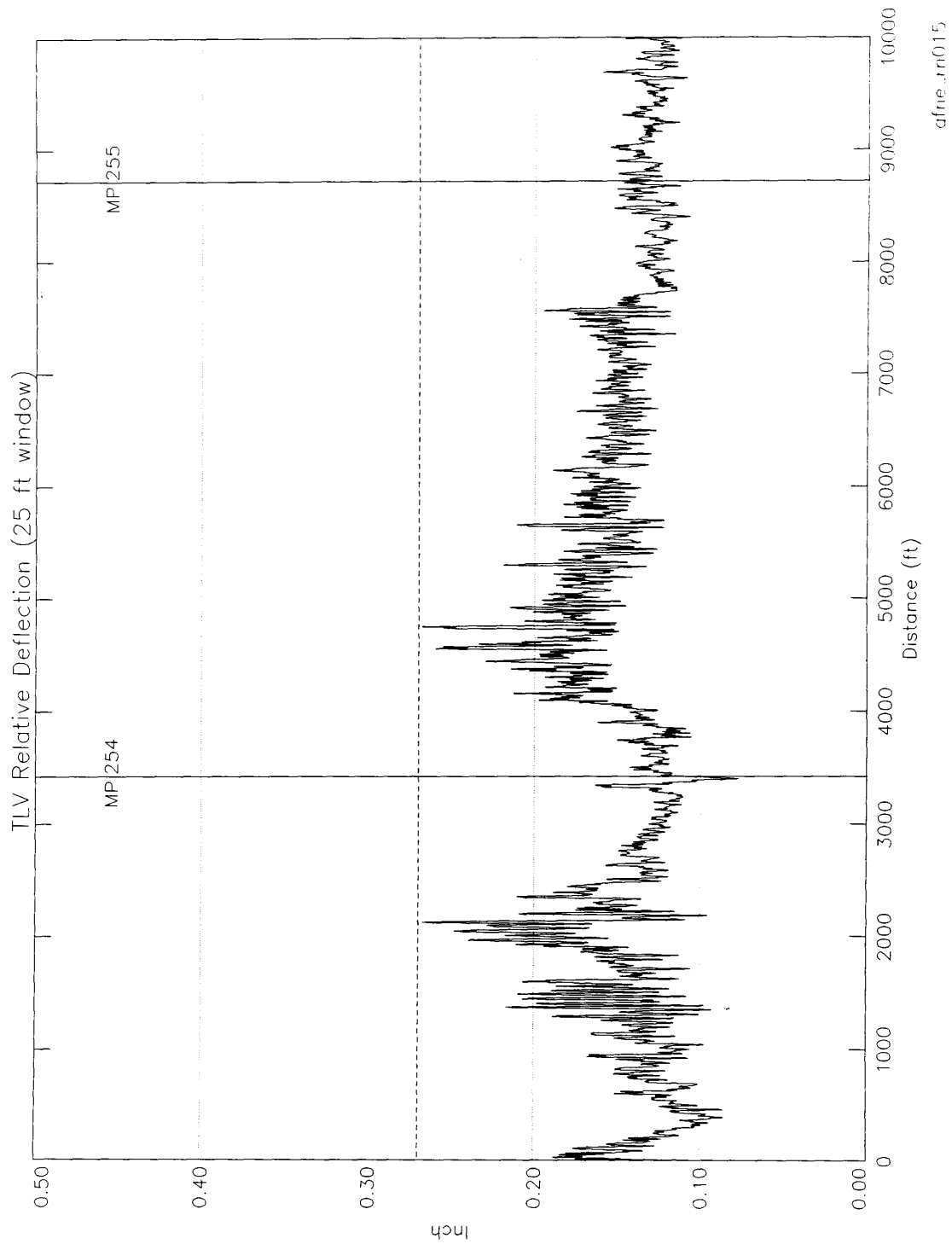


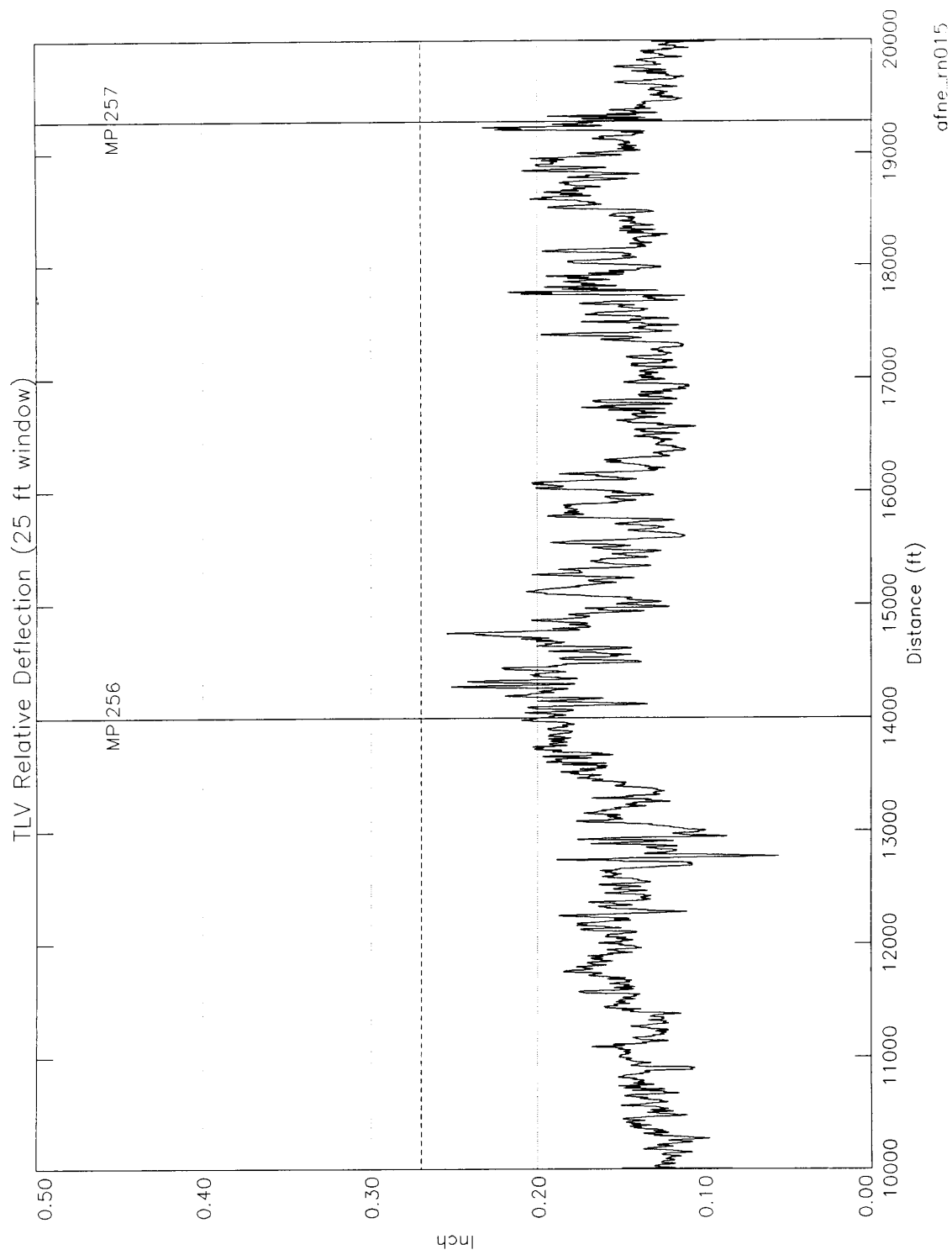


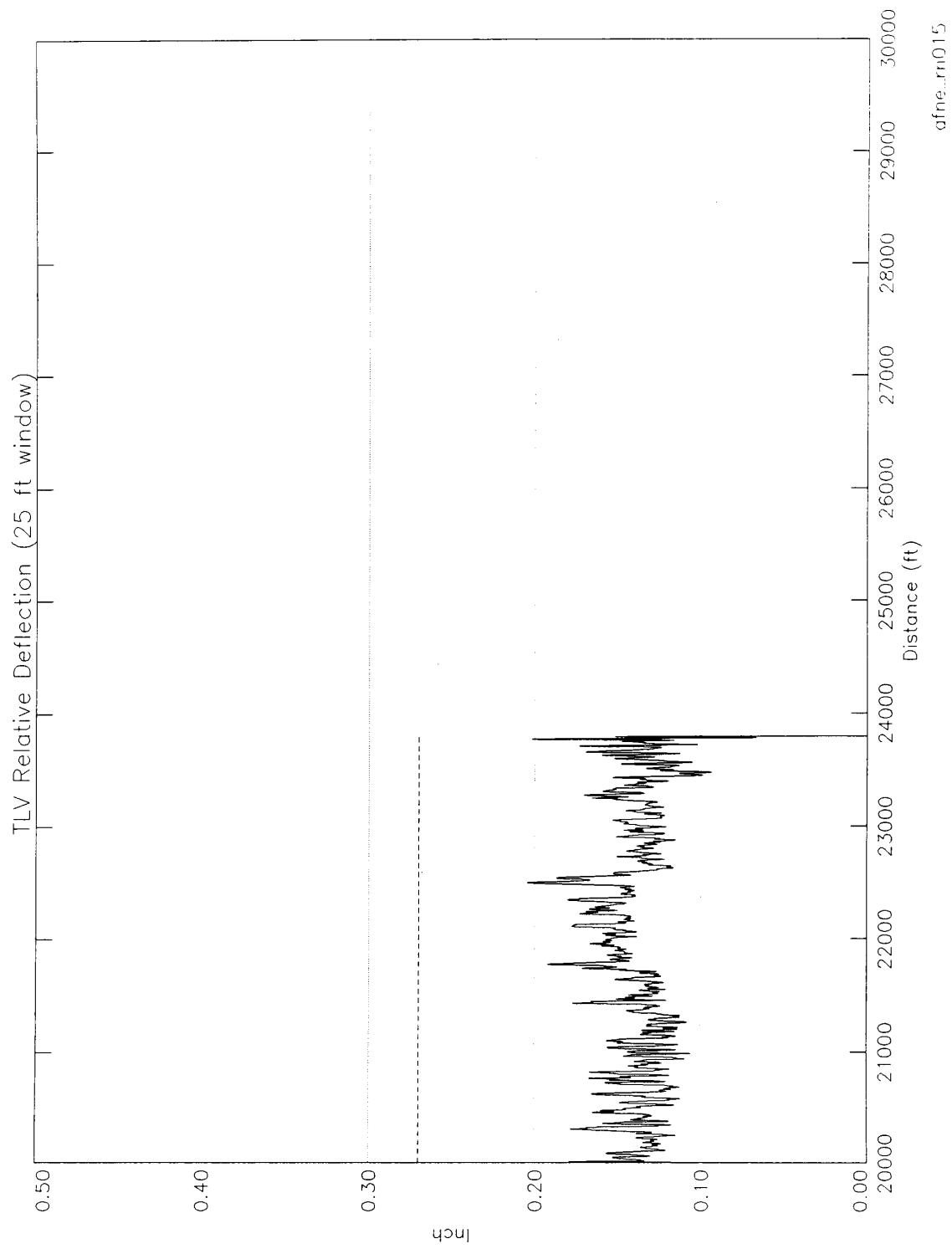


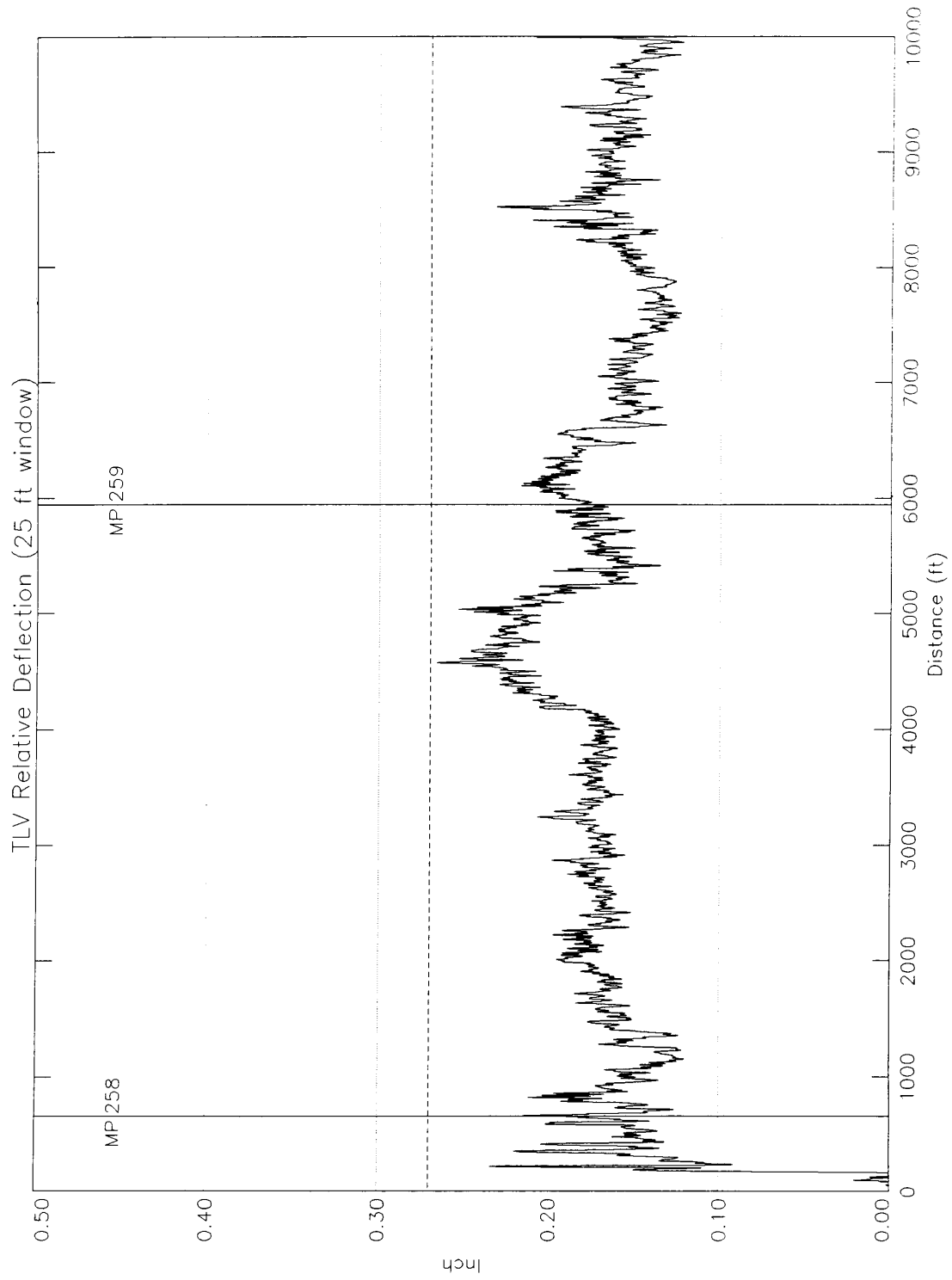


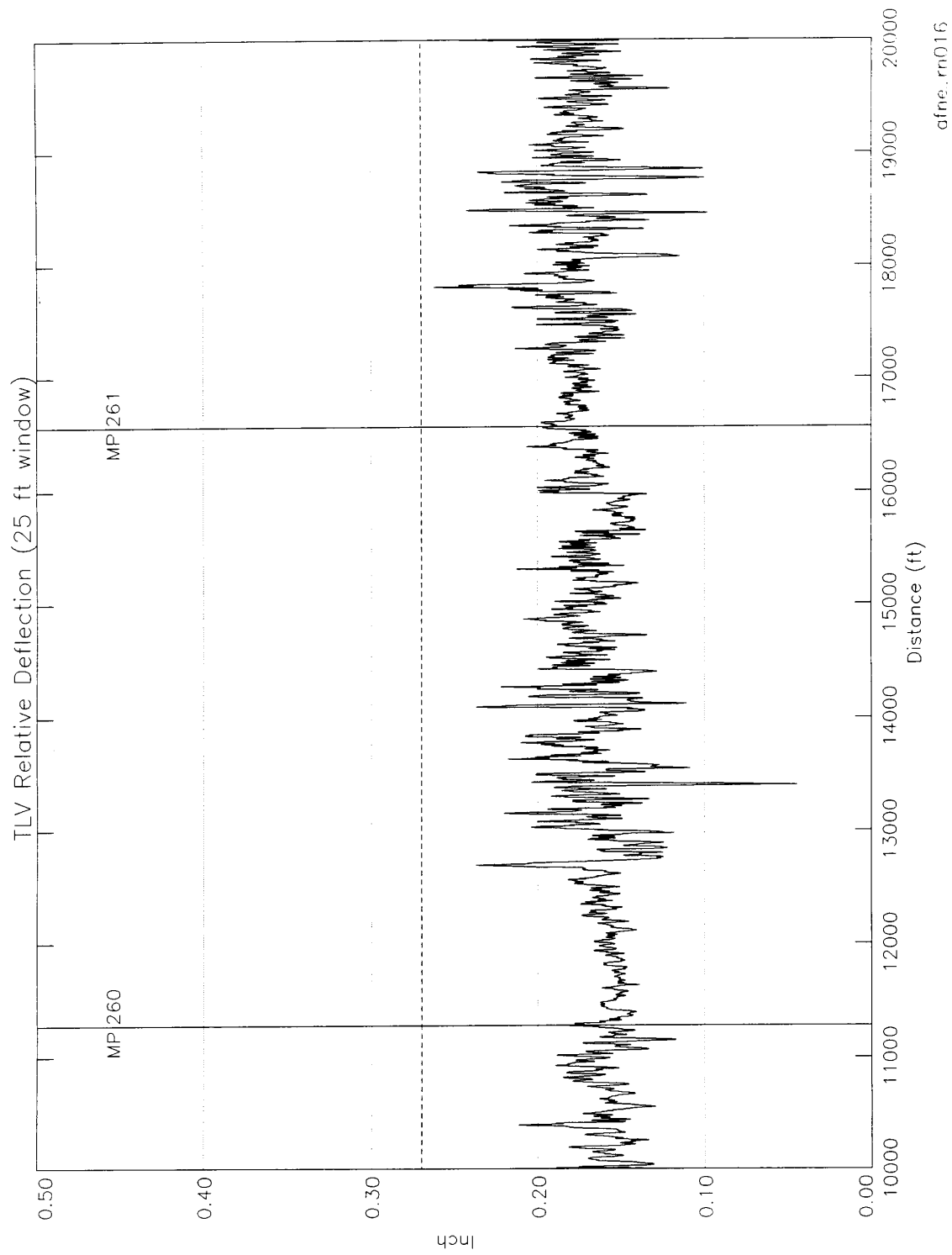
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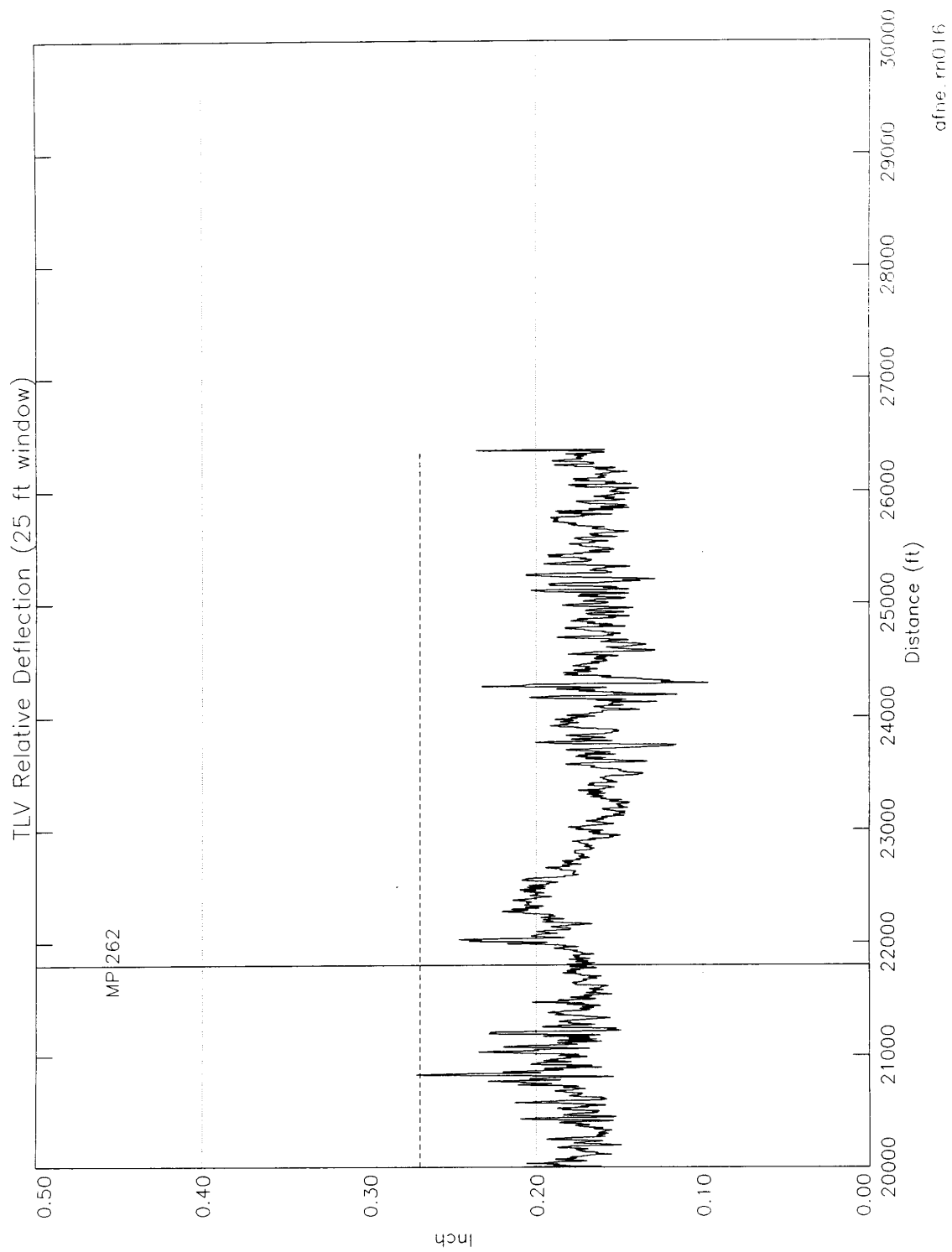


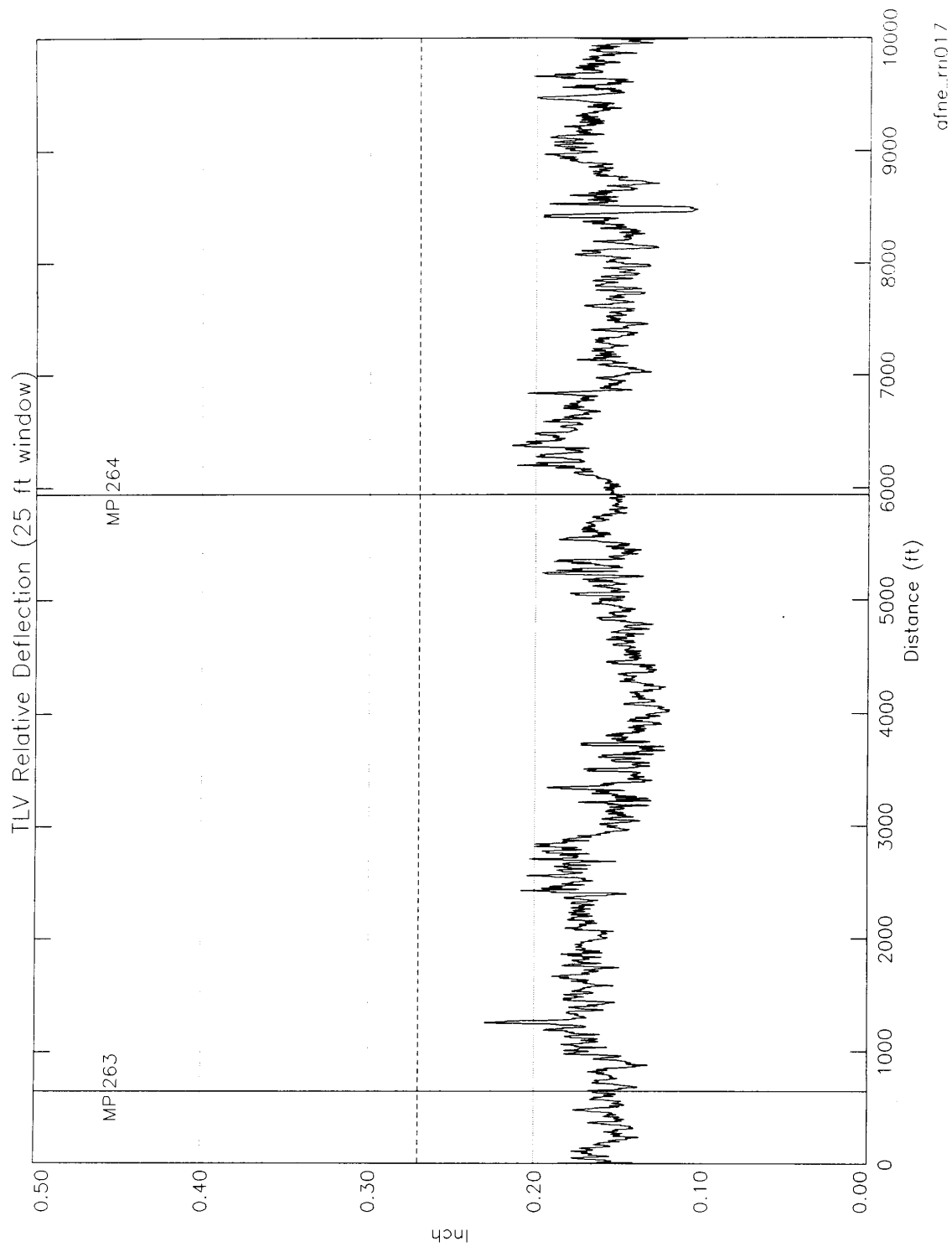


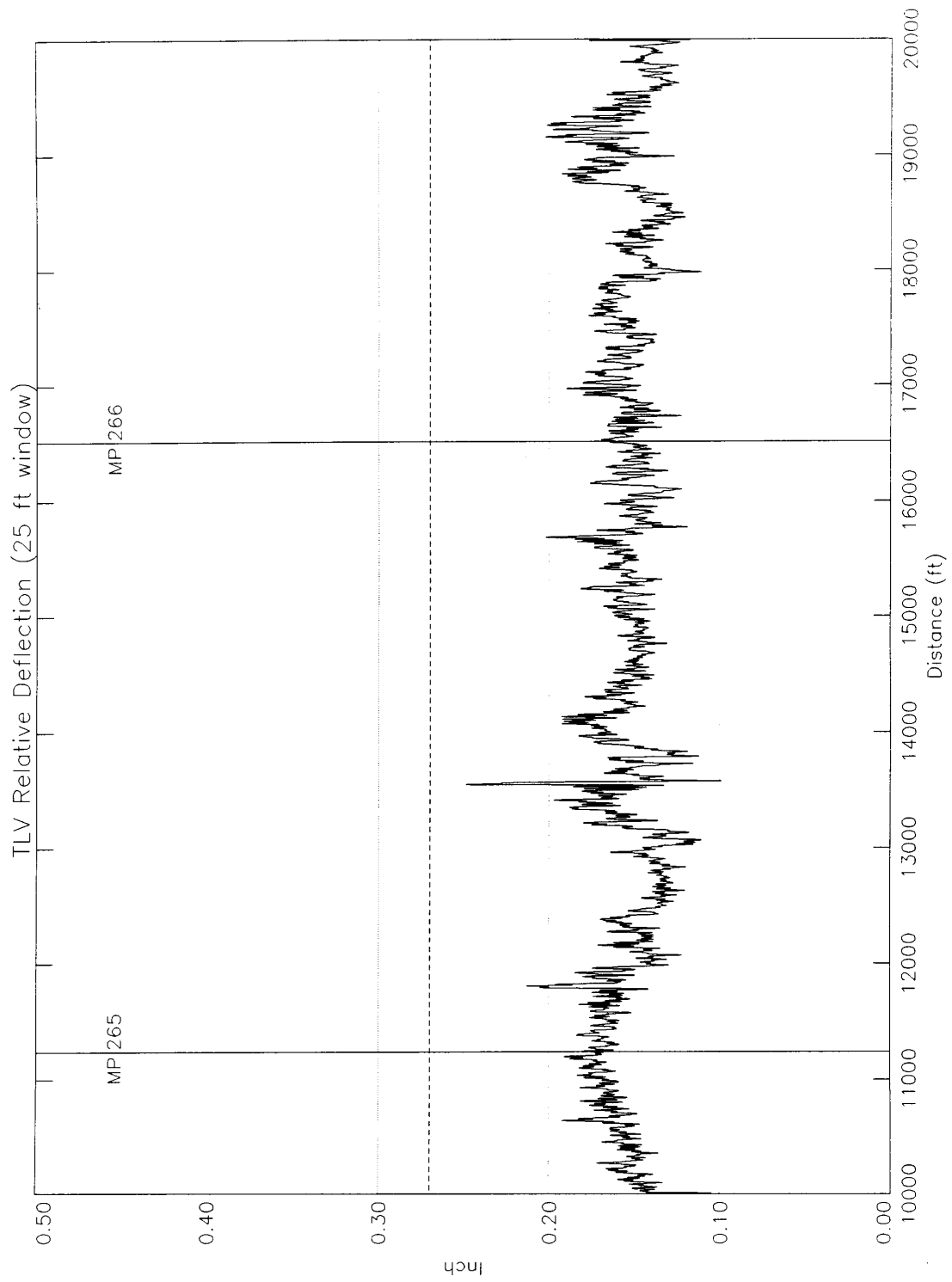


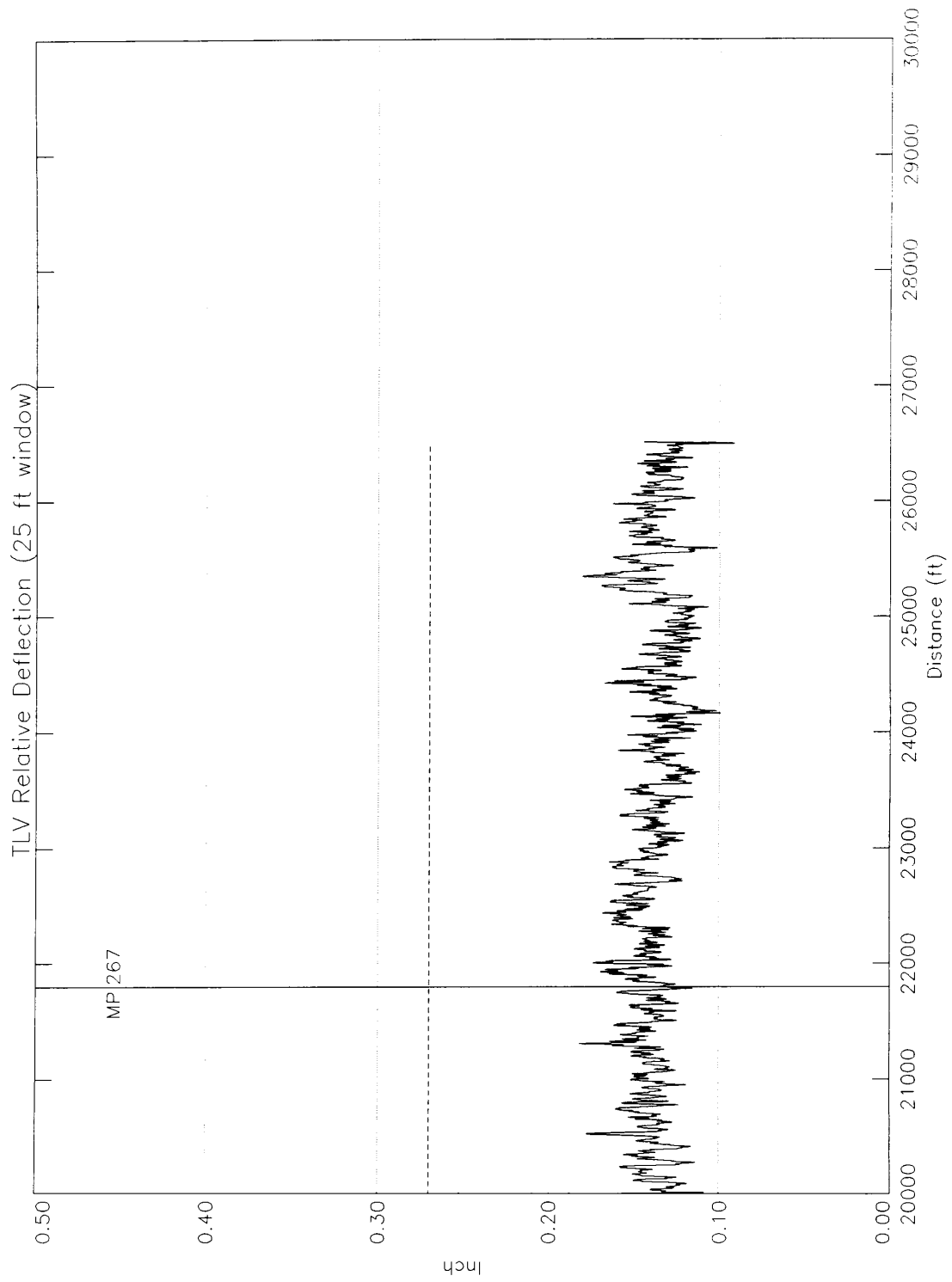


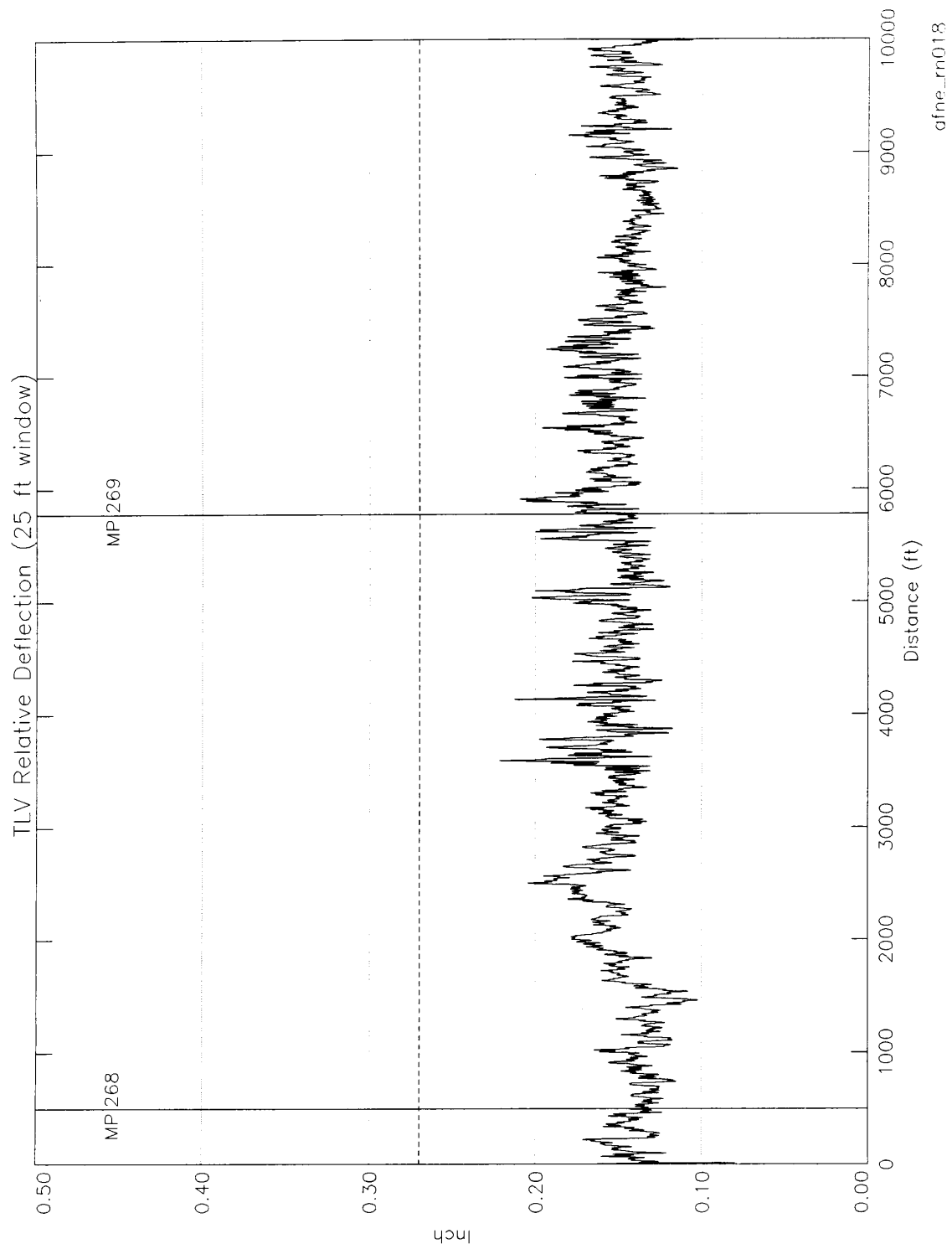


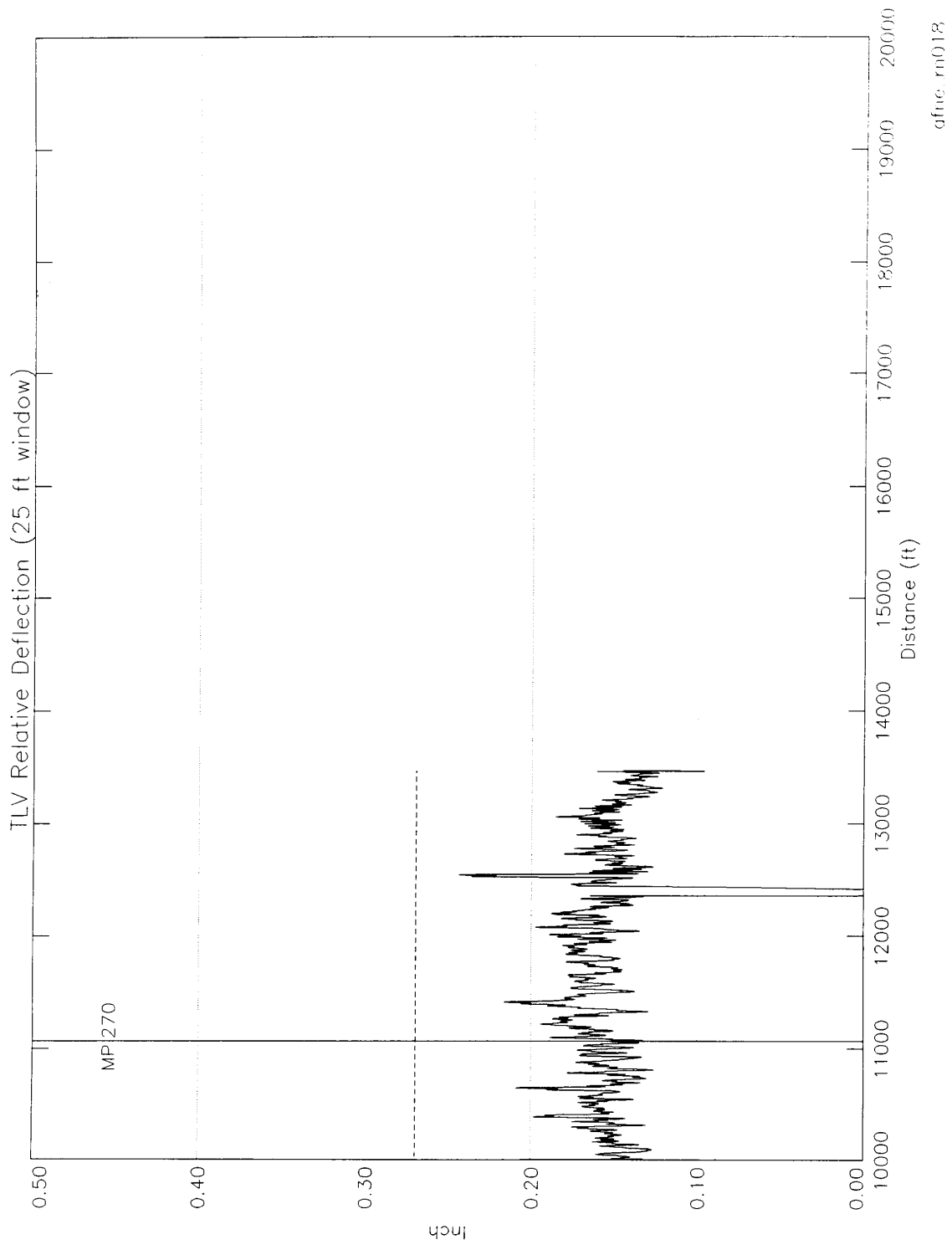


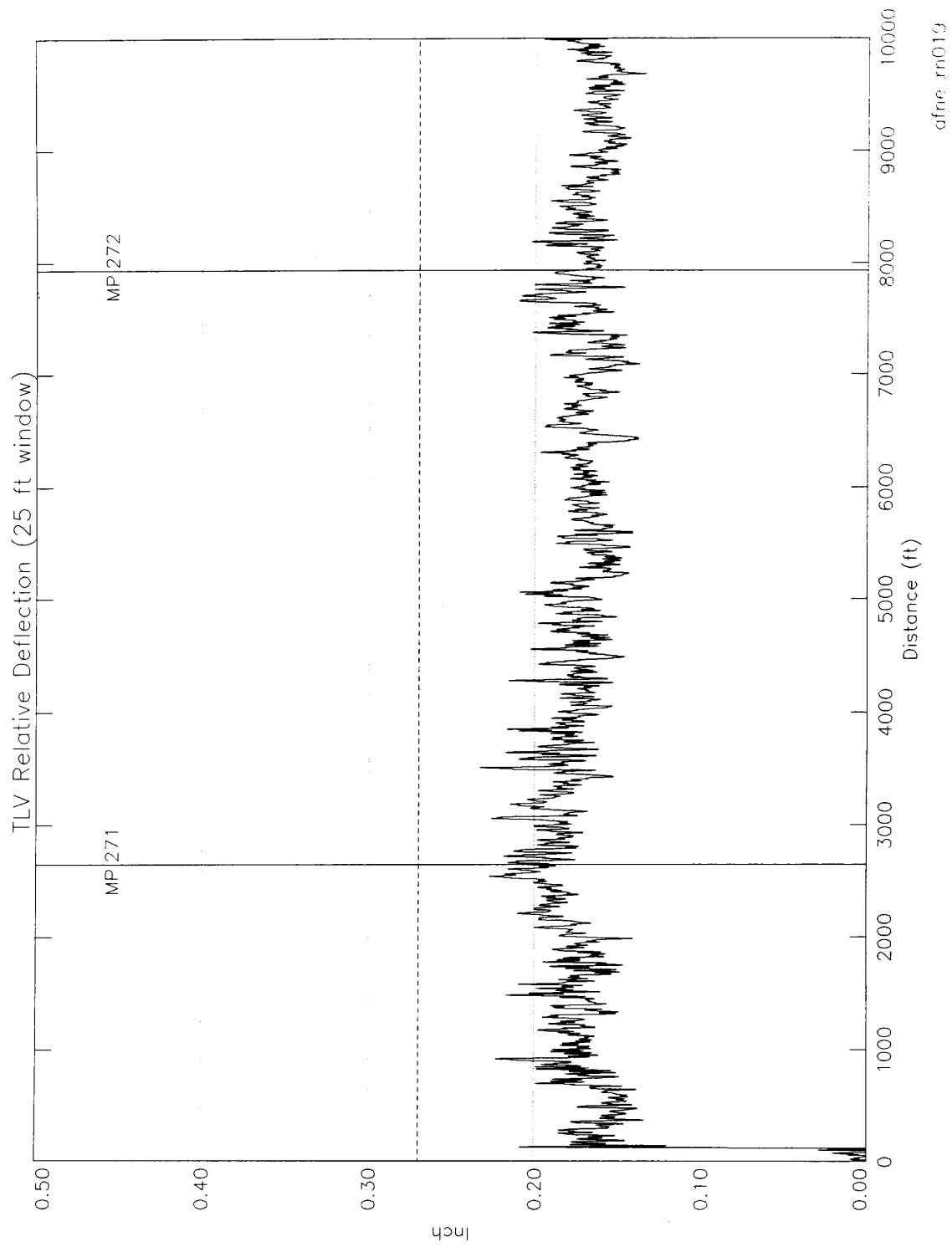


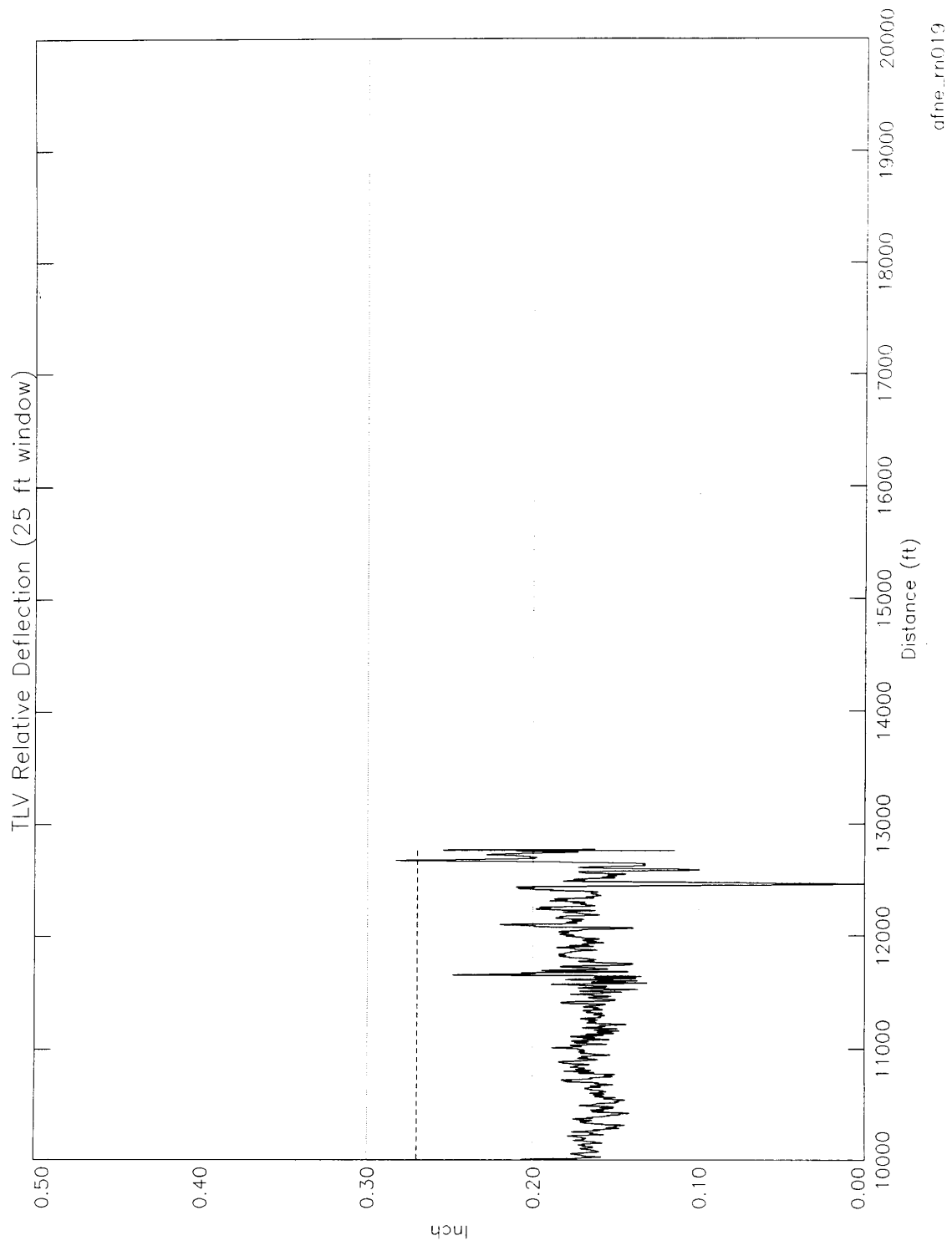












Appendix B

Static measurements and track modulus values.

STATIONARY TEST DATA						
Zone 1	tie "- 3" on insulated joint, south rail; tie "- 6" on insulated joint on north					
Mile Post						
Rail WT	115RE					
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	- 9 ties
0	0.00	0.00	0.00	0.00	0.00	0
10	0.06	0.05	0.06	0.16	0.06	0.04
33	0.19	0.18	0.20	0.39	0.23	0.15
Modulus	1981.425	1981.425	1795.001	925.973	1385.597	2475.779
Zone 2						
Mile Post	203.43					
Rail WT	115RE					
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0	0.00	0.00	0.00	0.00	0.00	
10	0.04	0.03	0.04	0.05	0.08	
33	0.12	0.10	0.13	0.15	0.19	
Modulus	3785.432	4523.119	3235.282	2811.267	2475.779	
Zone 3						
Mile Post	209.57					
Rail WT	115RE					
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0		0.00	0.00	0.00		
10		0.03	0.08	0.15		
33		0.12	0.16	0.25		
Modulus		3235.282	3785.432	2811.267		
Zone 4						
Mile Post	80' past -3 tie of zone3 paint					
Rail WT	115RE					
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0		0.00	0.00	0.00		
10		0.03	0.05	0.07		
33		0.09	0.12	0.15		
Modulus		5555.209	4523.119	3785.432		

Zone 5						
Mile Post						
Rail WT 115RE						
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0		0.00	0.00	0.00		
10		0.08	0.19	0.13		
33		0.16	0.26	0.20		
Modulus		3785.432	4523.119	4523.119		
Zone 6						
Mile Post 210						
Rail WT 115RE						
Vert Load	0	+ 3 ties	+6 ties	+9 ties	+12 ties	+15 ties
0	0.00	0.00	0.00	0.00	0.00	0.00
10	0.04	0.03	0.05	0.03	0.02	0.04
33	0.09	0.09	0.11	0.06	0.07	0.09
Modulus	7083.949	5555.209	5555.209	13998.25	7083.949	7083.949
Zone 7 - 40'						
Mile Post 249.63						
Rail WT 115RE						
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0		0	0	0		
10		0.09	0.16	0.07		
33		0.15	0.29	0.14		
Modulus		5555.209	1981.425	4523.119		
Zone 7 -20'						
Mile Post 249.63						
Rail WT 115RE						
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0		0	0	0		
10		0.06	0.17	0.13		
33		0.13	0.27	0.23		
Modulus		4523.119	2811.267	2811.267		
Zone 7						
Mile Post 249.63						
Rail WT 115RE						
Vert Load	+ 5 ties	+ 3 ties	end paint	- 3 ties	- 5 ties	- 7 ties
0	0.00	0.00	0.00	0.00	0.00	0.00
10	0.04	0.06	0.07	0.14	0.13	0.05
33	0.10	0.14	0.13	0.26	0.25	0.13
Modulus	5555.209	3785.432	5555.209	2204.586	2204.586	3785.432

Zone 8						
Mile Post	256.50					
Rail WT	115RE					
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0	0	0	0	0	0	
10	0.05	0.04	0.04	0.03	0.03	
33	0.11	0.1	0.08	0.08	0.07	
Modulus	5555.209	5555.209	9538.691	7083.949	9538.691	
Zone 9						
Mile Post	257	1.38° LH	switch			
Rail WT	115RE					
Vert Load	+ 9 ties	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties
0	0.00	0.00	0.00	0.00	0.00	0.00
10	0.09	0.12	0.06	0.09	0.21	0.30
33	0.24	0.23	0.13	0.16	0.34	0.45
Modulus	1637.245	2475.779	4523.119	4523.119	1981.425	1637.245
Zone 10						
Mile Post	257.02	1.38° LH	switch			
Rail WT	115RE					
Vert Load	+ 6 ties	+ 3 ties	end paint	- 3 ties	- 6 ties	
0	0	0	0	0	0	
10	0.15	0.06	0.02	0.1	0.17	
33	0.2	0.11	0.05	0.18	0.33	
Modulus	7083.949	7083.949	13998.25	3785.432	1502.25	

Zone 11		MP213.27	Retested Zone		
Rail WT	115 RE			3/4" gap	
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.06	0.15	0.18	
33		0.12	0.31	0.30	
Modulus (10k - 33k)		5547	1502	2201	
Zone 12		MP271.15	Crane's Crossing		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.03	0.10	0.07	
33		0.08	0.24	0.17	
Modulus (10k - 33k)		7073	1792	2807	
Zone 13		MP268.9	Partridge Hill Road		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.17	0.19	0.09	
33		0.28	0.27	0.17	
Modulus (10k - 33k)		2472	3780	3780	
Zone 14		MP267.35	No Paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.05	0.03	0.04	
33		0.11	0.09	0.10	
Modulus (10k - 33k)		5547	5547	5547	
Zone 15		MP265.13	No Paint, Farm Crossing		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	0.00
10		0.08	0.11	0.04	0.03
33		0.14	0.18	0.10	0.07
Modulus (10k - 33k)		5547	4516	5547	9524

Zone 16		MP265.45	Route 107		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.11	0.03	0.11	
33		0.19	0.08	0.23	
Modulus (10k - 33k)		3780	7073	2201	
Zone 17		MP257.97	Paint in a Switch		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0	0.00	0.00	0.00	0.00	
10	0.03	0.12	0.05	0.03	
33	0.1	0.28	0.12	0.08	
Modulus (10k - 33k)	4516	1500	4516	7073	
Zone 18		MP257.91	Paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.03	0.11	0.12	
33		0.08	0.22	0.22	
Modulus (10k - 33k)		7073	2472	2807	
Zone 19		MP259.47	(Bridge, Paint 6 ties after open de		
Rail WT	115 RE	1st tie off bridge, right side			
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.07	0.09	0.08	
33		0.14	0.16	0.14	
Modulus (10k - 33k)		4516	4516	5547	
Zone 20		MP260.49	300' before road crossing		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.05	0.14	0.11	
33		0.20	0.24	0.20	
Modulus (10k - 33k)		1635	2807	3230	

Zone 21		MP261.37	Paint		
Rail WT	112 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.07	0.16	0.06	
33		0.17	0.30	0.15	
Modulus (10k - 33k)		2813	1796	3237	
Zone 22		MP262.35	No Paint		
Rail WT	115 RE		130' from east abutment		
Vert Load	- 15 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0	0.00	0.00	0.00	0.00	
10	0.13	0.08	0.11	0.10	
33	0.23	0.13	0.17	0.17	
Modulus (10k - 33k)	2807	7073	5547	4516	
Zone 23		MP262.5	no paint, 30' before xing		
Rail WT	115 RE		drag det.	H.B.D.	
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.02	0.17	0.23	
33		0.06	0.28	0.43	
Modulus (10k - 33k)		9524	2472	1114	
Zone 24		MP262.6	no paint, possible HMA		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.04	0.05	0.03	
33		0.08	0.09	0.08	
Modulus (10k - 33k)		9524	9524	7073	
Zone 25		MP256.54	paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.10	0.15	0.07	
33		0.22	0.22	0.12	
Modulus (10k - 33k)		2201	4516	7073	

Zone 26		MP250.5	strong, no paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.03	0.06	0.03	
33		0.07	0.11	0.07	
Modulus (10k - 33k)		9524	7073	9524	
Zone 27		MP249.46	East side of bridge, no paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	0.00
10		0.03	0.07	0.19	0.24
33		0.08	0.13	0.24	0.33
Modulus (10k - 33k)		7073	5547	7073	3230
Zone 28		MP247.1	Paint, Pumping Mud		
Rail WT	115 RE		Knox Marsh overhead Bridge		
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0	0.00	0.00	0.00	0.00	
10	0.08	0.20	0.09	0.04	
33	0.18	0.38	0.22	0.10	
Modulus (10k - 33k)	2807	1282	1978	5547	
Zone 29		MP241.48	No Paint, Insulated Joint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.05	0.07	0.03	
33		0.10	0.17	0.09	
Modulus (10k - 33k)		7073	2807	5547	
Zone 30		MP241.2	Paint, heel of switch		
Rail WT	115 RE		rail meas is not rail tested in-moti		
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.05	0.03	0.01	
33		0.11	0.10	0.03	
Modulus (10k - 33k)		5547	4516	23999	

Zone 31		MP241.12	no Paint		
Rail WT	115 RE				
Vert Load	- 9 ties	- 6 ties	-3 ties	0	+ 3 ties
0	0.00	0.00	0.00	0.00	0.00
10	0.07	0.07	0.03	0.07	0.05
33	0.13	0.14	0.10	0.13	0.13
Modulus (10k - 33k)	5547	4516	4516	5547	3780
Zone 32		MP240.1	Paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.07	0.18	0.20	
33		0.13	0.26	0.27	
Modulus (10k - 33k)		5547	3780	4516	
Zone 33		MP239.1	Paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.03	0.08	0.03	
33		0.09	0.14	0.07	
Modulus (10k - 33k)		5547	5547	9524	
Zone 34		MP235.0	No Paint, High modulus location		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.03	0.02	0.05	
33		0.07	0.05	0.10	
Modulus (10k - 33k)		9524	13977	7073	
Zone 35		MP233.07	Paint x 2,		
Rail WT	115 RE	switch points @ -6 ties			
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0	0.00	0.00	0.00	0.00	0.00
10	0.01	0.07	0.21	0.07	0.03
33	0.04	0.18	0.42	0.14	0.08
Modulus (10k - 33k)	13977	2472	1044	4516	7073

Zone 36		MP230	No Paint		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.04	0.03	0.04	
33		0.10	0.09	0.10	
Modulus (10k - 33k)		5555	5555	5555	
Zone 37		MP228.13	no Paint, in a switch		
Rail WT	115 RE				
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0	0.00	0.00	0.00	0.00	0.00
10	0.05	0.09	0.13	0.07	0.03
33	0.16	0.23	0.30	0.29	0.11
Modulus (10k - 33k)	2472	1792	1383	981	3780
Zone 38		MP225.82	Paint, Switch		
Rail WT	115 RE	on joint bar	on the frog		
Vert Load	- 6 ties	- 3 ties	0	+ 3 ties	+ 6 ties
0		0.00	0.00	0.00	
10		0.06	0.02	0.01	
33		0.14	0.06	0.06	
Modulus (10k - 33k)		3780	9524	7073	

STAPLIN

VERIFIED STATEMENT OF DAVID E. STAPLIN

My name is David E. Staplin. I am Director - Railroad Services with LTK Engineering Services ("LTK"). This is the third verified statement I have submitted in this proceeding on behalf of the National Railroad Passenger Corporation ("Amtrak"), my two earlier statements - both of which dealt with track modulus testing of Guilford's 1/ Plaistow-Portland line - having been filed respectively as part of Amtrak's opening and rebuttal cases in last year's clarification proceeding.

Professional Background and Experience.

As noted in my earlier statements, I have over 30 years of experience in various facets of railway engineering, including having worked in both operating and staff positions:

- from 1970 to 1971, I was a track supervisor with the Penn Central Transportation Company;
- from 1972 until 1974, I was a Principal Engineer with Louis T. Klauder & Associates;
- from 1974 to 1976, I was Chief Engineer Planning with the United States Railway Association;

1/ Springfield Terminal Railway Company, Boston and Maine Corporation, and Portland Terminal Company are referred to collectively as "Guilford."

- from 1976 to 1981, I was initially Manager of Rehabilitation Planning, and thereafter a Division Engineer with Conrail;
- from 1981 until 1991, I successively held the positions of Director Planning and Valuation, Director Quality Control, Assistant Chief Engineer, and Assistant to the Vice President Engineering, Planning and Analysis with CSX Transportation, Inc.;
- from 1991 to 1994 I was Assistant Vice President and Chief Engineer of Amtrak;
- from 1995 to 1998, I was Executive Director of the American Railway Engineering and Maintenance of Way Association ("AREMA"); and
- from 1998 to the present, I have been in my current position with LTK, where my responsibilities include overseeing work done for freight railway companies, commuter rail projects on freight rail rights-of-way, and applications involving transit use of railway properties.

I graduated from the University of Michigan in 1969 with a B.S. in Civil Engineering, and I earned an M.B.A. from Jacksonville University in 1986. A copy of my resume is appended as Attachment 1.

In preparing this statement and in the work described below, I was assisted by my colleague, Steven M. Chrismer, Ph.D., who is a Principal Engineer at LTK. As explained in greater detail in his accompanying verified statement, Dr. Chrismer spent 16 years with the Association of American Railroads ("AAR") and its subsidiary Transportation Technology Center, Inc. ("TTCI") prior to his joining LTK in 1998. During his tenure with AAR/TTCI, he worked extensively with TTCI's Track Loading Vehicle ("TLV"), and was instrumental in modifying the TLV (which was initially used to assess lateral track support) so that it could make an in-motion, continuous assessment of vertical track support using a rail deflection-based measurement system. Dr. Chrismer has a first-hand understanding of the TLV and its capabilities.

Scope of Assignment.

I was asked by Amtrak to work with it and the Northern New England Passenger Rail Authority ("NNEPRA") in connection with the track deflection and related track modulus testing to be performed by TTCI on Guilford's Plaistow-Portland line. Specifically, it was my job to coordinate with TTCI with respect to the planned testing, to accompany TTCI's TLV as it went about its test activities, to provide guidance as to those locations where stationary track modulus testing should be conducted, and to be a resource to TTCI as it prepared its report on the

testing it performed. A copy of TTCI's report - entitled "Vertical Track Deflection Measurements Using the TLV", P-02-001, for Northern New England Passenger Rail Authority (Jan. 10, 2002) ("TTCI Report") - is appended as Attachment 2 to the accompanying verified statement of David Read.

In the discussion below, I first address TTCI's initial testing of the Plaistow-Portland line from September 26 to September 29, 2001; then, I discuss TTCI's follow-up testing of the line conducted from November 28 to November 30, 2001; and finally, I comment on the TTCI Report which summarizes TTCI's test findings.

Before turning to that discussion, however, it is useful first to review what the TTCI testing was designed to achieve, and how TTCI's TLV has provided a practical method of track modulus assessment for the railroad industry.

The purpose of the TTCI testing was to determine whether the rehabilitation of Guilford's Plaistow-Portland line had been successful in establishing adequate track support on the line. Amtrak seeks to conduct passenger operations over the line at speeds up to 79 miles per hour, and the Board has ruled that the line needs to have a track modulus of at least 2,750 lb/in² in order to support such speeds.

Until recently, it was not practical to measure track modulus over the length of a rail line, because this would

require prohibitively time-consuming and expensive static tests at a multitude of locations all along the line. As a consequence, the railroad industry does not have much experience in actually measuring track modulus.

Track modulus is employed as a theoretical construct in the design of rail lines, but it is rarely measured in the field. Where it is measured, this typically occurs at only a few locations on a line, and it is usually done for research or other special purposes. In maintaining their lines, railroads rely not on track modulus measurements, but rather on visual inspections of the track and on track geometry car readings to identify places where track support conditions may be inadequate.

TTCI's TLV for the first time makes it possible to accurately estimate the track modulus for the entire length of a rail line, although it does not do this directly. What the TLV does is to measure relative vertical track deflection - that is, the amount by which the track bends under the known weight of the equipment passing over it - on a continuous basis while passing over the line at approximately 10 miles per hour. The amount of relative track deflection is affected by the stiffness of the support under the track, i.e., by the track modulus.

After measuring the relative vertical track deflection over the entire line, the TLV takes several static measurements

of vertical track deflection at various locations. These static track deflection measurements are then compared to the relative deflection measurements at the same locations, and based on the static track deflection measurements the track modulus of each location is calculated. Then, using a regression analysis, TTCI derives a curve that relates relative rail deflection measurements to track modulus measurements, and determines the extent to which the former is a reliable indicator of the latter. If it determines that rail deflection measurements are a reliable indicator of track modulus (which it determined to be the case here), TTCI uses relative rail deflection data to determine track modulus over the entire length of the line.

It was in adherence to this approach that TTCI used the TLV to conduct track modulus testing of the Plaistow-Portland line.

A. TTCI September 26-29, 2001 Testing

As described in summary above, TTCI conducted its September 26-29, 2001 testing of the Plaistow-Portland line with the TLV in two phases - the first involving dynamic testing of the relative vertical deflection over the entire line, and the second involving stationary testing of absolute vertical deflection at selected locations.

The TLV train consist (made up of a Guilford locomotive, the TLV, an AAR-100 test car which is permanently

joined to the TLV, and an empty tank car) performed dynamic track deflection testing of the line on September 26-27, and then conducted stationary track deflection testing of selected locations on the line on September 28-29.

Weather considerations did not interfere with obtaining reliable test results; indeed, they served to enhance these results. Several days prior to commencement of the testing, the area experienced heavy rainfalls, and although it did not rain during the test days (except for a light drizzle on the last day), standing water could be observed in some of the open ditches. This rain would be expected to create a relatively high moisture content in the subgrade. This was beneficial for testing purposes because weak subgrades are typically easier to identify when high moisture levels are present.

The TLV consist was staffed by Randal Thompson (the TTCI team leader, whose resume is appended as Attachment 2), Previn Marquez, Joe Novak and Mike Reedy. Throughout the testing, I traveled on the TLV consist, as did Phillip Brake, an Assistant Vice President - Engineering with Guilford. In addition to Mr. Brake, Roger Bergeron, another Guilford Assistant Vice President - Engineering, also accompanied the TLV for a portion of the testing. Both Mr. Brake and I consulted

regularly with the TLV personnel as they went about their testing activities.

In conducting its dynamic deflection testing of the line, the TTCI employed a 0.28-inch deflection limit to identify locations for potential stationary track modulus testing. During the dynamic testing, I learned that the paint marking system on the TLV would not apply a paint mark on the track at those places where the 0.28-inch deflection limit was exceeded (as I had originally thought), but rather would apply the mark only when triggered by a proprietary TTCI measurement called the Vertical Strength Index ("VSI"). As described by TTCI, VSI is

a proprietary index developed to identify a nominal "soft" track threshold condition for the AAR research work, [with the TLV marking locations where the VSI] exceeds 0.07 inches. Unlike other track inspection devices that use paint to identify conditions that are out-of-specification, the TLV paint marks do not correlate to a specific rail deflection, stiffness or modulus value and do not necessarily mark a track segment that is "out of spec".

See Murray V.S., Att. 13 at 3.

As explained to me by TTCI, its proprietary VSI tends to be triggered where variability in track support is detected. It is not uncommon for such detected variability to coincide with a detected change in vertical track deflection. Accordingly, one would expect a VSI-driven paint mark to be placed at some locations where track deflection suddenly

exceeded the 0.28 inch limit, although this would not always be the case.

In fact, during the September 27 testing, the TLV's paint spray system failed, and only a limited number of locations were marked with paint. This failure to mark all locations where the VSI index was exceeded did not impair the results achieved through the testing, however. The purpose of the testing was to measure dynamic and static vertical track deflection, neither of which is directly measured by TTCI's proprietary VSI. Where paint spray data was available and served to identify locations that otherwise were appropriate for potential static testing based on track deflection data, it was taken into account.

During the two days of dynamic track deflection testing, detailed relative vertical deflection data was developed for the entire Plaistow-Portland line, with the initial output based upon a 2-foot moving average, and the ultimate output based upon a 25-foot moving average. Using the 2-foot moving average data (the 25-foot moving average data had not been developed at this point), sites were selected for static track modulus testing, the objective being to measure a range of sample track support conditions ranging from very soft to stiff.

A total of 56 static measurements were taken at 12 locations. Three of the 12 static test locations were very close together and are all referenced as test zone 7 in the TTCI Report. A number of the locations tested bore paint marks left by the TLV, confirming that TTCI's proprietary VSI often triggered markings at locations where comparatively high track deflection was detected. TTCI intentionally tested different track features, such as highway crossings, bridges, and turnouts, to permit an assessment of whether track support varied significantly at these locations.

TTCI was unable to conduct all the desired static track modulus tests during the allotted two-day period. Because the TLV was scheduled to move to another project, it could not remain on the Plaistow-Portland line for further testing.

B. TTCI November 28-30, 2001 Testing

In order to allow for additional stationary track modulus testing of the Plaistow-Portland line, arrangements were made by NNEPRA to have the TLV return to the line to conduct such testing. See Murray V.S., Att. 6 & 13. This testing was performed from November 28 to November 30, 2001.

Once again, I traveled with the TLV as it went about performing the supplemental testing, as did Guilford's Phillip Brake. The TTCI personnel who conducted the testing were the same as those involved in the September testing.

The weather was good throughout the three days of testing, with mist and occasional light rain from time to time. The temperature remained far enough above freezing during the days, as it had prior to the testing, that the ground was not frozen under the line (such freezing might have skewed the test results). Accordingly, weather had no adverse effect on the quality of the test results.

On the first day of testing, the TLV consist moved over the line, performing one static test and then repeating the rolling dynamic test of vertical track deflection between approximately MP 225 and Plaistow (MP 274). The rolling dynamic test was repeated so that the TLV could apply paint marks at locations on line segments where the paint system had failed during the September testing, it having been determined in the earlier testing that TTCI's proprietary VSI was often triggered where comparatively high track deflection was detected and that the paint marks were useful in identifying locations for potential static testing. In addition, the TTCI crew used the dynamic test to record landmark references in the TLV's data files, again for purposes of identifying locations for potential static testing.

From conversations with TTCI, I understand that the deflection data generated during this November dynamic testing coincided with the deflection data generated during the

September dynamic testing, confirming that the TLV was consistently analyzing the line's track support.

Following this dynamic testing, two days of static track deflection testing were conducted on the line. A total of 28 locations were tested, with between 3 and 9 individual track deflection measurements being done at each location. Based on discussions between myself and TTCI and upon data developed by TTCI (described below), these locations had been pre-selected before the November testing began, and the test plan identifying these locations had been shared with Guilford.

To assist in identifying locations for November static testing, TTCI performed a regression analysis using the September data it had developed. Comparing 2-foot moving average deflection data with the static track modulus test results from the 12 locations that were subjected to static deflection testing, TTCI determined that there was a high statistical correlation between the two. The analysis demonstrated that locations with a 25-foot average deflection greater than 0.28 inches could be expected to have a track modulus less than 2,750 lb/in², among other things confirming the appropriateness of using a deflection limit of 0.28 inches during the September testing to identify locations for potential static testing. (As discussed below, TTCI refined this regression analysis in its Report.)

In creating the list of locations where static track modulus tests would be performed in November, TTCI and I agreed that testing would be conducted in the area of certain locations with a 25-foot average deflection greater than 0.28 inches. In addition, we included other locations for static testing, where the 25-foot average deflection data showed that the locations had a range of support characteristics, including some locations evidencing very strong support. We also included locations for static testing where support characteristics might be influenced by particular track or civil features (such as being located at a bridge approach or at a highway crossing), although we found that relating deflection data to a particular track or civil feature was sometimes difficult to do where the test data did not pick up the presence of the feature and its location had to be estimated using a track chart.

When the November static testing was actually performed, the TLV consist first went to each pre-designated location identified on the test plan. A visual inspection of the area was then conducted, and in some cases the location utilized for static measurements was slightly different from the milepost designation set forth on the test plan because visual inspection permitted identification of conditions believed to contribute to localized vertical track support conditions. Most of these minor changes resulted from initial reliance on track

charts, where the correlation of deflection data and track chart data required on-the-ground adjustment.

As discussed below, the data developed through this static testing was then integrated into TTCI's Report.

C. The TTCI Report

The TTCI Report, dated January 10, 2002, sets forth TTCI's findings based on the testing it conducted on the Plaistow-Portland line during the preceding September and November. I have reviewed the Report in detail and agree with its findings and the data upon which those findings are based, data with which I am intimately familiar having been present while it was being generated through the operation of TTCI's TLV.

Using the results of the September and November tests, TTCI found that the Plaistow-Portland line has an average track modulus value of 5,346 lb/in², and that only 166 feet of the 355,186 feet of track over which Amtrak seeks to operate at speeds greater than 60 miles per hour - that is, less than 0.05 percent - has a track modulus equal to or less than 2,750 lb/in². Of this 166 feet of track, 107 feet are concentrated in less than one-fifth of a mile between milepost 220.74 and milepost 220.93 (in the area of Kennebunk, ME).

The manner in which TTCI arrived at these findings is straightforward. First, TTCI began with the static deflection

and track modulus measurements performed at 40 locations during the September and November tests. At each of these locations, between 3 and 9 individual measurements were made, with a measurement being performed at every third tie; 2/ locations where 3 measurements were made extended over about 10 feet, and locations where 9 measurements were made extended over about 30 feet. TTCI reports the results of its measurements at each location in Appendix B of its Report.

As noted above, the locations tested in November were selected based upon relative track deflection data (25-foot moving average) developed by the TLV, with some locations expected to have a high track modulus and others expected to have a low track modulus; a similar location mix was tested in September, with selections based on 2-foot moving average deflection data (25-foot moving average data was not then available). In addition, locations with specific track or civil features were selected to assess the impact of these on track modulus. Where a low track modulus at a particular location is reported on Table 2 of the TTCI Report (p. 10), it can often be tied to a track or civil feature at that location as identified on Table 1 of the report (p. 8).

2/ The TTCI Report states that measurements were performed on every second tie; what TTCI means by this is that two tie cribs separated each measurement.

For example, a high deflection was noted at the location identified as Zone 23 (pp. 8 & 10), where a hot box detector was attached to a crosstie. This type of location is difficult to tamp (the process of placing and consolidating ballast under the tie for support) with the production machinery used to rehabilitate track, and it is not uncommon for such locations to be skipped by production crews. Instead, they must be tamped using hand-held tools, which Guilford evidently neglected to do. Regular track inspections are designed to identify these situations and provide corrective action as part of the normal maintenance of way activity on the line. The existence of such situations, which are relatively commonplace along railroad rights-of-way, does not require any reduction in track operating speeds.

Second, TTCI used regression analysis to establish the relationship between the dynamic deflection data collected by the TLV in September and the static deflection and track modulus data developed in September and November. The September dynamic deflection data was used because it was developed in a single run of the TLV consist from Portland to Plaistow, and the significant rainfall prior to the test run served to enhance the quality of the test results. As noted above, the dynamic deflection data collected in November over part of the line conformed to the corresponding data collected in September, so

consideration of the November data would not have produced different results.

TTCI began its regression analysis by determining the dynamic deflection data that coincided with the static deflection values measured at each location. In doing this, TTCI correlated (i) the static measurement with the highest deflection at each location with (ii) the maximum dynamic deflection (2-foot moving average) at that location. These relationships are recorded in Table 2 of the TTCI Report (p. 10) (note that the TLV deflection data reflects total track deflection, whereas the static deflection data reflects measured deflection between application of a 10,000 pound and a 33,000 pound vertical load). 3/

TTCI next calculated the track modulus derived from the static measurement with the highest deflection at each location. TTCI then plotted static track modulus values as a function of TLV-derived dynamic deflection data, separately plotting the track modulus values calculated from September and

3/ Data from four locations identified on Table 2 were not included in TTCI's regression analysis. At three of these locations, this was because static measurements were taken on frogs in a turnout, where the frog's stiffness and moment of inertia were significantly different from rail in terms of calculating track modulus. At the fourth location, static measurements could not be taken on the proper rail because the site was near the end of a bridge where there was insufficient room to set up the equipment safely.

November data on Figure 5 of the TTCI Report (p. 11). It determined that there was no significant difference between the two sets of track modulus values in terms of the correlation they support.

Analyzing the statistical relationship of the data, termed the coefficient of determination or " r^2 ", TTCI found that the data had an r^2 of 0.821, a statistical relationship which indicates that dynamic track deflection data, as measured by the TLV, is a very reliable indicator of track modulus. Under TTCI's analysis, a dynamic track deflection of 0.274 inches is equivalent to a track modulus of 2,750 lb/in². 4/

Third, TTCI converted the dynamic deflection data based on a 2-foot moving average developed in September into a 25-foot moving average of such data, and identified locations reflected in that moving average where deflection was equal to or greater than 0.27 inches and hence track modulus would be

4/ As explained above, prior to the September testing, it was estimated that a dynamic deflection of 0.28 inches equated to a track modulus of 2,750 lb/in². This was before data had been gathered which permitted the preliminary regression analysis TTCI performed after the September testing. As discussed above, this preliminary regression analysis supported continued use of 0.28 inches. The 0.274 inch figure produced by the final analysis confirms the reliability of the September and November testing done by TTCI, which used dynamic deflection data greater than 0.28 inches to indicate candidate locations for static testing. That testing would not have been performed any differently if the 0.274-inch figure had been used in lieu of the 0.28-inch figure.

expected to be equal to or less than 2,750 lb/in². TTCI used 0.27 inches rather than the 0.274 inches supported by its regression analysis to be conservative and also to account for the fact that the TLV measurement system does not have the accuracy to resolve deflection data of less than 0.01 inches (absent this adjustment, a relative deflection reading of 0.27 inches would equate to a track modulus of 2,796 lb/in²).

The 25-foot moving average of dynamic deflection data was used because it was considered to be the absolute minimum length of track appropriate for assessing basic track support conditions. Normally, weakness in track support conditions requires attention only when it appears over distances of several hundred feet, and typically such weakness is associated with the influence of certain soil types or geologic formations. Based on my experience, the problems with track support at Kennebunk, ME (discussed below) fall into this category. Accordingly, TTCI's use of a 25-foot moving average of deflection data is quite conservative.

The 2-foot moving average data (which TTCI converts into 25-foot moving average data) collected by the TLV is of no value by itself in assessing track support conditions on the line. This data tends to capture isolated conditions that by themselves are not indicative of underlying track support. By averaging isolated deflection increases attributable to such

things as irregularities in rail joints, bad ties and battered welds with more normalized deflection measured on surrounding track, use of the 25-foot moving average data ensured that these isolated irregularities did not skew the assessment of generalized track support.

In addition, a normal rail car moving over a line depresses approximately 25 feet of track under each truck. Thus, using a 25-foot moving average of data permitted TTCI to capture the effects of a car on a particular segment of track.

Based on the data it developed, TTCI determined that the track it tested had an average track modulus of 5,346 lb/in² and a median track modulus of 5,258 lb/in². It also determined that only 166 feet of the 355,186 feet of track that it tested had a track modulus equal to or less than 2,750 lb/in². TTCI lists each location where this occurs (p. 15), and provides in Appendix A a series of charts which depict by milepost the relative dynamic deflection which the TLV measured over those portions of the Plaistow-Portland line where Amtrak seeks to operate at greater than 60 miles per hour.

TTCI identifies 14 locations where dynamic track deflection is equal to or greater than 0.27 inches and track modulus thus would be expected to be equal to or less than 2,750 lb/in². Of these locations, seven are in the Kennebunk, ME area (milepost 220.74 to milepost 220.93), accounting for a total of

107 feet of track. 5/ Amtrak and NNEPRA are aware of track support problems in this area attributable to the clay subsurface and poor drainage. Indeed, no static testing was done in the area because these problems had already been identified. Drainage and other work has been done in the area to correct the problem, but until it is confirmed that no further work is required and that the track meets Federal Railroad Administration Class 4 standards (these standards are not based on any consideration of track modulus), Amtrak proposes to operate over this track at a maximum speed of 30 miles per hour.

As to the seven other locations, they are significantly different from the locations in the Kennebunk area, which together encompass an extended track segment with support problems. Each of these other locations, found at an isolated place on the Plaistow-Portland line, has a track modulus that is only modestly below the Board's benchmark of 2,750 lb/in², and each extends for only a very short distance (ranging from two feet to 18 feet). 6/

5/ In fact, two of the seven locations - MP 220.74 and MP 220.92 - have a satisfactory track modulus of 2,796 lb/in² (conservatively reduced by TTCI to 2,750 lb/in²).

6/ TTCI conducted a static track modulus test at or in the general vicinity of each of these seven locations, with the exception of MP 205.45 (this location had a track deflection of

As noted above, one location (MP 205.45) has a satisfactory track modulus of 2,796 lb/in² (conservatively reduced by TTCI to 2,750 lb/in²). At two other locations (MP 213.24 and MP 272.89) - each of which has a track modulus of 2,676 lb/in² - Amtrak will operate at 60 miles per hour rather than 79 miles per hour based on operating considerations unrelated to track modulus, and hence there is no track modulus issue. With respect to the remaining four locations - three of which have a track modulus of 2,676 lb/in² and the other of which has a track modulus of 2,462 lb/in² (MP 241.02) - these modulus measurements are not indicative of any significant systemic support problems at these locations.

In these circumstances, there is no justification for limiting Amtrak's speeds at these four locations. Certainly, there is no safety issue raised by the track modulus results at these locations. As explained in my earlier verified statements in this proceeding, track modulus is not a safety standard.

[Footnote continued]

0.27, and hence had a satisfactory track modulus of 2,796 lb/in²). The static track modulus results obtained through this testing were based on data at a single, isolated spot. By contrast, the track modulus ascribed to a location by TTCI based on dynamic deflection data was based on a twenty-five-foot average of measurements. The former, single-point test results are not by themselves indicative of underlying substructure support, whereas the results obtained using the twenty-five-foot average data does afford a reliable assessment of such support.

Rather, it is a concept employed in the design of a rail line; because inadequate track support can lead to increased maintenance costs, railroads seek to construct rail lines with adequate track support (i.e., track modulus).

The data related to these four locations reveals that they do not suffer from material track support problems. Rather, their track modulus is very close to the Board's standard, and the slight departure from that standard is isolated to a few feet. In these circumstances, the Board can have confidence that the track will satisfactorily support 79 miles-per-hour Amtrak operations.

This conclusion is further supported by the track geometry testing Amtrak did of the Plaistow-Portland line on July 7, 2001. Using the track geometry car it employs for testing the Northeast Corridor, Amtrak found that the entire line - with the exception of track in the Kennebunk, ME area and certain locations where Guilford's rehabilitation work did not provide adequate superelevation in curves to support operations faster than 60 miles per hour and where Amtrak will so limit its speed until additional superelevation work is performed - would support 79 miles-per-hour operations. Indeed, this testing revealed that, from a track quality perspective, the line would support 90 miles-per-hour operations (that is, FRA Class 5 operations) but for exceptions recorded at eight locations

totaling 230 feet (and again excluding the Kennebunk area and the locations where additional superelevation work is required).

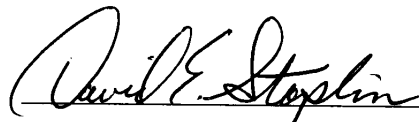
In addition to working with TTCI in connection with its testing and Report and reviewing the track geometry data generated by Amtrak, I have also recently ridden in the locomotive cab of one of Amtrak's Downeaster passenger trains between Plaistow and Portland. Locomotives provide a good place to observe and assess track quality because they are the heaviest vehicles in a passenger train consist and the suspensions are not tuned to passenger comfort. During my locomotive cab ride, I was able to experience the ride quality provided at, among other locations, the so-called exception locations identified in the TTCI Report. When the locomotive passed over those locations, I did not observe any significant change in ride quality. Ride quality was the same at those locations as elsewhere on the line, a result that I expected given the very short distances associated with the exception locations and the fact that they have a track modulus which at most is only modestly below the Board's standard.

In sum, based on the findings made in the TTCI Report, taking into account Amtrak's track geometry test results, and considering actual ride quality observations, the Board should permit Amtrak to conduct 79 miles-per-hour operations over all Plaistow-Portland line segments where such speeds are proposed.

VERIFICATION

I, David E. Staplin, declare under penalty of perjury
that the foregoing is true and correct. Further, I certify that
I am qualified and authorized to file this Verified Statement.

Executed on April 8, 2002.

A handwritten signature in cursive script, reading "David E. Staplin", written over a horizontal line.

David E. Staplin



LTK Engineering Services

**David E. Staplin, P.E.
Railroad Services Director**

Executive Summary

Dave Staplin's three-decade career spans all aspects of the rail industry. He has worked in both technical and senior administrative positions at several major authorities, including Amtrak and Conrail. He also served four years as Executive Director of American Railway Engineering and Maintenance of Way Association. At LTK, Dave directs the firm's work in the areas of railway operations, maintenance, economics and valuation. His group provides economic, operations and valuation support to the railroad and transit industry.

Dave is recognized in the rail industry as an expert on economic impacts of heavy axle loads, as well as joint passenger and freight operations. His expertise extends to conducting and analyzing feasibility and alternative studies as well as operations analysis and planning.

Employment

LTK Engineering Services

1998 to Present: Railroad Services
Director

American Railway Engineering and Maintenance of Way Association

1995 to 1998: Executive Director

Amtrak

1991 to 1994: Assistant Vice President
and Chief Engineer

CSX Transportation, Inc.

1981 to 1991: Assistant Chief Engineer

Consolidated Rail Corporation

1981: Division Engineer
1976 to 1980: Manager Rehabilitation
Planning

United States Railway Association

1974 to 1976: Chief Engineer Planning

Louis T. Klauder & Associates

1972 to 1974: Principal Engineer

Penn Central Transportation Company

1970 to 1971: Supervisor of Track

Education

M.B.A., Jacksonville University, 1986

B.S., Civil Engineering,
University of Michigan, 1969

Professional Registration

Licensed in Pennsylvania

Affiliations

AREMA

Past President

Past Board of Directors member

Committee Four – Rail, Subcommittee Chair

Committee Twenty-Four – Engineering

Education, Member

Transportation Research Board, Committee

A2M05 – Guided Intercity Passenger

Transportation Member

Committee A2M01 - Railroad Track Structure

System Design Member

Committee on Railway Maintenance A2M06 –

Track Maintenance Member

American Society of Civil Engineers, Member

Association of American Railroads,
Chairman of Rail Working Group,
Member of Heavy Axle Load Economic
Review Committee,
Member of TRACs Advisory Group,
Member Engineering Research Committee
Permanent Way Association, Member

Project Experience

Bay Area Rapid Transit (2001)

Supervised the development of schemes for use of two freight rail lines to extend service north from Richmond, CA into Western Contra Costa County. A proposed track configuration was developed to implement the desired level of service. Capital costs for these options were then developed, including right-of-way, roadbed, track, structures, signals and stations.

New Jersey Transit (2001)

Supervised engineering appraisal of the track, grading and signals for 56-miles of the NYS&W railroad in northwestern New Jersey. This project involved inspecting the line and making detailed notes of condition. These notes were then used to develop an appraisal based on going concern values.

Northstar Corridor Development Agency (2001)

Working on the Northstar Corridor Investment Study, developed feasible alternatives for arrangement of two station locations. The alternatives had to be compatible with freight rail needs as well. Supervised preliminary engineering of the Northstar shop including site layout, industrial engineering and track layout. Extensive analysis of potential Northstar operations were undertaken to determine fueling patterns for train consists and avoid multiple fueling locations.

Piedmont Area Regional Transit (2001)

Supervised development of three rail alternatives for the Piedmont area MIS study. Work included identification of route alternatives, estimated capital costs of construction, service to be provided, and estimated operating costs. Made presentations at two community meetings.

Railtrack (2001)

Reviewed cases of rolling contact fatigue for Railtrack and made recommendations for alleviating it. Emphasis was given to special trackwork. Railtrack is responsible for rail infrastructure in the United Kingdom.

Stanislaus County, California (2001)

Responsible for developing rail alternatives for the start-up of commuter rail service in Stanislaus County. Alternatives included different potential service levels as well as alternative routes. Supervised development of capital costs for infrastructure and total operating costs for each alternative.

Amtrak (2000 to Present)

Managed development of expert engineering testimony to support Amtrak and NNEPRA's contention that 79 MPH speeds should be granted for the start-up of intercity rail passenger service between Boston, MA and Portland, ME. Project involved the first ever use of the Track Loading Vehicle to estimate the sub-grade support conditions along an entire route.

Capital Area Transportation Authority (1999 to 2000, 2002)

In an on-going study, managed rail operation in Corridor One Major Investment Study. Developed cost estimates for improvements required for operation of diesel multiple unit commuter service on a Norfolk Southern branch line and Amtrak's Keystone Corridor. Improvements included track additions, upgrading of existing track, signal installations, grade crossing warning devices, stations and structures. Worked with Norfolk Southern to overcome concerns about services co-existing in the same corridor. At the completion of the study, rail was chosen as the preferred local option and the client is seeking funding for preliminary engineering.

Minnesota Department of Transportation (1999 to 2000)

Assisted in determining a recommended list of capital improvements in order to implement push-pull commuter rail service on Burlington Northern Santa Fe

transcontinental main line. Responsibilities included analysis of a recommended improvement list and developing alternate improvements to maximize use of available capital funds. Recommended approaches to enhance operations and improve the likelihood of BNSF approval. Advised URS/BRW on railroad practices and standards.

Central Ohio Transportation Authority (2000 to Present)

Coordinated the design and constructability issues between the architects, design engineers and the railroads, Norfolk Southern and CSX, for a new multi-modal terminal for downtown Columbus, OH. Responsible for advising the designers on methods to preserve space below the terminal for future commuter and intercity rail platforms. Project is in preliminary engineering.

New Jersey Transit (1999 to 2000)

Developed capacity constraints in order to meet vehicle maintenance requirements for expanded fleet of rolling stock. This analysis included the Meadows Maintenance Center, two major terminals, and 11 outlying points. A list of recommendations for short and long term improvements were drafted and New Jersey is now soliciting proposals to begin work.

CSXT Transportation (2000-2001)

Evaluated CSX's track (or "smoothing") teams engaged in surface correction to ensure that they were working in a safe and efficient manner. Made recommendations to CSX to improve productivity. Drafted recommendations for improving assignments of the basic track maintenance force on the southern third of the CSX system.

Metropolitan Mid-Ohio Regional Planning Commission (2000-2001)

Developed capital costs for revised routings of light rail system between downtown Columbus, OH, and Worthington, OH. The update considered many changes that had taken place since a 1994 study. The ownership of the rail right-of-ways had changed, the route available for entering downtown had changed and the end points of the line

were modified. LTK was responsible for vehicle, shop and systems costs. LTK was responsible for the civil costs outside of the freight railroad's right-of-way.

Metropolitan Planning Commission (1999 to 2000)

Developed investment costs for intercity rail alternative serving Sacramento and San Jose from downtown San Francisco via the Bay Bridge. Worked with Union Pacific to minimize freight impacts. Advised structural engineers on rail requirements for Bay Bridge.

Nationwide Insurance (1998-1999)

Investigated safety of rail operations for Nationwide Insurance in the downtown Columbus, Ohio in connection with the construction of a new sports complex that was adjacent to the tracks. Developed two alternatives for moving the rail freight traffic away from the arena along with cost estimates. The division of Conrail into Norfolk Southern and CSX was factored into all analyses.

Miami Valley Planning Commission (1999-2000)

Developed alternative light rail system routes to serve historical sites in Dayton, Ohio. These included all capital costs for grading, track, structures, signals, overhead catenary, and public improvements. Resolution of potential conflicts with freight rail service was also included in the analysis.

American Railway Engineering and Maintenance of Way Association (1995 to 1998)

Managed 5,600-member railway engineering professional organization. Managed transition from AAR affiliation to complete independence. This required recruiting staff, setting up independent offices, computer (LAN) systems, and procedures for accounting, financial controls, and personnel. Managed transition through merger with three other professional organizations. This required revamping staff assignments, workloads, procedures and developing a new membership database. The organization runs with 20 percent fewer staff as a result. Revamped technical programs to include new formats, offering of

educational seminars and special symposiums, increasing interest and revenues. Converted Manual of Engineering to electronic publishing and made it available on CD-ROM, increasing its marketability. Instituted review of technical committee activities that streamlined operations. Committee efficiency has been increased and assignment schedules reduced.

Amtrak (1992 to 1995)

Managed engineering department of 2,800 employees with an annual expense budget of \$166 million and capital budget of \$100 million.

Developed 10-year capital budget strategy that resulted in better allocation of capital funds in response to specific needs. Initiated project management approach in engineering department including the use of computerized scheduling. Improved scheduling resulted in better schedule adherence and improved unit costs. Implemented new procedures for difficult maintenance situations. Speed reductions due to track conditions were greatly reduced, improving schedule reliability. Unit costs of work were also greatly reduced. Installed high-speed turnouts with world's first 40-ton panel lifting equipment. This method saved money and permitted 80 mile per hour speeds for diverging moves, the fastest in the U.S. Schedule reliability was increased.

CSX Transportation, Inc. (1981 to 1991)

Assistant to the Vice President Engineering Planning and Analysis (1990 to 1991)

Worked with Department Heads on formula of engineering policy and represented the Vice President of Engineering at industry functions. Provided engineering support for two major acquisitions. Developed strategy to increase axle loads on key service routes, improving efficiency and competitiveness.

Assistant Chief Engineer (1989 to 1990)

Managed \$229 million capital track program, involving over 1,200 employees. Reorganized operations, reducing labor costs by 10% on tie installation, 20% on surfacing and 8% on rail replacement. Production quantities increased.

Refocused safety on problem rail gang, reducing injuries by 70%.

Director of Quality Control (1987 to 1988)

Managed \$3 million track safety testing programs, including staff of 20. Managed Quality Improvement process in Engineering Department, training 850 employees. Established joint management employee council on tie gang in conjunction with maintenance of way union, increasing production by 40% in 18-month period.

Director of Planning and Valuation (1981 to 1986)

Directed staff of seven in planning and economic studies. Directed college recruiting and hiring for Engineering Department. Established policies for rail usage, resulting in cost reduction. Developed computerized data bases, providing improved information to managers.

Conrail (1976 to 1981)

Division Engineer (1980 to 1981)

Directed organization of over 1,000 employees with an annual budget exceeding \$30 million. Maintained safe operation over 2,500 miles of road, including track, signals, and electrified commuter operation.

Manager Rehabilitation Planning (1976 to 1980)

Developed \$2.7 billion track rehabilitation program resulting in improved safety and reliability of operations. Miles of speed restrictions dropped from 8,500 to 3,000.

United States Railway Association (1974 to 1976)

Determined track maintenance funding for all Conrail options studied.

Louis T. Klauder & Associates (1972 to 1974)

Participated in feasibility studies of rail and transit operations nationwide.

Penn Central Transportation Company (1970 to 1971)

Maintained safe operations over 100 miles of track and supervised 14 employees.

Randal L. Thompson, BSEE

Profession:

Senior Engineer I, Product Line Manager-TLV, Transportation Technology Center, Inc. (TTCI), a wholly owned subsidiary of the Association of American Railroads (AAR)

**Key
Qualifications:**

Randal has 13 years of overall experience in the use of the Track Loading Vehicle. Randal specializes in the design and construction of the instrumentation, hydraulics, and control systems of the TLV. Randal possesses in-depth knowledge of state-of-the-art instrumentation equipment such as Lasers, LVDT's, Accelerometers, and video cameras used in the operation of the TLV.

Education:

- B.S., Electrical Engineering, Purdue University, Hammond, Indiana.

**Experience
Record:**

As a Senior Engineer I, Product Line Manager - TLV (August 1999-Present) Pueblo, Colorado, Randal manages and coordinates all TLV SRI Projects and is the "Point of contact" for all TLV based activities. He also administers the day-to-day budgeting for the various TLV projects. Randal is responsible for authoring reports and proposals for old and new TLV project work (SRI and Commercial) and provides presentations and project updates to various committees.

As a Senior Engineer I (August 1996 - August 1997) Pueblo CO., Randal was responsible for the operation and modifications of the Track Loading Vehicle (TLV). He was also responsible for purchasing equipment and supplies for all aspects of testing. He wrote test plans, proposals, and cost estimates and provided a complete documentation report upon completion of each project.

As a Test Engineer, Instrumentation (August 1989 - August 1996), Chicago, IL., Randal supervised and directed technicians in setting up instrumentation for data collection. He designed mounting hardware for installing many different types of transducers. He also designed and built hardware to interface to servo-controlled hydraulic systems for the TLV and other test equipment.

As a CO-OP Engineer (1984 - 1986), INTEL CORPORATION, Santa Clara, CA., Randal worked for the following departments:

- PMO Manufacturing Engineering - (sessions 4,5) Randal designed and built an add-on board to interfaced test equipment to an IBM PC. He also wrote a complete users manual for the above-mentioned equipment

**Experience
Record (cont):**

- PCO Technical Marketing - (sessions 1,2,3) Randal taught a CAD system to technicians. He initiated a color-coded wire wrapping system for building prototype circuits. Randal also learned how to layout & build prototype boards

Other Skills:

Hardware

- Microcomputers (IBM compatible, Hewlett Packard, IBM RISC, LINUX)
- LAN (Local Area Network)
- Data Acquisition systems (Hewlett Packard, IBM, MegaDac, Campbell)
- MTS hydraulic control systems (design, setup and control)
- Experience with various transducers (LVDTs, Load cells, Accels, Lasers, Thermocouples, etc.)

Software

- AutoCad - OrCAD - MS Word - MS Excel - MS Project
- Power Point - Lotus 123 - Quattro Pro - Windows98, ME, XP, NT
- "C" language - HP Basic - LINUX - - Assembly language

**Professional
Associations
and Honors:**

- Member, American Railway Engineering and Maintenance-of-way Association

Publications:

- Thomson, R., Li, D., "Automated Vertical Track Strength Testing Using TTCI's Track Loading Vehicle," *Technology Digest* TD02-002, Association of American Railroads February 2002.
- Thompson, R., Marquez, P., and Li, D., "Track Strength Testing Using TTCI's Track Loading Vehicle," *RT&S Magazine*, December 2001, pp. 15-17.
- Thompson, R., Pasta, C., and Marquez, P. "Track Vertical Strength Measurement Using TTCI's Track Loading Vehicle," *Technology Digest* TD99-007, Association of American Railroads, February 1999.
- Li, D., Shust, W., Thompson, R. and Cooke, J. "Prototype Technique for Automated Lateral Track Panel-Strength Measurement," *Technology Digest* TD98-013, Association of American Railroads, May 1998.
- Elkins, J., Thompson, R. and Shust, W., "Distance Required For Flange-Climb Derailment." *Technology Digest* TD98-006, Association of American Railroads, February 1998.

CHRISMER

VERIFIED STATEMENT OF STEVEN M. CHRISMER

My name is Steven M. Chrismer. I work as a Principal Engineer with LTK Engineering Services ("LTK"). I have earlier submitted two verified statements in this proceeding on behalf of the National Railroad Passenger Corporation ("Amtrak"), the first as part of Amtrak's opening case in last year's clarification proceeding and the second as part of Amtrak's rebuttal case in that proceeding. Both of my earlier statements dealt with track modulus testing of Guilford's 1/ Plaistow-Portland line.

Professional Background and Experience.

I have worked for twenty years in the railroad engineering field. Following graduate school, I spent sixteen years working with the Association of American Railroads ("AAR") and its subsidiary, the Transportation Technology Center, Inc. ("TTCI"). Prior to my departure from AAR/TTCI in 1998 to accept my current position with LTK, I was a Senior Research Engineer and much of my work concentrated on developing methods to determine track strength and characterization of track substructure support. My interest in this subject matter

1/ Springfield Terminal Railway Company, Boston and Maine Corporation, and Portland Terminal Company are referred to collectively as "Guilford."

extends back to my Ph.D. studies; my dissertation was entitled "Mechanics-Based Model To Predict Ballast-Related Maintenance Timing and Costs."

While at AAR/TTCI, I was a leading advocate for making TTCI's Track Loading Vehicle ("TLV") - which was originally designed to assess lateral track support - capable of assessing vertical track support on a continuous basis through in-motion testing and using a measurement system based on rail deflection readings. I was intimately involved in early work on achieving this goal, and I have closely followed development of the TLV's vertical support assessment capabilities since leaving AAR/TTCI.

I graduated from Pennsylvania State University in 1980 with a B.S. in Civil Engineering, and again in 1983 with an M.S. in Civil Engineering. I earned a Ph.D. in Civil Engineering from the University of Massachusetts in 1994. A copy of my resume is appended as Attachment 1.

I have worked closely with my colleague David E. Staplin in preparing this statement and in the work which both he and I have performed on Amtrak's behalf in regard to track modulus testing of Guilford's Plaistow-Portland line.

Matters Addressed in Statement.

In this statement, prepared on behalf of Amtrak, I address three subjects. First, I discuss the evolution of the

testing methodology employed by TTCI in its dynamic track deflection and static track modulus testing of Guilford's Plaistow-Portland line. Second, I explain the appropriateness of the regression analysis employed by TTCI to correlate dynamic track deflection data generated through its in-motion testing of the Plaistow-Portland line to static track modulus testing of particular locations on the line, and then to validate use of track deflection data as an indicator of track modulus. Third, I address why TTCI's use of a 25-foot moving average of dynamic track deflection data is the most reliable indicator of track modulus and underlying track support, and explain that in light of TTCI's findings, there is no track support impediment to 79 miles-per-hour Amtrak operations.

Although I do not address every topic discussed in TTCI's report - entitled "Vertical Track Deflection Measurements Using the TLV", P-02-001, for Northern New England Passenger Rail Authority (Jan. 10, 2002) ("TTCI Report") and appended as Attachment 2 to the accompanying verified statement of David Read - I agree with the manner in which TTCI conducted its testing of the Plaistow-Portland line and the findings set forth in the TTCI Report.

A. Evolution of TTCI Testing Methodology

Between the time in mid-2000 that TTCI first began discussing with the Northern New England Passenger Rail Authority ("NNEPRA") the methodology it would use for testing the Plaistow-Portland line and the actual conduct of that testing on September 26-29, 2001 and November 28-30, 2001, the testing methodology evolved and improved.

When TTCI conducted its September 26-29, 2001 testing, it did so under an agreement entered into with NNEPRA on September 25, 2000, approximately a year before the testing was initiated. See Murray V.S. at 8 & Att. 3. Although the agreement undertook to describe how the testing would be performed, in certain respects this description had become outdated by the time the testing took place. The supplemental agreement entered into between TTCI and NNEPRA on November 26, 2001 to govern the November 28-30 testing of the line provided an accurate description of the testing methodology employed by TTCI in both its September and November testing. 2/ See Murray V.S. at 12 & Att. 13.

2/ There was one error in this description, which mistakenly referred to the initial output of TTCI's dynamic testing as being based upon a 5-foot moving average of data. In fact, the initial testing output collected in both September and November was based upon a 2-foot moving average of data.

Miscellaneous methodology improvements. As explained in the September 25, 2000 agreement, testing of the line was to be conducted in two phases using TTCI's TLV - the first involving dynamic testing of the line's vertical track deflection, and the second involving stationary testing of the line's vertical track deflection and track modulus at select locations.

With regard to the first (dynamic testing) phase, as explained by TTCI,

[t]he TLV will be used to continuously measure the rail deflection of the track at a speed of 10 mph. The applied vertical load will be 30,000 lb. Data from both the TLV and the tank car will be digitally sampled at 20 samples-per-second which equates to a data point taken every 9 inches at 10 mph. A moving 25-foot average (34 data points) is then calculated as the final data output.

Markers will be placed in the data to represent [sic] mileposts, turnouts, bridges, grade crossings and other track features. . . . The data will be plotted as rail deflection as a function of track distance. Milepost and track feature markers will also be included in the plots.

In the second (stationary testing) phase,

[t]he deflection data will be examined and stationary measurements will be performed at those locations where the largest rail deflections were measured. It is anticipated that 20 - 40 stationary measurements will be performed and that the effort will take one day. Track modulus

will be calculated from the stationary deflection data based on the track stiffness between 10,000 lb. and 30,000 lb. The stationary measurements based on [sic] should be an acceptable indicator of the minimum track modulus for the line.

See Murray V.S. at 8 & Att. 3 at 2.

Although this two-phase testing approach was implemented by TTCI during its September 26-29 and November 28-30 testing of the Plaistow-Portland line, certain of the testing parameters described in the year-old agreement were modified.

For example, in the dynamic testing phase, a vertical load of 40,000 pounds was employed in lieu of the 30,000 pounds described in the agreement, and also in lieu of the 33,000 pounds which during the clarification proceeding last year all parties understood would be the applied vertical load. TTCI used the 40,000-pound load because it better represents the upper loading range of a freight car taking into account the moving car's dynamic effects on track and underlying support structure (as discussed below, TTCI's use of this heavier load required modification of the 0.25-inch deflection benchmark to 0.28 inches). 3/

3/ The upper loading range of a passenger car would be substantially lighter than that of a freight car. It would not afford as accurate an assessment of vertical track deflection
[Footnote continued]

In addition, although the final data output of the dynamic test phase was a 25-foot moving average (discussed in greater detail below), through improvements in the TLV the underlying data upon which this average was based was more refined than originally contemplated. Deflection data was digitally sampled at 100 samples-per-second (not 20 samples-per-second) and a 2-foot moving average was calculated, which in turn was translated into the 25-foot moving average.

With respect to the static testing performed by TTCI, track modulus was not calculated from the stationary deflection data based on the track stiffness between 10,000 pounds and 30,000 pounds as originally contemplated, but rather between 10,000 pounds and 33,000 pounds. During last year's reconsideration proceedings, the parties were aware of this change, and both sides submitted evidence as to how deflection and track modulus should be measured under application of a 33,000-pound static wheel load.

TLV paint spray system. The September 25, 2000 agreement makes no mention of the paint spray system integrated into the TLV, a system which I described in a statement filed in

[Footnote continued]

where a mix of freight and passenger traffic moves over the subject line, as is the case on the Plaistow-Portland line.

last year's clarification proceeding as placing a paint spot at each location on the line where a pre-established benchmark for dynamic track deflection was exceeded. As explained in the November 26, 2001 agreement, the TLV paint spray system was modified so that it applied a paint spot at each location on the line where a proprietary TTCI measurement called the Vertical Strength Index ("VSI") was exceeded.

As described by TTCI, VSI is

a proprietary index developed to identify a nominal "soft" track threshold condition for the AAR research work, [with the TLV marking locations where the VSI] exceeds 0.07 inches. Unlike other track inspection devices that use paint to identify conditions that are out-of-specification, the TLV paint marks do not correlate to a specific rail deflection, stiffness or modulus value and do not necessarily mark a track segment that is "out of spec".

Murray V.S., Att. 13 at 3.

In application, the VSI benchmark tends to be triggered where there are significant variations in detected track support. Accordingly, although the VSI benchmark and the vertical track deflection benchmark are not always triggered by the same track support conditions, in many cases they are and the VSI paint spot will mark a location where the deflection benchmark has been exceeded.

Deflection limit used in testing. In conducting its dynamic deflection tests of the line, the TLV used a 0.28-inch deflection limit to identify locations for potential stationary track modulus testing, rather than the 0.25-inch limit that was originally contemplated. The reason for this change is that, as originally planned, deflection was to be measured under a vertical wheel load of 33,000 pounds, this load being applied to each rail as the TLV consist moved over it at 10 miles per hour. But, as described above, the testing ultimately conducted measured deflection under a vertical wheel load of 40,000 pounds, an increase in load that required a related increase in the deflection limit.

By way of explanation, it is first worth reviewing how the 0.25-inch deflection limit was established, based on the assumption that the applied vertical load would be 33,000 pounds.

In his initial verified statement filed in this proceeding on Amtrak's behalf (as part of Amtrak's April 2, 1999 Opening Brief and Evidence), Dr. Arnold D. Kerr compared the track deflection resulting from various combinations of individual uncoupled and coupled vehicles on track with a modulus of 2,750 lb/in². He found that the largest deflection occurs under the 33,530-pound wheels of a locomotive when it is

coupled to a passenger car. For the assumed 115-pound rail, Dr. Kerr's analysis showed that the expected rail deflection is 0.16 inches after accounting for the dynamic effects of a load moving at 10 miles per hour.

Independently, in his verified statement filed in this proceeding on Guilford's behalf (as part of Guilford's May 11, 2001 Opposition), Dr. Allen M. Zarembski noted that the 0.16-inch limit also applies (within round-off error) for a single isolated axle such as the TLV loading axle moving at 10 miles per hour.

The 0.16-inch deflection limit derived by both Dr. Kerr and Dr. Zarembski cannot be used directly in the TLV testing because it does not account for voids in the track structure being assessed. Before a track deflection value can be used to calculate track modulus, the portion of deflection due to slack must be accounted for and removed. ^{4/} Because the TLV references the relative deflection measured under its loaded wheel to that measured under a wheel with near zero load, the associated deflection will include slack. Therefore, the amount of slack must be added to the 0.16-inch deflection to provide

^{4/} Slack is attributable to physical gaps or voids between rail and tie plate, tie plate and tie, and/or ballast and tie.

the total limiting allowable deflection measured in response to the moving 33,000-pound TLV wheel load.

As discussed in the joint verified statement of David Staplin and myself filed in last year's clarification proceeding (as part of Amtrak's May 29, 2001 Rebuttal), a review of the literature shows that a typical amount of void is 0.12 inches for conventional wood-tie ballasted track. W. Ebersohn & E. Selig, AAR Report # LA-009, "Evaluation of Substructure Using Field Tests" (Dec. 1996). When added to the 0.16 inch limit, a total allowable relative deflection of 0.28 inches is derived. However, to be conservative, it was decided that the assumed amount of void would be reduced to a smaller-than-typical 0.09 inches, thereby producing a deflection limit of 0.25 inches ($0.16 + 0.09$). 5/

This 0.25-inch limiting value was developed under the assumption that track deflection would be measured with the TLV applying a 33,000-pound maximum wheel load moving at 10 miles per hour. However, subsequent testing experience by TTCI established that application of a 40,000-pound maximum load was

5/ The manual published by the American Railway Engineering and Maintenance of Way Association ("AREMA") makes reference to a 0.25-inch limiting value for rail deflection. The 0.25 inches mentioned in the AREMA manual does not include slack.

preferable in terms of the accuracy and meaningfulness of the data derived. To account for this increase in maximum wheel load, a corresponding increase in the track deflection limit was calculated to maintain an equivalent test. Because the relationship between load and deflection is relatively linear at the higher load range of 33,000 to 40,000 pounds, the 0.16-inch deflection with voids removed was increased by proportion to 0.19 inches ($0.16/x = 33,000/40,000$). When this is added to the assumed 0.09-inch gap represented by slack, the deflection limit under the moving 40,000-pound wheel load becomes 0.28 inches.

B. Regression Analysis Data Correlation

As discussed above, TTCI conducted dynamic track deflection testing of the Plaistow-Portland line. It employed a 0.28-inch deflection limit, based initially on moving 2-foot average deflection data and ultimately on moving 25-foot average deflection data, to identify locations where track modulus was expected to be less than 2,750 lb/in².

TTCI conducted static vertical track deflection testing at or near various locations where moving 25-foot average deflection data recorded values greater than the 0.28 deflection limit. It also tested some locations where the 0.28-inch deflection limit was not exceeded and a satisfactory track modulus would be expected. Static track modulus measurements

were taken at 40 locations; at each of these locations, between 3 and 9 individual measurements were made. A measurement was performed at every third tie; 6/ locations where 3 measurements were made extended over about 10 feet, and locations where 9 measurements were made extended over about 30 feet.

TTCI employed regression analysis to correlate dynamic relative deflection recorded at each location with the track modulus measured statically at the location. To do this, it paired the static measurement with the highest deflection at each location (calculated from the load increment from 10,000 to 33,000 pounds) with the maximum relative deflection value recorded at the same location from the in-motion testing. Next, it calculated the track modulus associated with the static deflection data. Then, using regression analysis, it plotted track modulus as a function of relative deflection.

TTCI performed two separate regression analyses as it went about testing the Plaistow-Portland line.

First, between the time of the first testing in September and that in November, TTCI performed a regression

6/ The TTCI Report refers to measurements being performed on every second tie. What TTCI means is that there were two tie-cribs separating each measurement.

using the dynamic and static deflection data from the first (September) test and found a high degree of correlation. Using the correlation equation obtained from that analysis, the best-fit curve indicated that locations where the modulus was expected to be less than the target minimum of 2,750 lb/in² were likely to have a 25-foot average deflection of 0.28 inches, the same value as my initial estimate.

Second, after the November testing was completed, TTCI performed a regression using the combined track modulus values from the September and November tests (plotting these values against the 2-foot moving average deflection data generated in September), and found that it provided a correlation coefficient of 82.1%. This coefficient demonstrates that dynamic track deflection data is a very reliable indicator of static track modulus. The resulting regression equation showed that a modulus of 2,750 lb/in² correlates to a relative track deflection of 0.274 inches, 7/ which again confirms the reasonableness of the 0.28-inch deflection limit used in the field to identify locations where static track modulus testing might productively be performed.

7/ TTCI uses a value of 0.27 inches to be conservative and because the resolution of the measuring system on the TLV is on the order of 0.01 inches.

It was unnecessary for TTCI to test every location where the moving 2-foot deflection data indicated that the 0.28-inch deflection limit was exceeded. This is because, as discussed below, the 2-foot deflection data is not indicative of a meaningful track support problem; it is only after this data is synthesized into moving 25-foot deflection data that any useful track support conclusions can be drawn from the data.

The reason for statically testing the vertical track deflection and track modulus of certain locations was to ascertain the relationship between the dynamic deflection data and the corresponding static data at the same location. Once enough samples were taken to permit satisfactory establishment of this relationship, no further static testing was necessary. Having confirmed that dynamic deflection data is a reliable indicator of track modulus, TTCI could then confidently use 25-foot moving average deflection data to indicate where track modulus falls below the 2,750 lb/in² standard.

In this regard, exact correspondence between track modulus derived from dynamic deflection data and track modulus measured in the field through static testing should not be expected. Although a correlation coefficient of 82.1% indicates that dynamic deflection data is a very reliable indicator of

track modulus, it does not suggest that there is always an exact correspondence between the two. 8/

The amount of variability in the relationship between the two values would not be expected to be meaningful given (i) the very high mean and median track modulus calculated by TTCI for the line (5,346 lb/in² and 5,258 lb/in², respectively), and (ii) the frequency distribution evidenced by the individual track modulus values calculated by TTCI (depicted in Figures 8 and 9 of the TTCI Report (p. 14)) which indicates that the vast preponderance of the track modulus values are well in excess of 2,750 lb/in². Variation around these very high values would not be great enough to change the overall conclusion that the line has a track modulus well in excess of 2,750 lb/in², and that at most, only a handful of isolated locations have values below that benchmark.

At the time that my two verified statements were submitted in last year's clarification proceeding, TTCI had not worked out the use it would make of regression analysis in its testing of the Plaistow-Portland line. Accordingly, my

8/ This is illustrated by the fact that in Figure 5 of the TTCI Report (p. 11), the static measurements do not all fall precisely on the depicted regression curve, some being above the curve and some below it.

description in those statements of the testing that TTCI would perform did not address regression analysis or how the selection and number of static tests would be influenced by the use of that analysis. Instead, my statements discussed generally conducting stationary track modulus tests at locations where dynamic deflection data suggested there may be a track modulus issue, without addressing how the results derived in such testing would be used. Now that TTCI has fully developed the regression analysis approach it employed, I am very comfortable with that approach, and believe that it affords an efficient and reliable means of assessing track modulus.

C. Appropriate Use of 25-Foot Moving Average

As noted above, the TLV measured or "sampled" the relative deflection of the Plaistow-Portland line 100 times per second, which corresponds to a measurement every 1.81 inches at the test speed of 10 miles per hour. This deflection data was averaged over a moving 2-foot baseline to remove any spurious data that might result from high frequency electronic noise or vibration in the system. The TLV computer saved the 2-foot average data, but not the data measured every 1.81 inches that were used to obtain the average data.

The average deflection over the 2-foot baseline length was calculated and recorded as the deflection value at the

midpoint of the baseline. The baseline was then advanced to the next measurement interval (advanced by 1.81 inches) and the average deflection value was calculated again and assigned to the next position. The same number of data points were always being averaged as the baseline moved along because as the next data point was picked up at the leading end, the last data point dropped off.

The data that were averaged over the 2-foot moving baseline was then averaged over a 25-foot moving baseline. This 25-foot baseline removes the effects of short track sections with features that may exhibit more than nominal deflection such as bridge approaches, highway crossings, switches, and crossties in poor condition. Any excessive deflection at these short track sections is due to voids between rail, tie, and ballast, can be corrected by routine maintenance, and is not a function of underlying track support.

The track modulus measurement is intended to identify soft substructure conditions beneath the tie/ballast interface. Because substructure support does not change appreciably over 2-foot intervals, the longer, 25-foot baseline is needed to identify locations with potentially excessive substructure deflection.

Not only does use of a 25-foot baseline eliminate the influence of short, aberrational track segments which are not indicative of underlying track support, but it also squares with the "footprint" of a typical rail car. The axles of a typical rail car truck depress approximately 25 feet of track as they move along a line. By employing a 25-foot moving average of deflection data, TTCI captures the influence of rail car loading on a particular section of track.

Although the single-axle TLV load serves to obtain the deflection values, the length of track over which these deflection values are averaged is chosen based on the deflection basin produced by the common loading case of a two-axle truck. In this way, the effective length of the track that contributes to the deflection response is obtained, and provides the best means of assessing track support. In fact, there is a strong case to be made that a much larger averaging length than 25 feet should be employed, given that the end trucks of two vehicles produce a significantly longer deflection basin with little unloading between the trucks. TTCI, however, has conservatively limited its averaging length to 25 feet.

Based on the moving 25-foot average deflection data it developed, TTCI found that the Plaistow-Portland line had an average track modulus of 5,346 lb/in² and a median track modulus

of 5,258 lb/in². It also found that only 166 feet of the 355,186 feet of track that it tested had a track modulus equal to or less than 2,750 lb/in². This is not the profile of a line with any significant track support problems. Instead, as would be expected given its recent, extensive rehabilitation, the line - including its newly installed 115-pound rail - is soundly supported and well within industry standards.

TTCI identifies 14 locations where dynamic track deflection is equal to or greater than 0.27 inches and track modulus would be expected to be equal to or less than 2,750 lb/in². As a practical matter, these 14 locations fall into two groups.

First, 7 locations, accounting for a total of 107 feet of track, are in the Kennebunk, ME area (MP 220.74 to MP 220.93). Of these 7, two locations actually satisfy the 2,750 lb/in² standard, having a maximum deflection of 0.27 inches and a track modulus of 2,796 lb/in² (conservatively rounded downward by TTCI to 2,750 lb/in²). Aware of track support problems in this area, Amtrak and NNEPRA did not have TTCI conduct any static track modulus testing at these locations. Amtrak trains will operate at a maximum speed of 30 miles per hour over this track pending resolution of these problems, and demonstration that the track qualifies for a Federal Railroad Administration track

class (which is unrelated to track modulus) that will permit faster speeds.

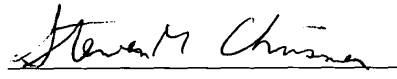
Second, the remaining 7 locations occur at isolated locations on the Plaistow-Portland line and in each case involve only a relatively small number of feet of affected track. One of these locations (MP 205.45) satisfies the 2,750 lb/in² standard, having a maximum deflection of 0.27 and a track modulus of 2,796 lb/in² (conservatively rounded downward by TTCI to 2,750 lb/in²). Two of the locations (MP 213.24 and MP 272.89) involve track over which Amtrak does not propose to operate at 79 miles per hour, and hence the track modulus measurement at each location of 2,676 lb/in² is more than adequate to support operations over this track.

This leaves 4 locations where Amtrak plans to operate at 79 miles per hour and track modulus was modestly below the 2,750 lb/in² standard. None of these locations evidences any material track support deficiencies. Three of the locations have a modulus of 2,676 lb/in² and one a modulus of 2,462 lb/in². They range in length from 2 feet to 18 feet. Stationary track modulus testing was conducted at or in the vicinity of each location, and no inherent support problems were identified. Accordingly, there is no valid reason why, assuming the track is

properly inspected and maintained, 79 miles-per-hour Amtrak operations should not be conducted over this track.

VERIFICATION

I, Steven M. Chrismer, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement. Executed on April 8, 2002.

A handwritten signature in cursive script, appearing to read "Steven M. Chrismer", is written over a horizontal line.

Steven M. Chrismer



LTK Engineering Services

**Steven M. Chrismer, P.E.
Senior Engineer**

Executive Summary

Dr. Steve Chrismer has devoted nearly two decades to studying and working with rail track. Steve spent 17 years doing research and general engineering for the Association of American Railroads where he concentrated on the area of vehicle-track interaction and developed a variety of methods to reduce maintenance requirements and mitigate track-train forces.

While with LTK, Steve has worked on a variety of projects with duties that have included investigating track maintenance procedures, clearance requirements of vehicles and vehicle compliance with ADA at platforms. He has also conducted a variety of investigations, including those devoted to excessive noise, truck frame cracking and derailments.

Employment

LTK Engineering Services

1998 to present: Senior Engineer

Association of American Railroads

1982 to 1998: Senior Research Engineer

Education

B.S., Civil Engineering,
Pennsylvania State University, 1980
M.S., Civil Engineering,
Pennsylvania State University, 1983
Ph.D, Civil Engineering,
University of Massachusetts, 1994

Professional Registration

Licensed in Colorado and Pennsylvania

Affiliations

AREMA



Project Experience

Railtrack (UK) (2001)

Investigated existing track maintenance procedures and practices, and proposed changes based on "best practices" to prevent formation of the type of rail defects which led to the fatal Hatfield derailment. Assisted in advancing the understanding of the vehicle-track interaction mechanism that leads to the formation and propagation of this type of rail defect.

Metropolitan Transit Authority of Harris County (2000 to Present)

Determining specification requirements for vehicle clearance, dynamic stability in curves and tangent track, wheel dimensions and profile, and vehicle compliance with ADA at platforms.

Sacramento Regional Transit (2000 to Present)

Inspected vehicles and track to determine causes of excessive wheel/rail noise while curving,

and of hunting motions in tangent track.
Made recommendations on vehicle and
track modifications.

***Tri-County Metropolitan Transportation
District of Oregon (2000)***

Inspected vehicles and track to
determine causes of excessive
wheel/rail noise while curving, and of
hunting motions in tangent track. Made
recommendations on vehicle and track
modifications.

Amtrak (1998 to Present)

Working on Amtrak High Speed Trainset
project checking the carbuilder's
engineering analyses and compliance
with specifications.

Port Authority Transit Corporation (1999)

Provided assistance to PATCO in
determining the cause of truck frames
cracking.

***Association of American Railroads -
Transportation Technology Center, Inc. (1982
to 1998)***

Developed engineering design and
economic principles to provide for a
more cost-effective selection of track
materials and track maintenance
methods. Duties also included
determining the economic impact of
heavy axle loads on the track structure
and performing analysis with NUCARS
model to determine and mitigate
vehicle-track forces. Routinely worked
with AAR member railroads to produce
savings to the industry by reducing
operating cost and improving track
performance. Helped the railroad
industry realize large cost savings due
to elimination of unnecessary,
inappropriate, or ineffective track
maintenance.

CUNNINGHAM

343

VERIFIED STATEMENT OF JOHN J. CUNNINGHAM

My name is John J. Cunningham. I am the Chief Engineer for Policy, Planning & Standards of the National Railroad Passenger Corporation ("Amtrak"). In that position, I am responsible, among other things, for overseeing Amtrak's technical standards for track construction, track maintenance and track safety, and for developing Amtrak's capital program for track construction and rehabilitation.

I have spent 40 years in the railroad industry, the last 35 of which have been in maintenance-of-way positions. I joined Amtrak in 1973, and was appointed Assistant Chief Engineer, Maintenance of Way and Structures, in 1985. In that position, and in my subsequent position as Assistant Chief Engineer, Track, which I held from 1995 until I assumed my current position in January of 1998, I was responsible for all track construction and maintenance on the more than 2,500 miles of track that Amtrak owns, and for the development and issuance of Amtrak's track construction, track maintenance, and track safety standards. Since 1985, I have also been responsible for Amtrak's monitoring of track conditions on both its own rail lines and the rail lines owned by freight railroads and commuter authorities over which Amtrak operates.

I am a former member of the Board of Directors of the American Railway Engineering & Maintenance Association ("AREMA"), formerly the American Railway Engineering Association. I am also a member of AREMA Committee 12 (Passenger & Commuter) and AREMA Committee 17 (High Speed Rail).

In this verified statement I explain, first, the function of track support (i.e., "track modulus") in railroad maintenance and operations. The primary use and consideration of track modulus is in the design of the roadbed for new or rehabilitated track, so that adequate support is provided for the track. With respect to track maintenance, track modulus will affect the amount of maintenance required to maintain acceptable track geometry for a given operation.

Next, I describe the condition of the Guilford Transportation Industries, Inc. ("Guilford") Plaistow-Portland line, as revealed by hi-rail car and geometry car inspections that Amtrak made in June and July 2001. In general these inspections demonstrated that the line would support passenger train operation at speeds up to the proposed 79 MPH except in a few instances where slower speeds are indicated.

Third, I discuss the speeds at which Amtrak proposes to operate its passenger trains on the Plaistow-Portland line, which I conclude are appropriate and safe.

The Role Of Track Support (Modulus)
In Railroad Maintenance And Operations

I have been asked by Amtrak to describe how "track modulus" affects maintenance of railroad track.

The first thing that I want to point out is that track modulus is not used as a safety criterion and as such is not something that railroads normally measure or inspect for in connection with track maintenance. However, track support is important in track maintenance, and track modulus is a measure of track support. Operating railroads demonstrate a large range of track modulus, typically from 1,000 to 5,000 pounds per inch per inch ("lb/in²"). I understand that the inspection of the Plaistow-Portland line by Transportation Technology Center, Inc. ("TTCI") using its Track Loading Vehicle ("TLV") showed that the average track modulus of this line is 5,346 lb/in². This is a very high value and reflects the fact that this line has been fully rehabilitated and that it enjoys a superior support medium due to the glacial moraine subsoil, made up of sand, gravel, and boulders.

Adequate track support is important to track maintenance in two senses. First, well-maintained track is expected to provide adequate support for the track components, such as rails and ties. "Soft" track support in a particular location is a sign that the track will need more maintenance at

that location for a given traffic level; for example, the track may require more surfacing cycles to maintain acceptable track geometry than a track with higher support values.

Second, if track has poor support the track components, such as rail, ties, and other track material, will wear out faster. This is because track moves, laterally and vertically, as trains run over it, and poorly-supported track will move more than well-supported track. The excess movement of poorly-supported track causes the track components to wear out prematurely, resulting in higher expenditures for track maintenance over time.

Although railroads want their track to be adequately supported, they do not use measurements of track modulus to determine whether or not their tracks have sufficient support. Track modulus is difficult and time-consuming to measure. Until the recent development of the TLV by TTCI, track modulus could be measured only by manual methods at a few selected locations on a rail line; it was impractical to measure track modulus over the length of an entire line. Even today, with the new technology TTCI has developed, most railroads are not likely to start measuring track modulus as part of their routine maintenance practices, because it is not necessary to do so.

Railroads can determine if their track is adequately supported through periodic inspections, without measuring track

modulus. Such inspections, which are required by the Federal Railroad Administration ("FRA"), are able to identify locations and causes of inadequate track support, such as drainage problems or weak subsoil. A track is generally considered to have inadequate support when the number of treatments for maintenance and the cost of maintenance are significantly higher than the norm for the railroad or industry.

Railroads use a track geometry car to inspect the gage, alignment, cross-level, and other parameters of track; inadequate track support can result in frequent deficiencies in these parameters, which will be detected by the track geometry car. Amtrak has developed a special track geometry car, which conducts tests while operating at the rear of a train at speeds of up to 125 MPH.

When visual or mechanized inspection reveals that a segment of track has a problem caused by inadequate track support as evidenced by accelerated degradation, appropriate maintenance can be carried out to correct the root cause of the poor support. Generally speaking the work necessary to cure the root cause of poor support can be as simple as cleaning out a track side ditch to provide drainage or as complex as creating a new drainage system or increasing the thickness of the granular layer in the substructure. The most common cause of poor support in an existing railway is impeded drainage that entraps water in

the substructure of the track. In many cases this can be cured by ditch maintenance or the reconstruction or improvement of ditch lines.

Track modulus is not a safety criterion. There is no FRA track safety standard for track modulus. Of course, if poor track support is not addressed through maintenance, it may eventually contribute to safety problems, such as bad alignment, deteriorated ties, etc., that will violate FRA standards, but poor track support is not a violation of any safety standard, nor in itself a hazardous condition.

It is perfectly safe to operate at scheduled speeds over a segment of track that has poor support, but meets the applicable FRA standards, until the cause of the poor support can be addressed through maintenance. If a railroad decides to reduce operating speeds over such a segment, it does so for reasons of maintenance economics - because faster operations would cause the poorly-supported track to wear out more quickly - but this is not required for safety reasons.

In the case of the Plaistow-Portland line over which Amtrak is now operating, FRA regulations require twice weekly track inspections. In addition, Amtrak will operate its track geometry car over the line every six months during the first year of 79-MPH operations and annually thereafter. The results

of a track geometry inspection on July 8, 2001 are summarized in the next section of this statement.

The Condition Of The Plaistow-Portland Line

In addition to the testing of the Plaistow-Portland line by TTCI using its TLV (which is discussed in the Verified Statements of David Read, David Staplin, and Steve Chrismer), Amtrak has performed its own inspections in order to determine the track's condition and ability to support the proposed operations. The testing by Amtrak included a visual inspection by hi-rail vehicle on June 27, 2001 and a track geometry car inspection on July 8, 2001. The results of Amtrak's tests show that the line has been satisfactorily rehabilitated and the planned operations can be conducted safely at the speeds proposed and without excessive maintenance expenses.

The hi-rail inspection was performed by Conrad Ruppert, Amtrak's Division Engineer. He traveled over the line in a hi-rail vehicle observing conditions visually and stopping to make more detailed inspections where appropriate. He noted that there were track support problems in the vicinity of Kennebunk, ME. Other than that, he concluded that the condition of the line was suitable for Amtrak's proposed operations at speeds up to 79 MPH.

The track geometry inspection of the Plaistow-Portland line was made under the supervision of Amtrak's Senior Director

of Clearances Inspection and Tests and a crew of three technicians for operation of the car. Amtrak's track geometry car was attached to the rear of a special train and ran the length of the line at speeds up to 60 MPH, inspecting for any deficiencies in gage, alignment, profile, and warp. These parameters were measured by the non-contact inertial measurement system of the car. The test of the main tracks was completed in one day and the sidings were tested on the return trip the following day.

The inspection was successfully carried out and yielded comprehensive and reliable results. It showed that the geometry of the track in question is suitable for the proposed Amtrak operations at speeds of up to 79 MPH. 1/ The few track geometry exceptions that were detected were found to be minor and/or easily reparable at minimal cost; they were reported to Guilford for action.

In sum, the hi-rail car and track geometry car inspection results showed that the Plaistow-Portland line is

1/ Defects in the geometry of two stretches of track around Kennebunk limit speeds to 30 MPH (FRA Class 2), as reflected in Amtrak's proposed operating speed table, discussed in the next section. When the track support in that area is improved and the proper geometry restored, the line will be suitable for 79-MPH operation in that area. In a few locations the superelevation of curves was found to be inadequate, which will require slower operation around those curves until the situation is resolved.

fully capable of the proposed 79-MPH operations and will require minimal expenditures for future repairs due to track support conditions. These inspections confirmed the excellent track support conditions shown by TTCI's inspection of the line using its TLV.

Amtrak's Proposed Operating Speeds

The speeds at which Amtrak proposes to operate are discussed in Attachment 25 of the Verified Statement of Michael Murray. The speeds on most line segments were agreed on by Amtrak and Guilford in 1999, subject to the Surface Transportation Board finding that 115 lb. rail was sufficient to support 79-MPH operations. In a few instances Amtrak has decided that operational considerations dictate different speeds over certain segments, for the time being. Where reduced speeds are due to current track conditions, they will be adjusted upward when those conditions are corrected, in accordance with the agreement between the parties.

In my opinion, based on the results of the thorough track inspections and testing by Amtrak personnel and by TCCI, the Plaistow-Portland line is suitable for Amtrak passenger operations at the proposed speeds of up to 79 MPH.