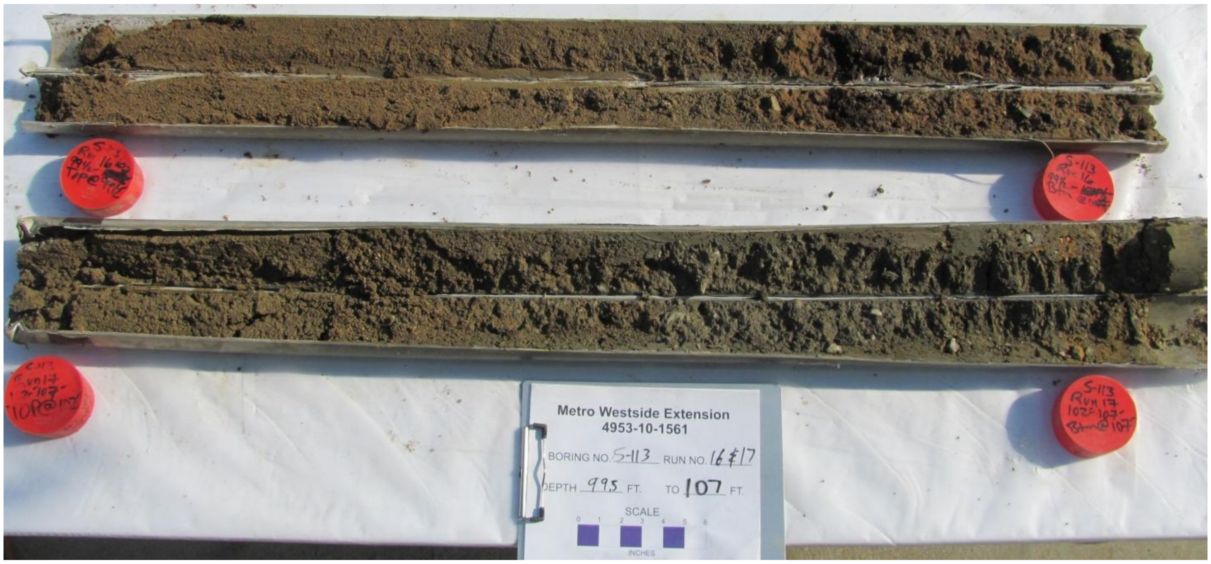


S-113 [99.5 – 107 feet]

S-113 [107 – 117]

Figure A-9.72

S-113 [117 – 122 feet]

Figure A-9.73

S-114 [6 –18 feet]

S-114 [18–28 feet]

Figure A-9.74

S-114 [28–38 feet]

S-114 [38–48 feet]

Figure A-9.75

S-114 [48–58 feet]

S-114 [58–68 feet]

Figure A-9.76

S-114 [68–78 feet]

S-114 [78–88 feet]

Figure A-9.77

S-114 [88–98 feet]

S-114 [98–108 feet]

Figure A-9.78

S-114 [108–120 feet]

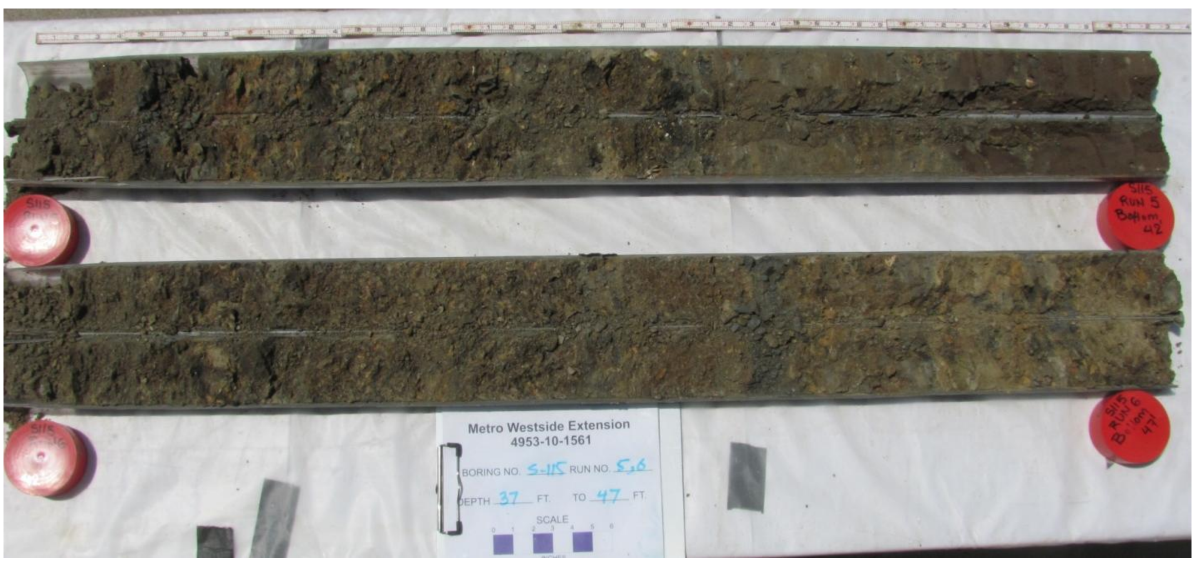
Figure A-9.79

S-115 [7 – 17 feet]

S-115 [17 – 27 feet]

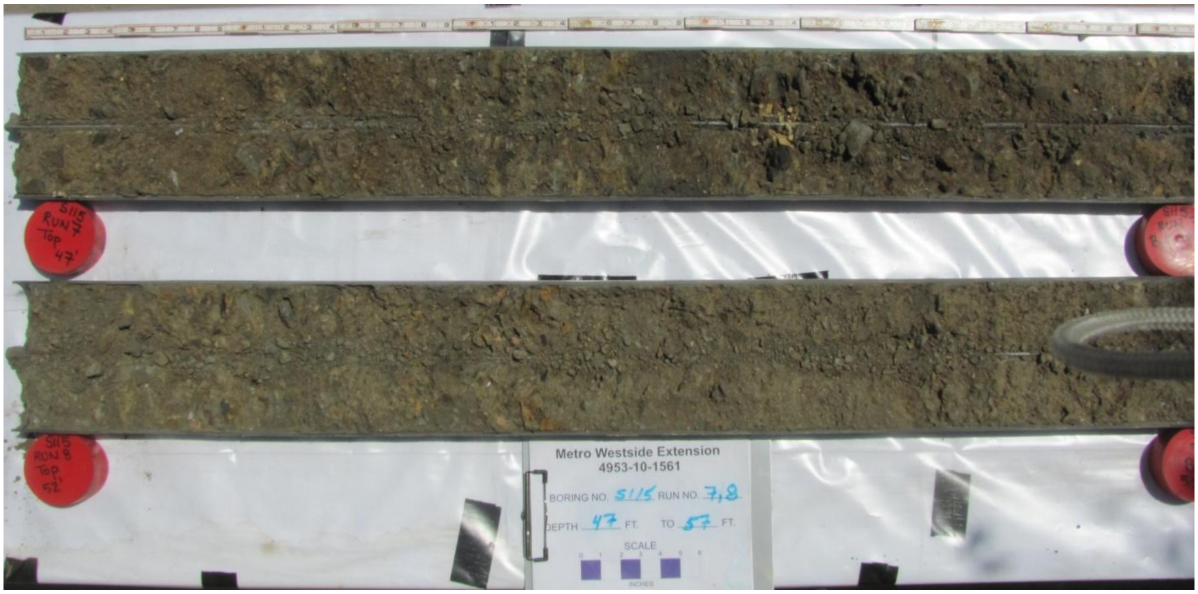
Figure A-9.80

S-115 [27 – 37 feet]

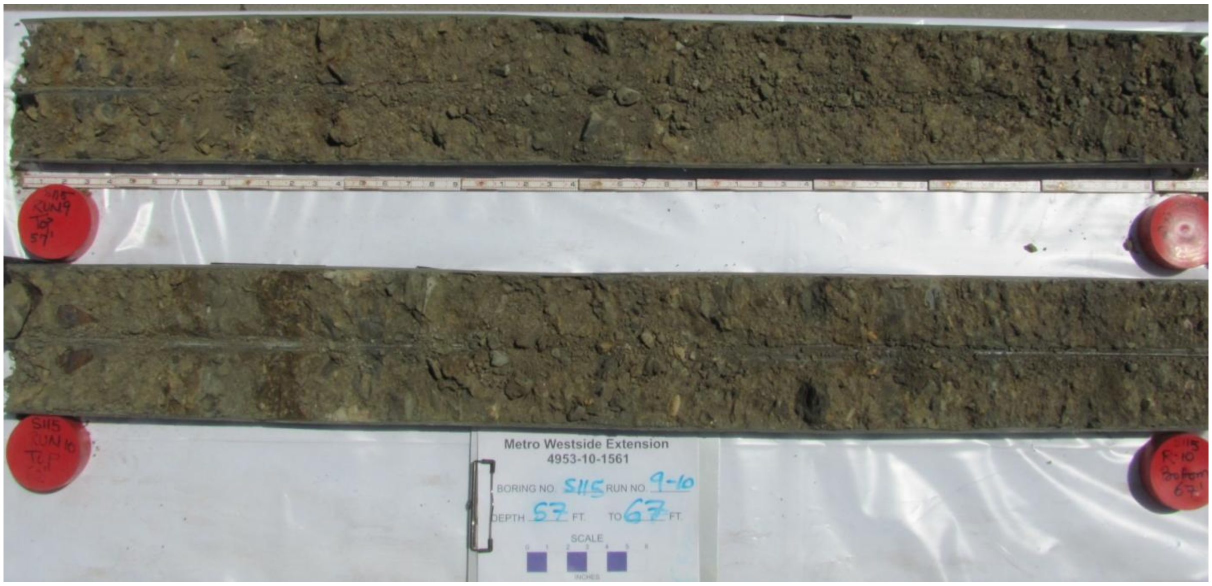


S-115 [37 – 47 feet]

Figure A-9.81



S-115 [47 – 57 feet]

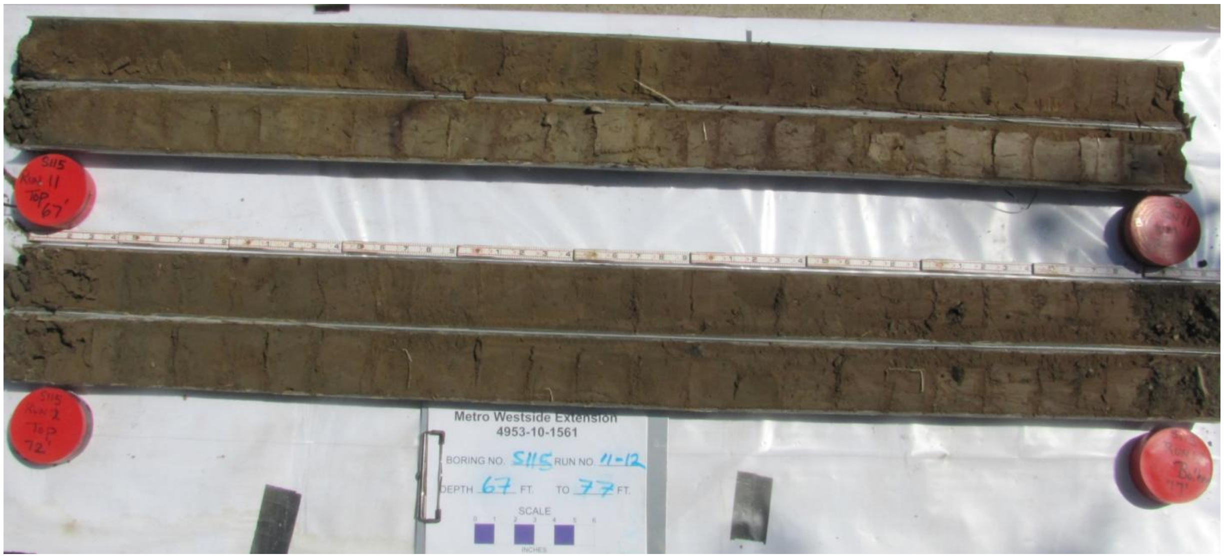


S-115 [57 – 67 feet]

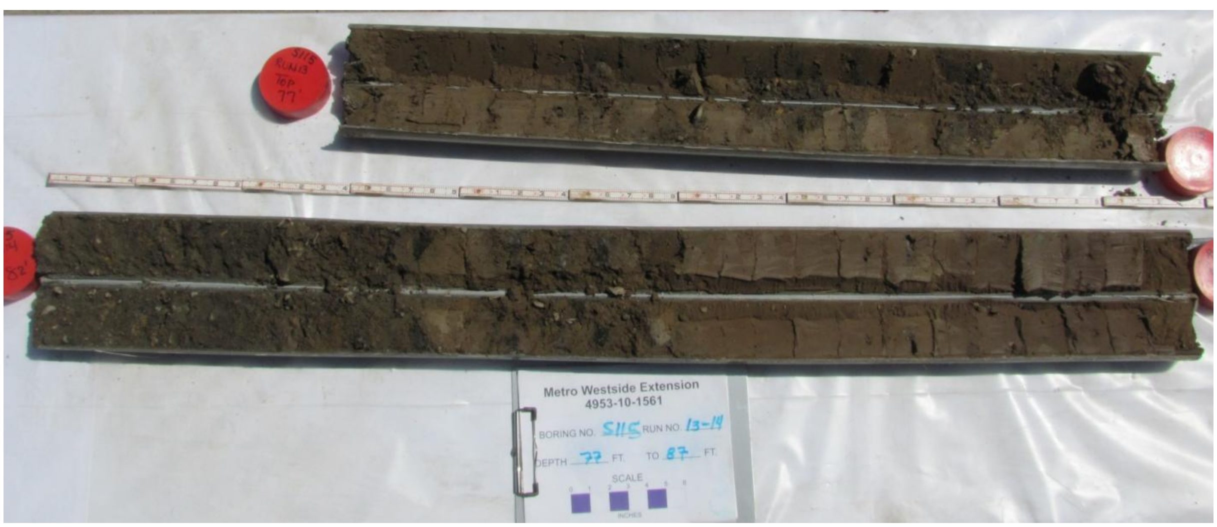
Figure A-9.82

Westside Subway Extension, Project No. 4953-10-1561

By: Y.N. 6/15/11, Checked By: APR 6/30/2011

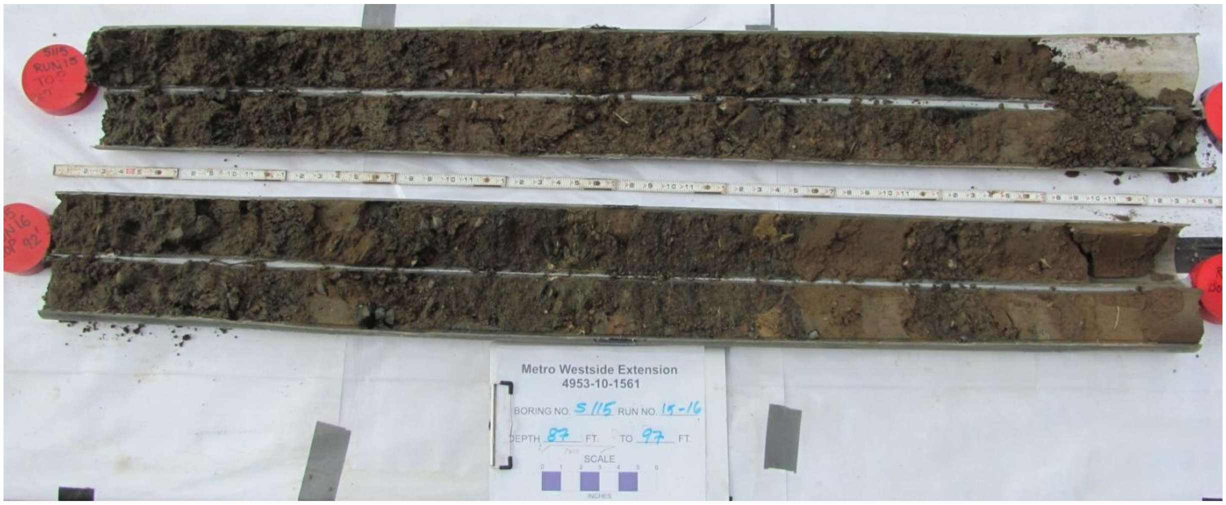


S-115 [67 – 77 feet]



S-115 [77 – 87 feet]

Figure A-9.83



S-115 [87 – 97 feet]

S-115 [97 – 107 feet]

Figure A-9.84

S-115 [107 – 117 feet]

S-115 [117 – 122 feet]

Figure A-9.85

S-116 [7 –17 feet]

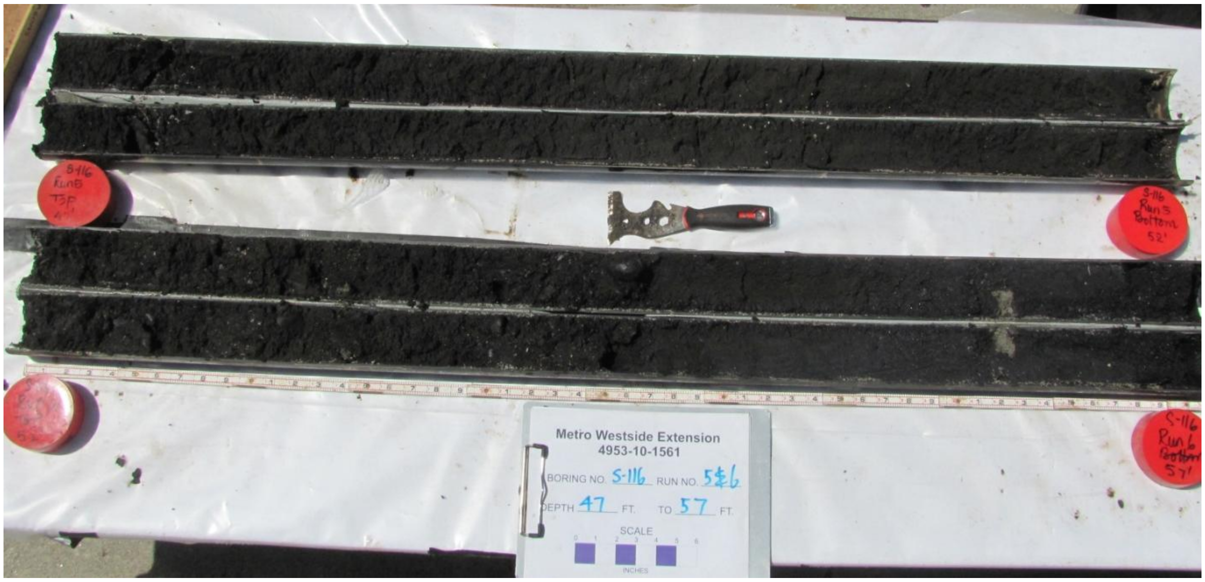
S-116 [17 – 27 feet]

Figure A-9.86

S-116 [27 – 37 feet]

S-116 [37 – 47 feet]

Figure A-9.87



S-116 [47 – 57 feet]

S-116 [57– 67 feet]

Figure A-9.88

S-116 [67 – 77 feet]

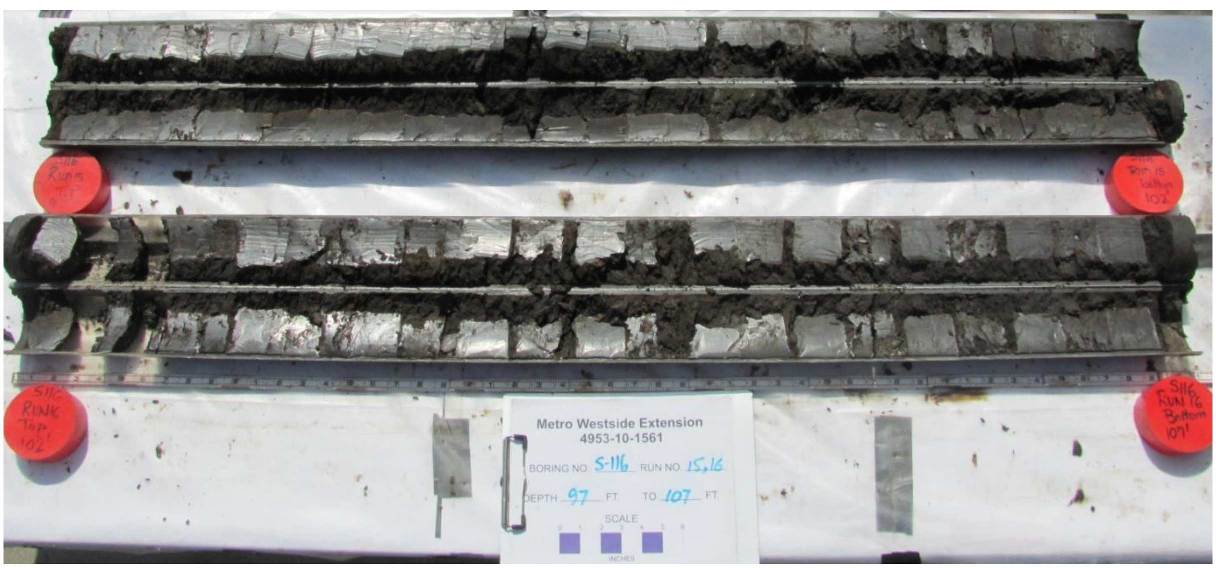
S-116 [77 – 87 feet]

Figure A-9.89

Westside Subway Extension, Project No. 4953-10-1561

By: Y.N. 6/15/11, Checked By: APR 6/30/2011

S-116 [87 – 97 feet]



S-116 [97 – 107 feet]

Figure A-9.90

Westside Subway Extension, Project No. 4953-10-1561

By: Y.N. 6/15/11, Checked By: APR 6/30/2011

S-117 [11 – 17 feet]

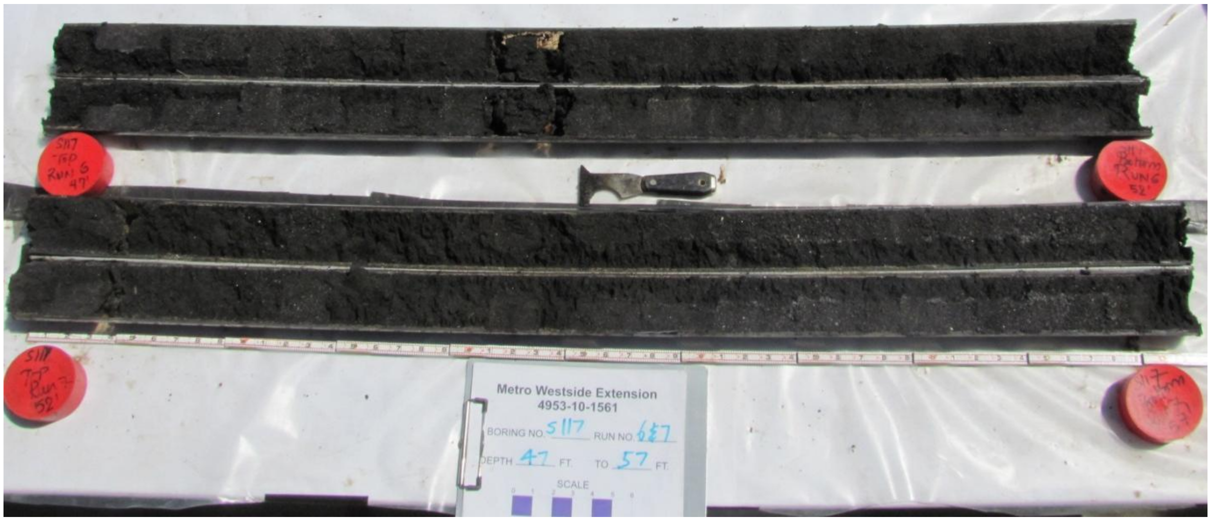
S-117 [17 – 27 feet]

Figure A-9.91

S-117 [27 – 37 feet]

S-117 [37 – 47 feet]

Figure A-9.92



S-117 [47 – 57 feet]

S-117 [57– 67 feet]

Figure A-9.93

S-117 [67– 77 feet]

S-117 [77 – 87 feet]

Figure A-9.94

S-117 [87 – 97 feet]

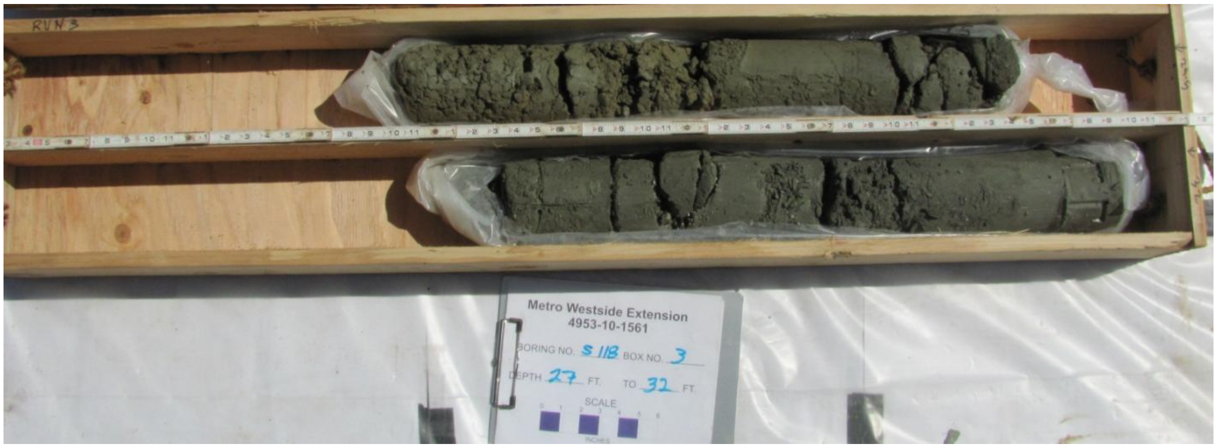
S-117 [97 – 102 feet]

Figure A-9.95

S-118 [7 –17 feet]

S-118 [17 – 27 feet]

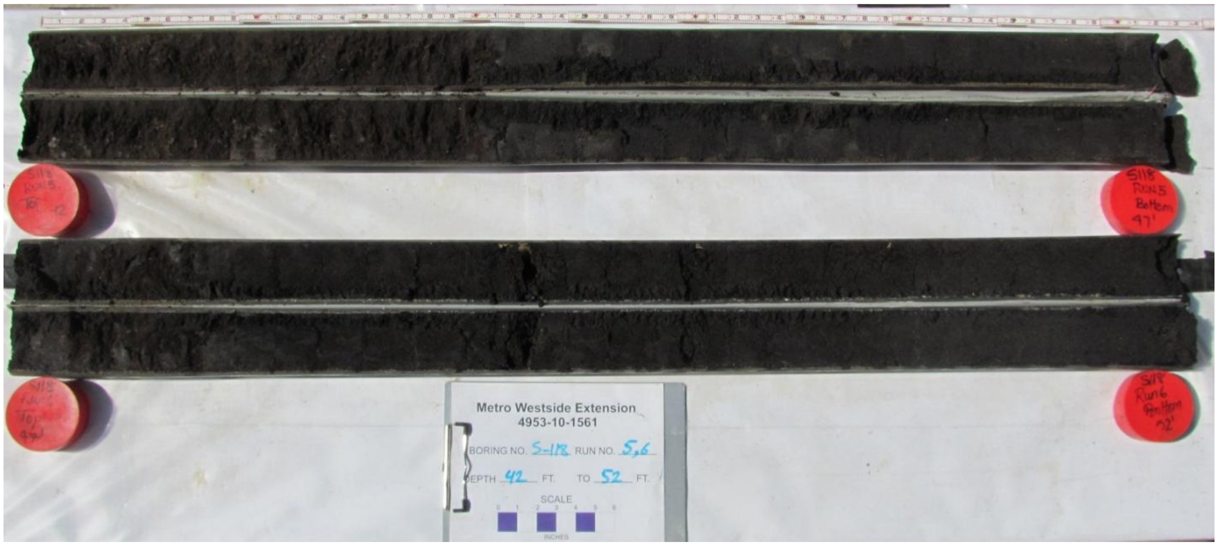
Figure A-9.96



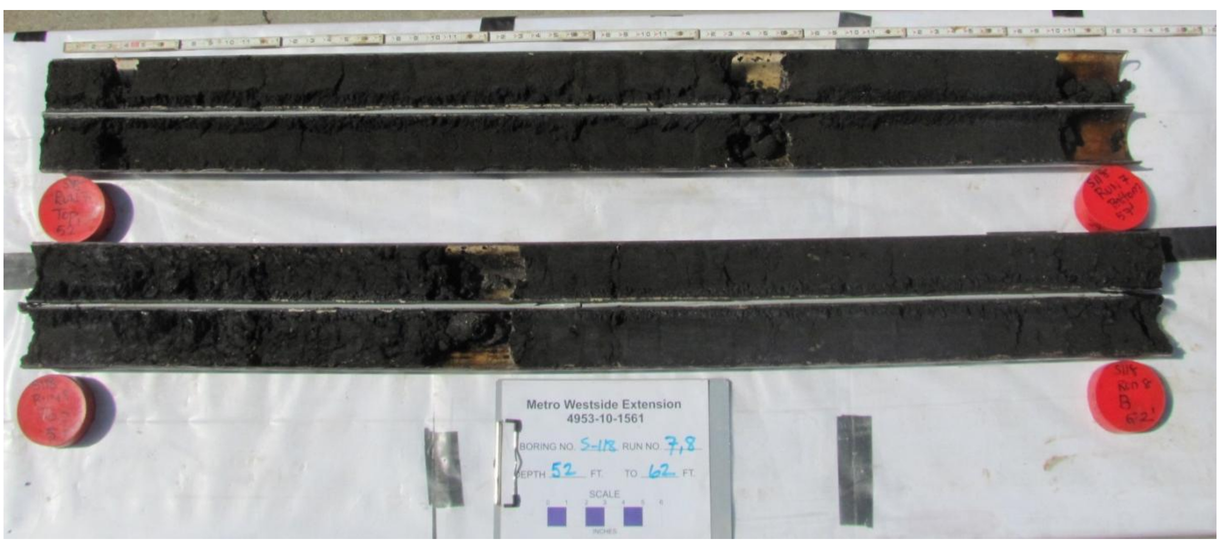
S-118 [27 – 32 feet]

S-118 [32 – 42 feet]

Figure A-9.97



S-118 [42 – 52 feet]



S-118 [52– 62 feet]

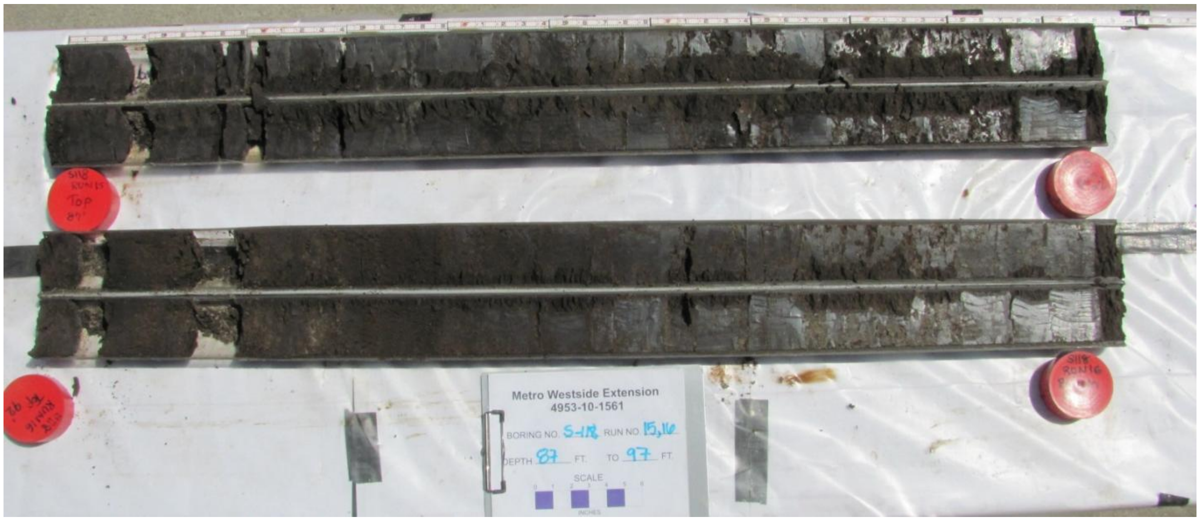
Figure A-9.98

S-118 [62– 72 feet]

S-118 [72 – 77 feet]

Figure A-9.99

S-118 [77– 87 feet]



S-118 [87 – 97 feet]

Figure A-9.100

S-118 [97 – 102 feet]

Figure A-9.101

FIGURES A-10.1 THROUGH A-10.78
NOISE/VIBRATION TESTING (PE PHASE)

MEMORANDUM

To: Steven Wolf
Parsons Brinckerhoff

From: Matthew Sneddon
Hugh Saurenman
ATS Consulting

Date: June 21, 2011

Subject: Results of Borehole Vibration Propagation Tests for Westside Subway Extension

Table of Contents

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1. INTRODUCTION

1.1 Overview

This report presents the results of vibration propagation tests that were performed to assist in predicting the levels of groundborne vibration and noise that would be generated by the proposed Westside Subway Extension. The testing was performed as part of the Final Environmental Impact Statement and Environmental Impact Report (FEIS/EIR).

Borehole vibration tests were performed in order to determine directly the vibration propagation characteristics for subsurface vibration sources at a given site. The test method consists of generating ground vibration at the bottom of the hole using the drill rig penetration drop hammer. The impulsive forces transmitted into the soil at the bottom of the borehole are measured using a special load cell and the resulting surface acceleration measured at varying distances from the hole.

The resulting measurements are digitally processed to obtain the *transfer mobility*, which characterizes the relationship between the exciting force and the resulting ground motion. Additional details on the test procedure, equipment, and data processing is provided in Section 2.

Testing was performed at 12 sites, selected from the roughly 100 rotary-wash boreholes that were part of the overall geotechnical investigation undertaken by Mactec Engineering[1]. The locations of the test boreholes, the test dates, and the depths of the tests are given in Table 1 and Figure 1 shows the general locations of the test sites.

Table 1: Borehole Locations and Test Dates

Borehole	Location / Cross Street	Test Date(s)	Test Depths (ft)
G-106	Wilshire / Arden	24-Mar-2011	50, 60, 70
G-124	Wilshire / Fairfax	17-Mar-2011	40, 55, 60
G-134	Wilshire / Hamel	30-Mar-2011	50,60, 70
G-145	Wilshire / El Camino	14 - 15 Mar 2011	50, 60, 70
G-152	Santa Monica / Wilshire	31 Jan - 1 Feb 2011	55, 65, 75
G-164	Moreno / Young	26 - 27 Jan 2011	45, 55, 65
G-165	Beverly Hills HS (classrooms)	5-Mar-2011	55, 65, 75
G-166	Beverly Hills HS (Lacrosse field)	19-Mar-2011	55, 65, 75
G-173	Missouri / Fox Hills	21 - 22 Feb 2011	60, 70, 80
G-176	Warner / Thayer	27-Dec-2010	80, 90, 97
G-178	Wilshire / Manning	17-Jan-2011	65, 75, 85
G-203	VA Medical Center	3-May-2011	55, 65, 75

[1] MACTEC Engineering and Consulting Inc., Project 4953-10-1561

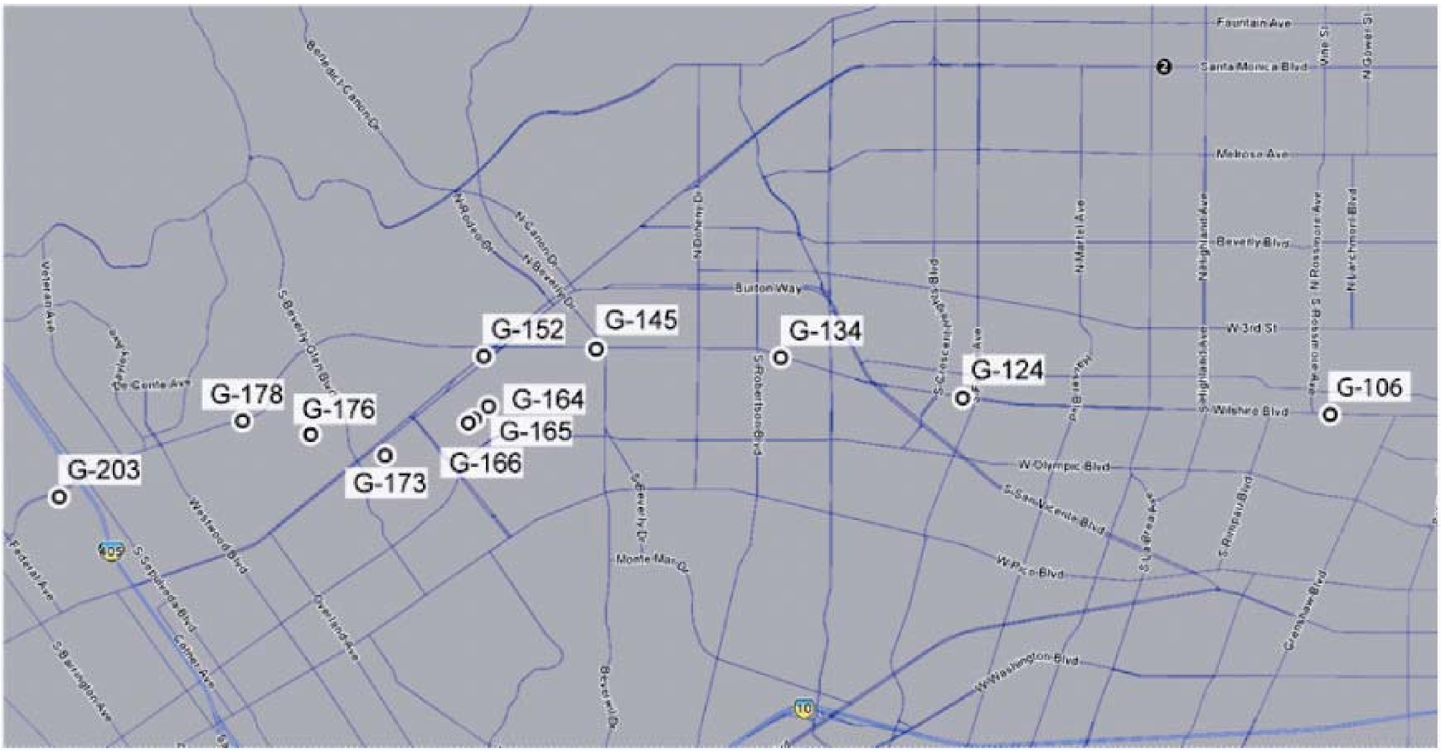

Figure 1: Overview of Vibration Test Borehole Locations

1.2 Executive Summary

The 12 borehole sites listed in Table 1 were selected for the vibration survey based on two criteria. The first consideration was to select test sites based on their proximity to vibration-sensitive sites previously identified in the draft EIS/EIR as exceeding the Federal Transit Administration (FTA) criteria. The second was to select locations that would provide a reasonably uniform sampling along the proposed subway alignment. Three of the sites selected for this study (G-164, G-165, and G-166) were located at or near Beverly Hills High School, which had been identified as a site of particular concern.

At many of the test sites, the borehole vibration measurements and the subsequent mobility calculations were affected by unexpectedly low force level being developed at the bottom of the boreholes, high ambient vibration levels, or a combination of the two. The resulting low signal-to-noise ratio levels resulted in a relatively high scatter in calculated point source transfer mobility (PSTM) values. The line source transfer mobility (LSTM) functions derived from the PSTM data have been reviewed for reasonableness and provide a good estimate of vibration propagation characteristics over frequency ranges that the coherence exceeds 0.3. However, care should be exercised applying the derived LSTM functions at low and high frequencies and at diagonal distances that are outside the 50 to 200 foot range of the measurement data.

Figure 2 provides an overview of the final LSTM curves for the twelve sites assuming a vibration line source that is the length of a 6-car train and a 100 foot receiver distance. The shapes of the 1/3 octave band spectra are all similar. There is a broad peak in the LSTM spectra between 16 and 40 Hz with the LSTM falling off at a rate of about 10 decibels per octave at higher frequencies. The LSTM curves all fall within an 18-dB wide envelope at essentially all frequencies. Sites that are toward the high side of this envelope are G-106, G-134, and G-176. Sites G-145 and G-178 fall noticeably below the mean for most of the frequency range.

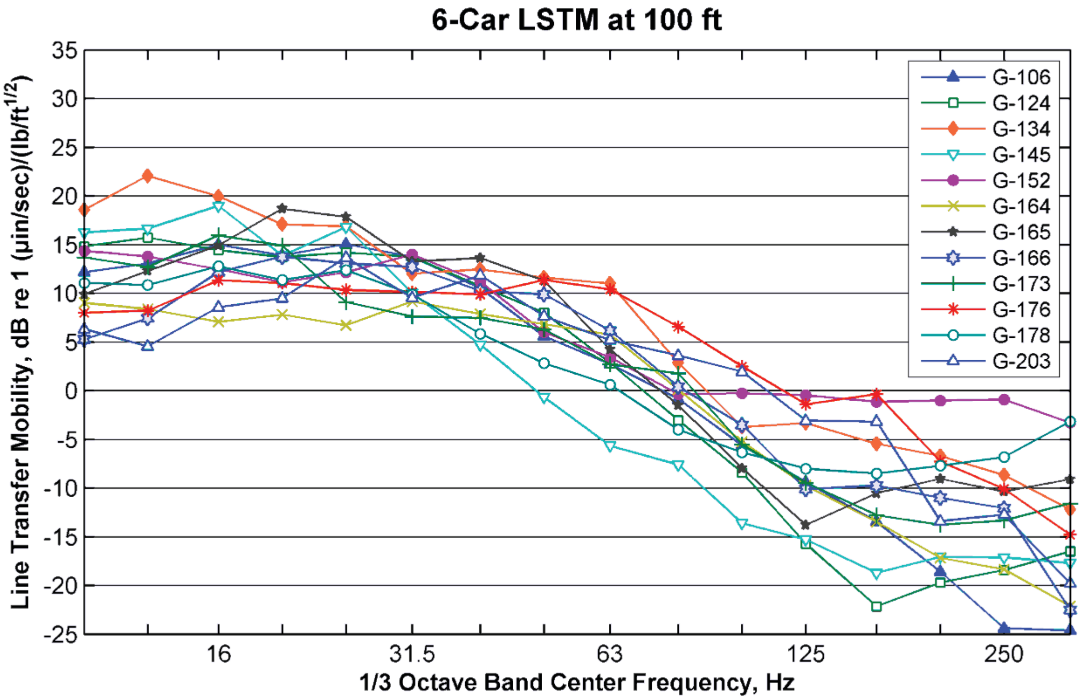

Figure 2: Cross-site Comparison of LSTM Values (6-Car trains at 100 Foot Diagonal Distance)

Additional observations from inspection of the 12 LSTM functions are:

- **Comparisons between G-164, G-165, and G-166:** These sites were closely spaced, with 475 feet separating G-164 and G-165, and only 220 feet between G-165 and G-166. The resulting LSTM spectra for these three sites are in most respects similar (particularly the LSTM spectra for G-165 and G-166), but with two notable differences. The 50-foot LSTM for G-166 is significantly elevated at 63 Hz (approximately 10 dB) with respect to the other sites. In addition, the LSTM levels in the 16-25 Hz bands vary as much as 15 dB between sites. It should be noted however that the PSTM coherence values at these frequencies were uniformly poor at these sites.
- **Comparison between G-173 and SB-2:** Site G-173 (Fox Hills Drive & Missouri Ave.) The site G-173 borehole was located only 75 feet from a prior borehole test (SB-2) conducted in June 2010. The SB-2 test results were documented in a previous report, but a top-level comparison of the results is of interest here. The SB-2 test consisted of PSTM measurements at six distances for a single test depth of 103 feet. The G-173 tests were done at depths of 60, 70, and 80 feet with the line array orthogonal to the SB-2 test. The peak force levels (35k lbs) developed during the SB-2 test were distinctly greater than for G-173, where typical levels were 20k lbs (60 ft), 15k lbs (70 ft) and 10k lbs (at 80 ft). The general shape of the PSTM spectra and the derived LSTM values are quite similar between the two tests, but the absolute levels in all cases are approximately 10 dB greater in the G-173 measurements. This is a significant difference,

particularly in view of the otherwise consistent behavior and the (relatively) good quality of the data. After carefully inspecting the data, we are confident that the results reflect variations in the vibration transmission characteristics of the soil at a depth of 100 feet at SB-2 compared to the vibration transmission characteristics of the soil at shallower depths at G-173.

- **Indoor/Outdoor results from G-165:** Indoor vibration measurements were made in three classrooms at Beverly Hills High School during the G-165 borehole test. For two of the classrooms (123 and 201), little amplification was observed, but room 107 showed significantly increased levels at low frequency. Detailed results from the indoor measurements can be found in Sections 3.7.2 and 3.7.3

The remainder of this report presents the detailed result from each downhole vibration propagation test. The field testing and data procedures are described in Section 2 and the results for each borehole are presented in Section 3. Included in Section 3 for each site are:

- A description of the site.
- Graphs of the measured PSTM spectra and the corresponding coherence values at each measurement depth.
- The LSTM spectra derived from the PSTM spectra presented in tabular as well as graphic form.

All LSTM values presented in Section 3 are for a line source corresponding to a-6-car train. Table 2 presents the approximate difference between LSTM curves for different length line sources and different distances from the tracks. The absolute values of the adjustments increase with distance from the tracks and reach the maximum at distances of 300 to 600 ft from the tracks. All other things being equal, fewer cars per train will result in lower LSTM values.

Table 2: Adjustment Factors to Approximate LSTM for Different Length Trains

Distance (feet)	LSTM Adjustment in dB*	
	2-Car	4-Car
50	-0.4	-0.5
75	-1.3	-0.7
100	-2.1	-0.9
150	-3.0	-1.2
200	-3.4	-1.3
250	-3.9	-1.4
300	-4.2	-1.5
400	-4.6	-1.7
500	-4.8	-1.8
600	-4.8	-1.8
800	-4.8	-1.8
1000	-4.8	-1.8

Note:
* Value to be added to 6-car LSTM levels for 2- or 4--car train lengths

2. TEST PROCEDURE

2.1 Field Procedures and Equipment

The borehole vibration tests for this program involved generating subsurface vibration via hammer impacts while measuring the surface response at a number of locations, as illustrated in Figure 3. Surface vibration at each site was measured using six PCB model 393A03 seismic accelerometers, deployed on a single radial away from the hole, at (nominal) surface distances of 25, 37, 50, 75, 100, and 150 feet. These surface acceleration measurements were all made with the accelerometers oriented in the vertical direction. At two test sites (G-134 and G-145) supplemental triaxial acceleration measurements were made at one measurement location.

The driving force for the measurements was supplied by the drill rig's standard 140 lb drop hammer. A downhole load cell was used to measure the resulting impact force applied to the soil. All test signals (force and acceleration) were digitally recorded using 4-channel Rion DA-20 data recorders. The acceleration and force signals were stored in WAV files for subsequent analysis.

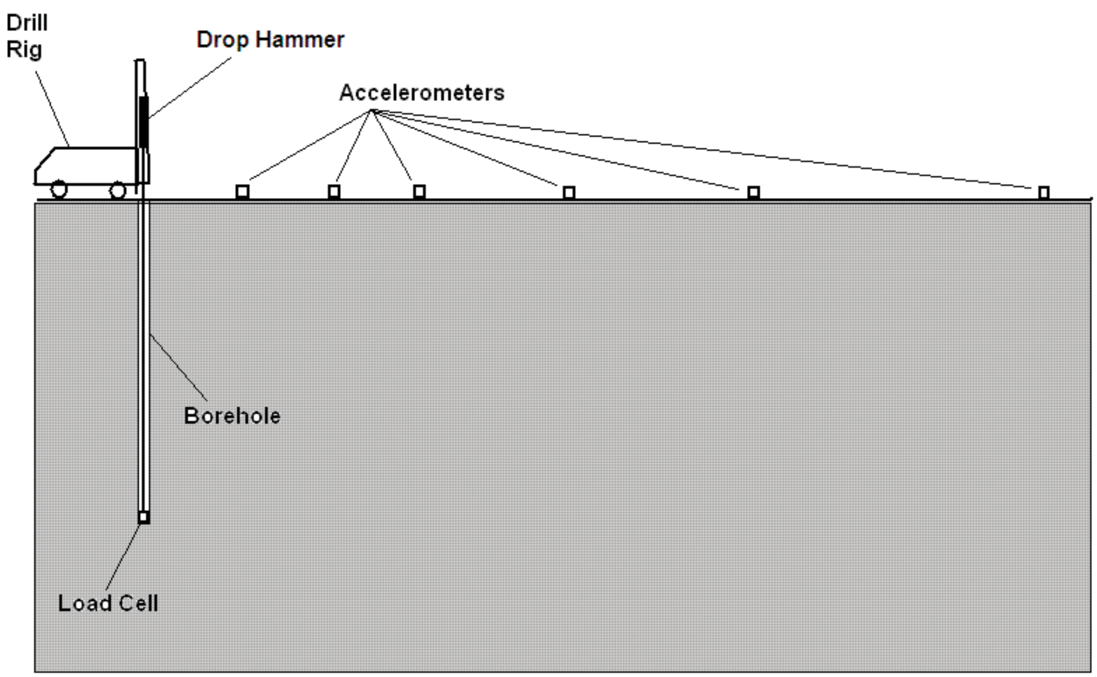

Figure 3: Borehole Test Configuration

The target test depths were set near the top, mid-plane, and bottom of the proposed tunnel structure at each site. The actual depth was usually adjusted slightly to accommodate other testing requirements such as soil sampling or pressure tests. Once on-site, the field crew would identify the measurement locations to be used, attach the accelerometers to the ground using base plates or ground stakes as appropriate, connect all transducers to the data recorders and check each data channel, making sure that the transducers were working, the channel assignments were correct, and that there are no electrical noise problems present.

Once the drilling crew reached each target test depth, the drill string would be withdrawn from the borehole, the load cell attached, and then re-inserted into the borehole. At each depth the test procedure consisted of the following steps:

1. The load cell and data recorders were powered on, and the load cell supply voltage checked.
2. One or more sets of trial impacts (of typically 5 hits each) were made to settle the load cell at the bottom of the borehole and provide a check of recording levels for the load cell and each of the accelerometer channels.
3. Once satisfied that the signal levels were correct, the data recorders were started and the drill rig operator asked to run off the desired number of hammer impacts. Typically 100 hits were requested, although in some instances an additional series of impacts were recorded where the ambient vibration levels were particularly high or the field team decided to use using alternate recording settings.
4. Once the desired number of impacts had been collected, the data recorders were stopped and the drill crew directed to bring up the load cell.

2.2 Data Processing Procedures

The data analysis was conducted in two principal phases as described in the following subsections. In the first phase all quality control and signal processing steps are performed, culminating in a set of *point source transfer mobility* (PSTM) estimates for each test site. This work was done using the MATLAB Signal Processing toolkit. The second phase of the analysis takes these individual PSTM estimates and derives *line source transfer mobility* (LSTM) values for each site. These calculations were done primarily using Excel spreadsheets.

2.2.1 Signal Processing Procedures

There were four main data steps involved in processing the recorded field data into the required PSTM estimates:

1. ***Quality Control:*** Parse the raw time history files into individual impacts and examine these individual samples for noise or other problems. Because of the large number of impacts (typically 100) and the high ambient vibration levels in many locations, we employed an automatic accept/reject function to reject samples with excessive interference from ambient vibration. The primary source of ambient vibration was vehicular traffic on Wilshire and Santa Monica Boulevards.
2. ***PSTM Estimation:*** Process the selected impact data to obtain the narrowband transfer functions between the exciting force and the response at each accelerometer position. These transfer functions are often termed *accelerance* functions. Mobility (velocity/force) is derived here from accelerance by applying a $1/\omega$ correction factor. The resulting transfer function relationship between the force and the vibration velocity response is referred to in this report as the *point source transfer mobility* (PSTM) and is the inverse of the system impedance.
3. ***One-Third Octave Levels:*** Consolidate the narrowband transfer mobility spectral values into 1/3 octave bands.
4. ***Curve Fitting:*** Pool the PSTM results at different depths and distances, and calculate a best-fit curve of transfer mobility as a function of diagonal distance from the impact location. These best-fit curves are developed for each 1/3 octave band.

2.2.2 Developing Line Source Transfer Mobility Curves

While the point source transfer mobility represents the response at the surface from a vibration source at a single subsurface point, the line source transfer mobility (LSTM) represents the response from forces distributed along a line such as a train. This more accurately represents the energy from trains that may be many feet long. For surface vibration propagation tests, it is common to measure point transfer mobility at 11 force locations in a line along the proposed alignment, and explicitly combine the point transfer mobilities to estimate the LSTM. This straightforward approach is impractical for a subway tests because it would require 11 boreholes. Therefore the contributions along the line must be calculated from one set of measurements.

To do this, the equivalent LSTM as a function of distance was derived from the measured point source transfer mobilities at the six accelerometer positions. A linear regression was first calculated for each frequency band as previously described, and used to predict the point source transfer mobility as a function of distance. Line integration of these regression functions was then used to calculate the equivalent LSTMs. The resulting LSTM functions can then be combined with separately developed *force density* functions to predict future groundborne vibration levels along the Westside alignments.

3. TEST RESULTS

The following sections provide descriptions of each site as well as the test results. For each test site graphs are provided showing the measured PSTM spectra and corresponding coherence values at each measurement depth. The LSTM spectra are provided in tabular as well as graphic form. All LSTM values in this section are for a line source corresponding to a 6-car train. Table 2 (page 4) provides adjustment factors that can be applied to these LSTM levels to estimate LSTM spectra for 2- or 4-car trains.

3.1 Site G-106

3.1.1 Site Description

Testing at this site was performed on 24 Mar 2011, at test depths of 50, 60, and 70 feet. The borehole was located in the median of Wilshire Boulevard, between Arden and Lucerne. The nearest vibration-sensitive receiver to this borehole is NV-9, identified as "Apartments". The building is the Chateau Fremont at 4444 Wilshire Boulevard, directly across from the borehole position. The accelerometers were located at distances of 25, 37, 50, 75, 100, and 150 feet from the borehole, in a line extending eastward from the borehole with no lateral offset. Vehicular traffic on Wilshire Boulevard was particularly heavy throughout the testing period, with a few breaks. Additional observations from the measurements include:

- At the 50 ft depth, the load cell advanced 18 inches due to the impact hits, with little movement after hit 50. Typical peak forces ranged from 6-10k lbs. 120 impacts recorded.
- At the 60 ft test depth there was no perceptible drill string advancement after hit 20. Typical peak forces ranged from 10-20k lbs. 110 impacts recorded.
- At the 70 ft depth, the drill string advancement was not noted. Typical force levels were 17-25k lbs. 100 impacts recorded.

3.1.2 Results for G-106

- Coherence was poor at the 50 foot depth except for a few mid-frequency points at the closest accelerometer positions. This is probably due to the low force levels developed at the 50 test depth, in combination with the high ambient vibration levels.
- The coherence is somewhat improved at the 60 and 70-foot test depths although still poor at the lowest and highest frequencies.
- The levels and shapes of the PSTM at all depths were similar.
- The best fit LSTM shows the smallest decrease with distance in the 31.5 Hz band (almost none) where coherences never exceeded 0.5 and the greatest in the 125 Hz band where coherences were often the highest.

3.1.3 Plots and Tables

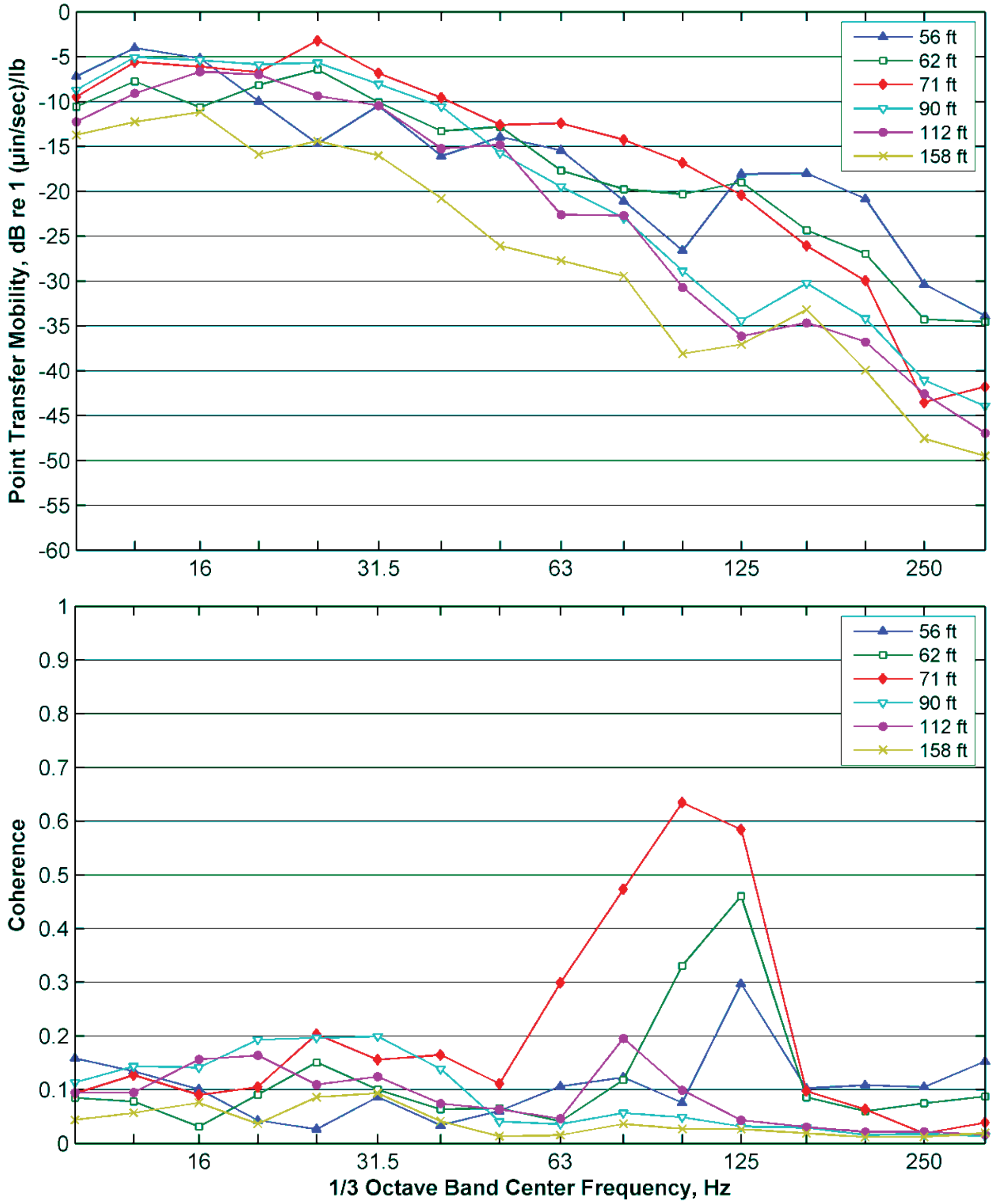

Figure 4: G-106. Measured PSTM at Depth of 50 ft

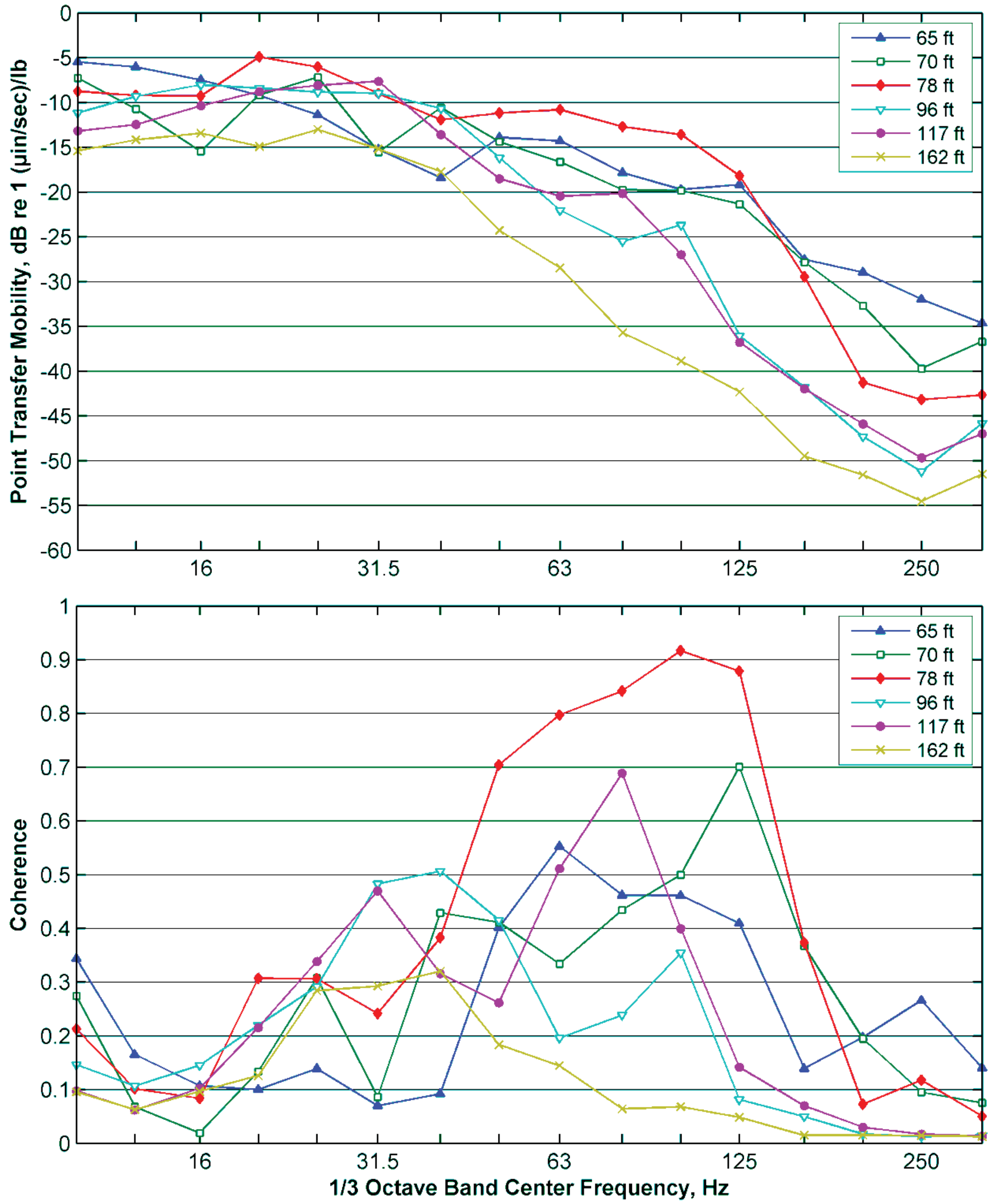

Figure 5: G-106. Measured PSTM at Depth of 60 ft

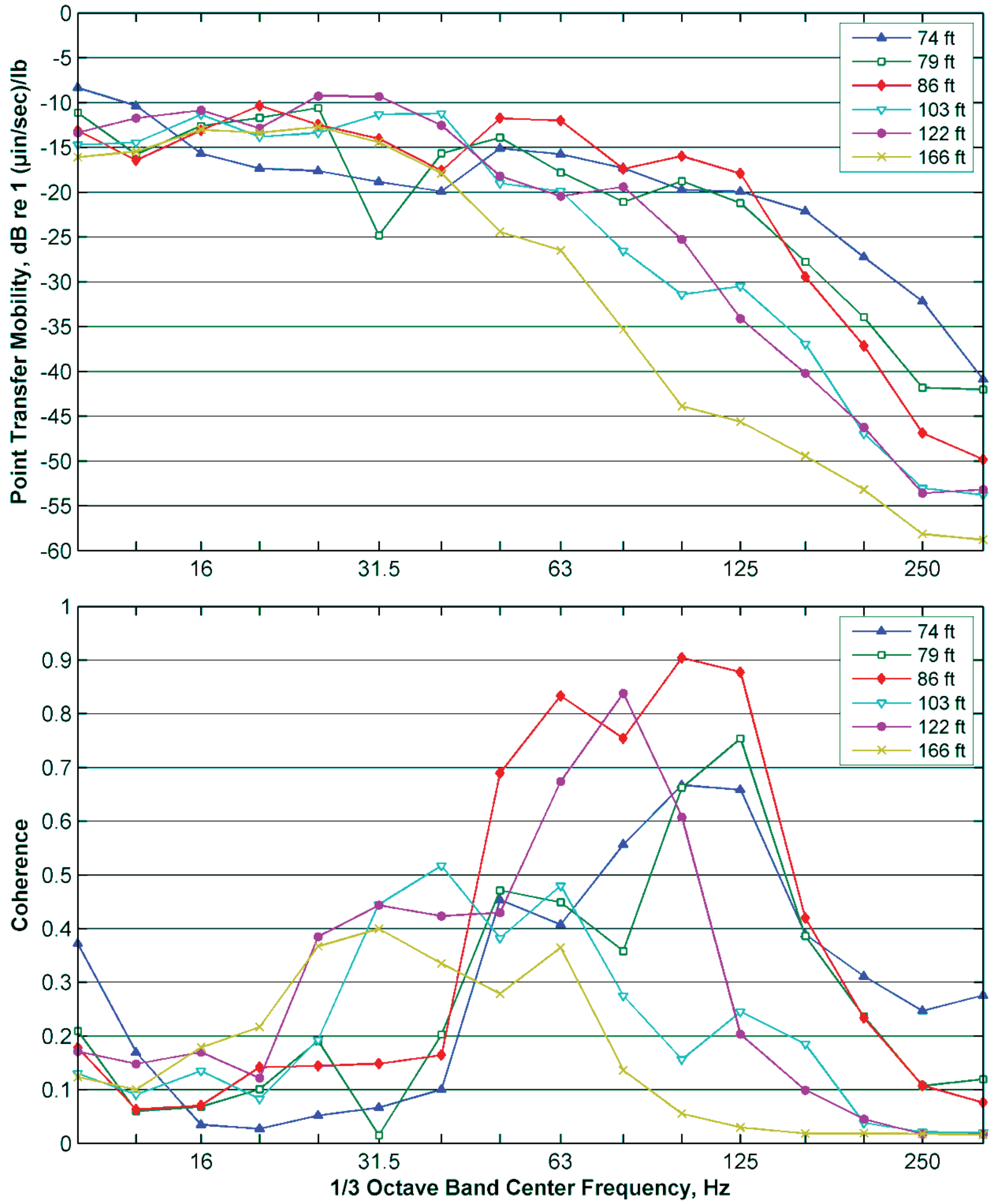

Figure 6: G-106. Measured PSTM at Depth of 70 ft

Table 3: G-106. Coefficients for Best Fit LSTM							
Freq. (Hz)	**A**	**B**	**C**	**Freq. (Hz)**	**A**	**B**	**C**
10	20.03	4.00	-3.97	**63**	30.49	-5.56	-4.16
12.5	18.25	4.92	-3.76	**80**	32.59	-8.61	-4.06
16	13.96	4.43	-1.96	**100**	57.10	-24.77	-3.30
20	15.04	5.66	-3.12	**125**	80.79	-39.98	-2.56
25	14.04	4.49	-2.00	**160**	63.11	-32.46	-2.91
31.5	13.29	0.99	-0.38	**200**	59.86	-33.49	-2.86
40	9.66	4.78	-2.18	**250**	41.10	-26.31	-3.22
50	26.96	-2.25	-4.23	**315**	30.31	-20.44	-3.52

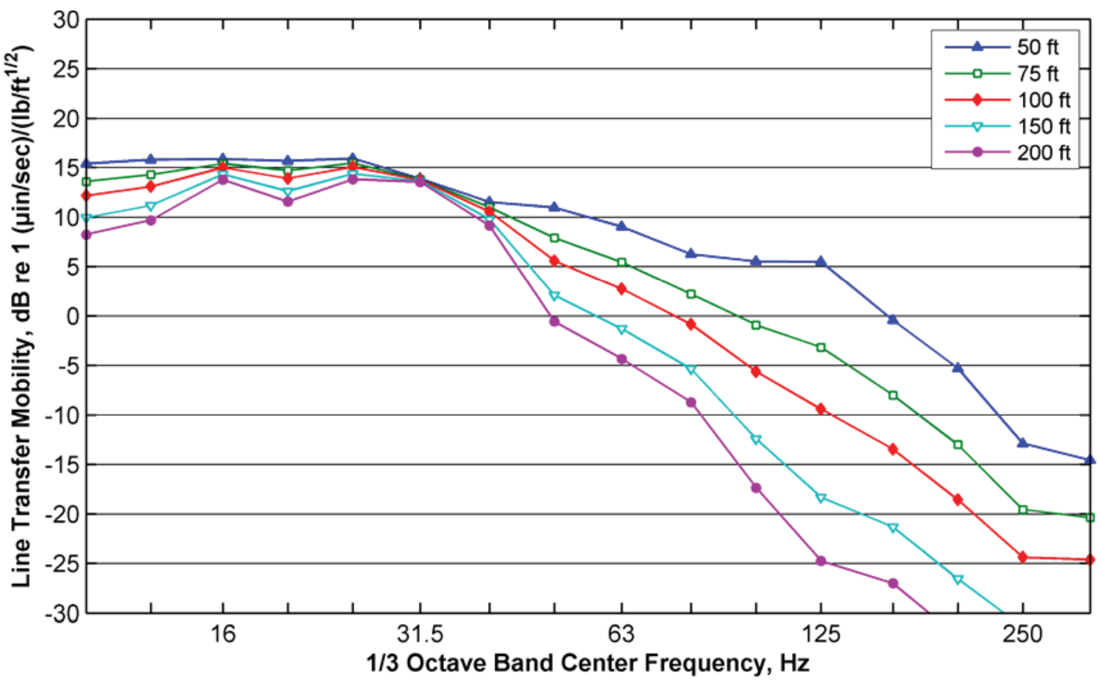

Figure 7: G-106. Best Fit LSTM

3.2 Site G-124

3.2.1 Site Description

Testing at this site was performed on 17 Mar 2011 at test depths of 40, 55, and 60 feet. The borehole was located in the median of Wilshire Boulevard, between Fairfax and McCarty Vista, in front of 6134 Wilshire Boulevard. The nearest vibration-sensitive receiver to this borehole is NV-24, identified as "Apartments". The apartments at issue appear to be to the rear and above the businesses on the south side of Wilshire Boulevard, directly across from the borehole position. The accelerometers were located along Wilshire Boulevard at distances of 25, 37, 50, 75, 100, and 140 feet from the borehole location. The accelerometer line was offset from the borehole by 3 feet. The measurements were interfered by continuous vehicular traffic on Wilshire Boulevard. Additional observations from the measurements include:

- At 40 ft depth, the load cell advanced 6 inches due to the impact hits. Typical peak forces ranged from 8k to 12k lbs. 100 impacts recorded.
- At 55 ft, the drilling supervisor reported encountering tar. There was no perceptible drill string advancement during the test. Typical peak forces ranged from 17k to 20k lbs. 100 impacts recorded.
- At 60 ft, the drill string advanced only two inches from the impact hits. Typical force levels were 12k to 15k lbs. 100 impacts recorded

3.2.2 Results for G-124

- The center-depth measurement was taken at 55 feet. Not surprisingly the PSTM values for the 55 and 60 ft depths were comparable at all measurement distances.
- The coherences for the measurements at all but the farthest (150-foot) accelerometer were generally good between 20 and 80 Hz. This is attributed to relatively high force levels (and correspondingly improved signal-to-noise ratios) compared to other sites (e.g., site G-106).

3.2.3 Plots and Tables

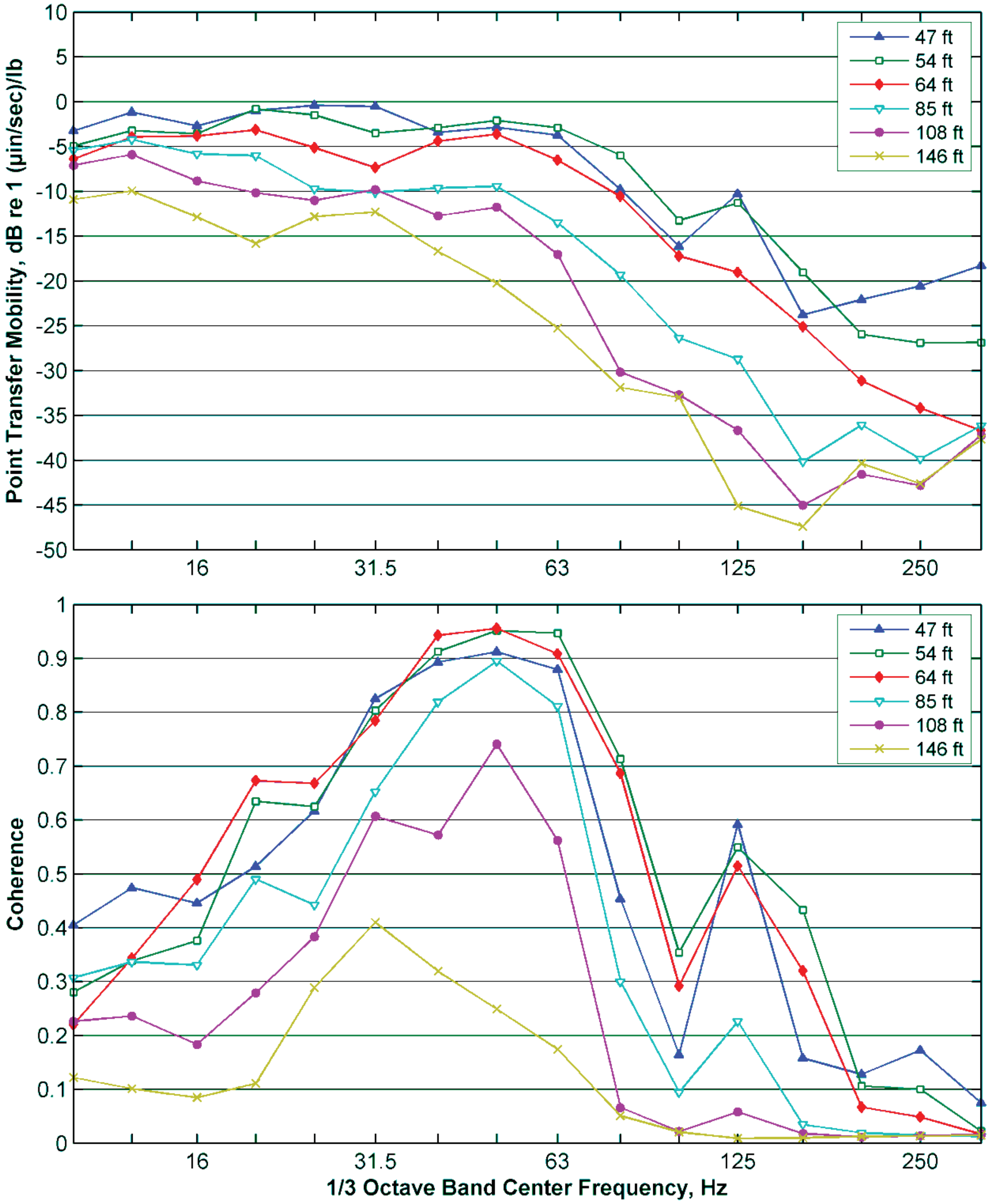

Figure 8: G-124. Measured PSTM at Depth of 40 ft

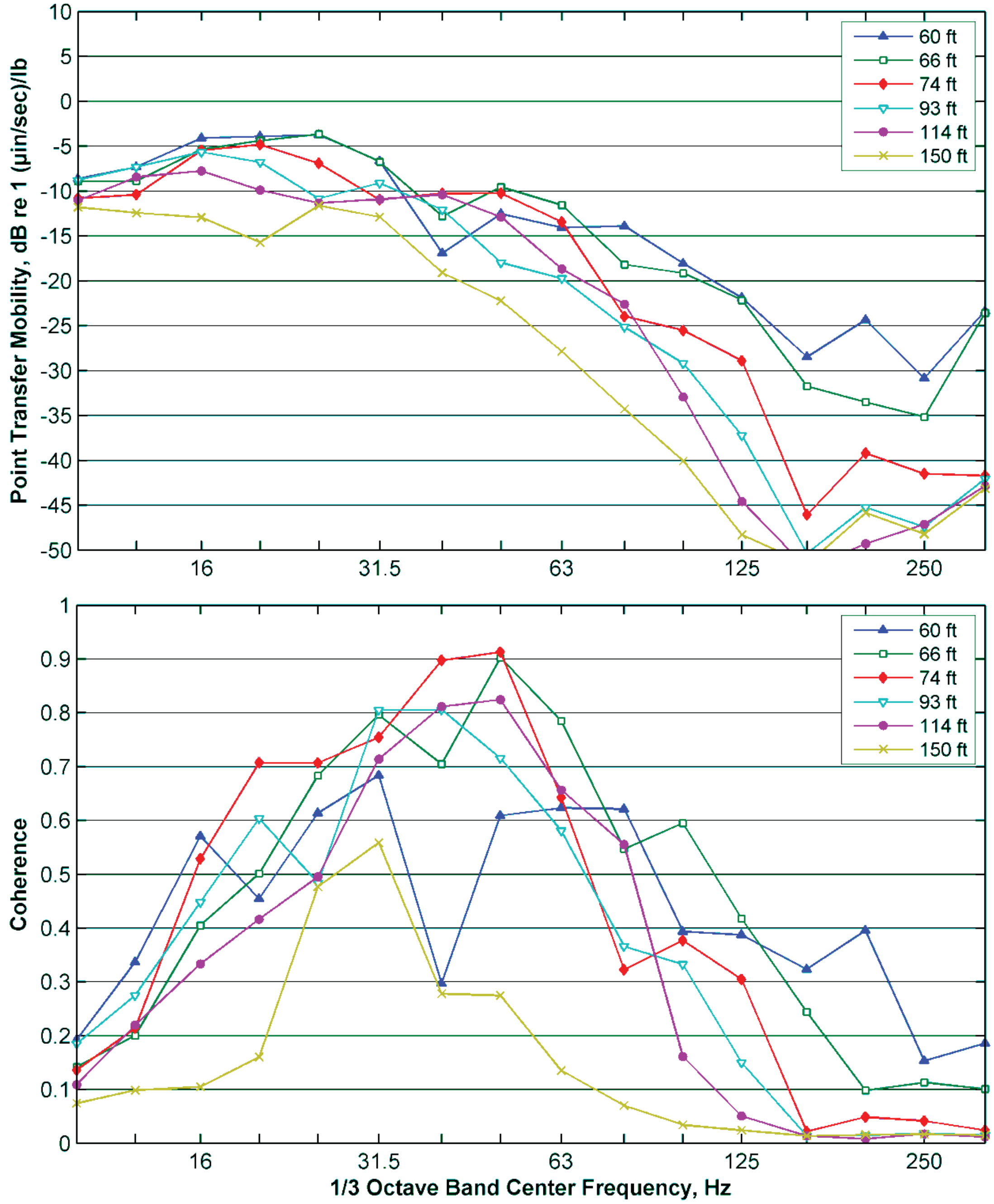

Figure 9: G-124. Measured PSTM at Depth of 55 ft

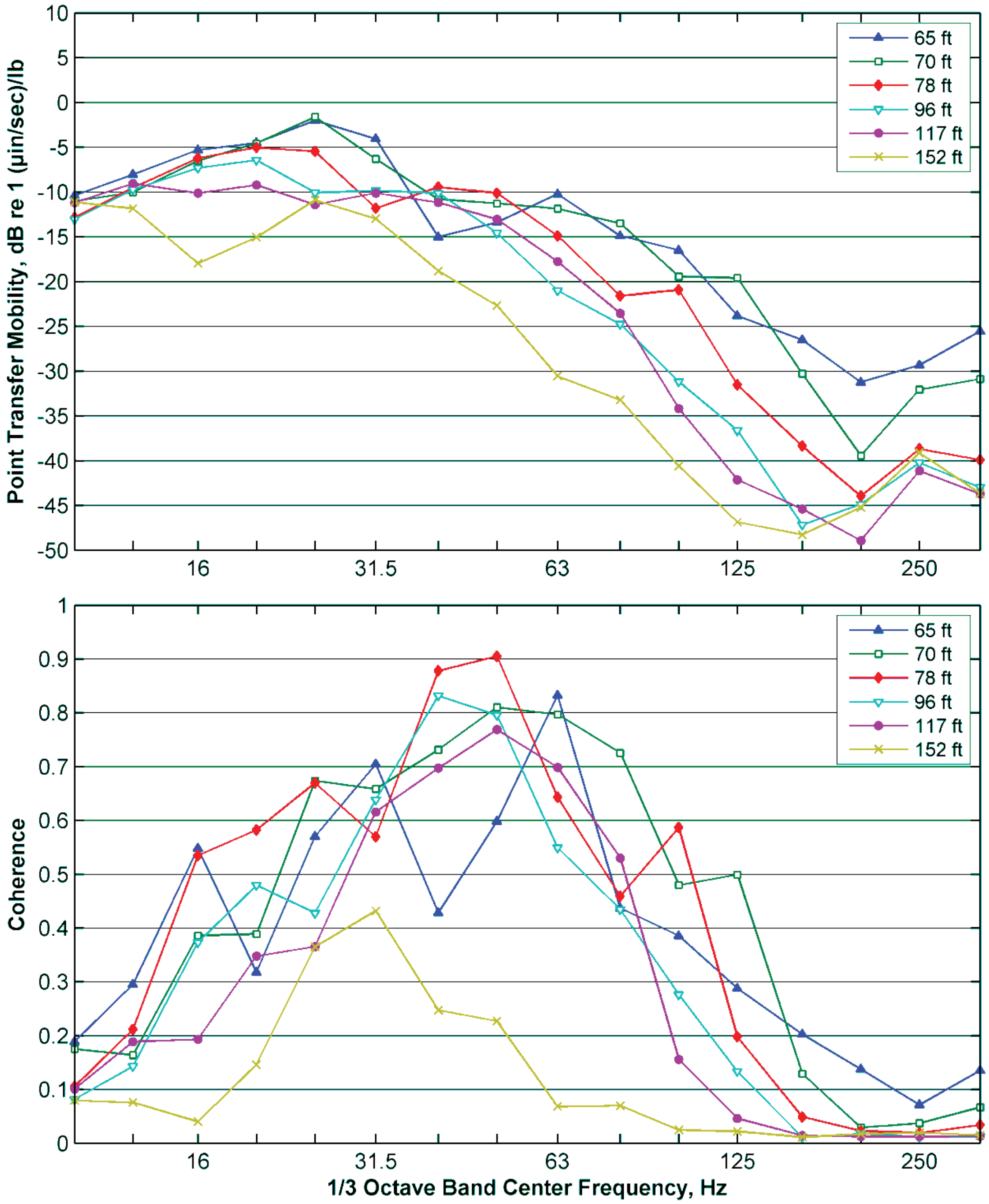

Figure 10: G-124. Measured PSTM at Depth of 60 ft

Table 4: G-124. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	15.50	5.63	-2.99	**63**	62.98	-23.34	-3.37
12.5	18.40	5.53	-3.44	**80**	65.62	-28.07	-3.13
16	29.36	0.93	-4.20	**100**	68.00	-32.38	-2.92
20	39.16	-4.35	-4.19	**125**	108.66	-58.59	-1.81
25	32.71	-0.81	-4.23	**160**	72.00	-42.15	-2.46
31.5	23.33	3.31	-4.06	**200**	38.69	-22.37	-3.42
40	21.69	2.74	-4.11	**250**	28.40	-15.94	-3.74
50	40.27	-7.98	-4.08	**315**	36.71	-19.49	-3.56

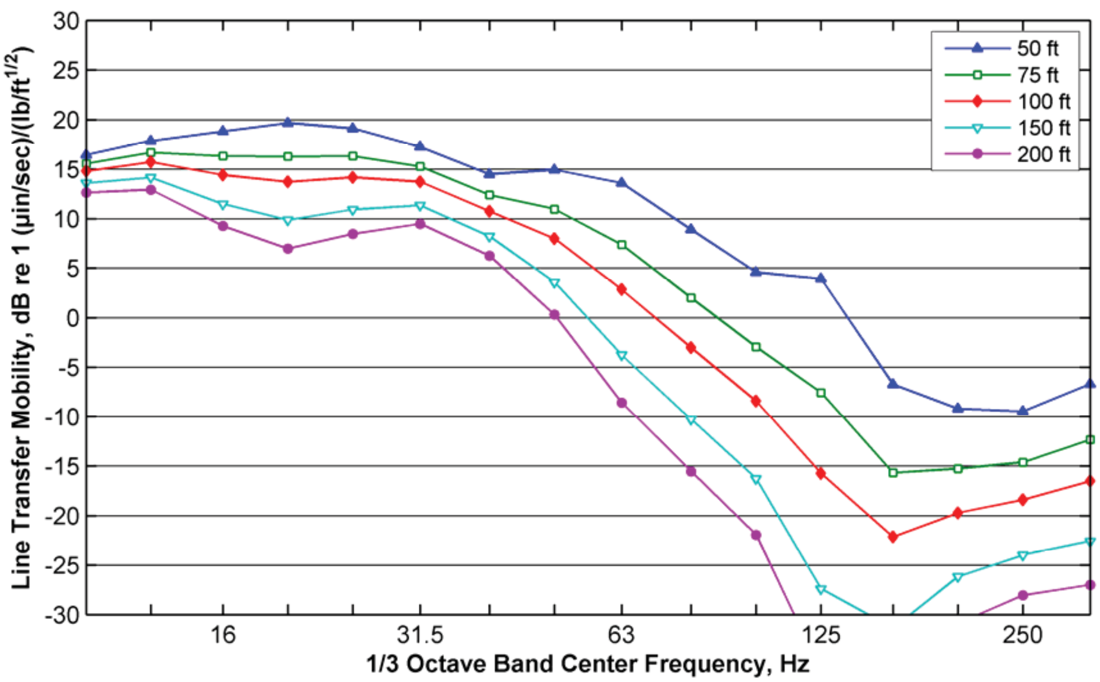

Figure 11: G-124. Best Fit LSTM

3.3 Site G-134

3.3.1 Site Description

Testing at this site was performed on 30 Mar 2011 at test depths of 50, 60, and 70 feet. The borehole was located in the median of Wilshire Boulevard between Arden and Willaman. The nearest vibration-sensitive receiver to this borehole is NV-132, a residence approximately ½ block north of Wilshire on N. Hamel Drive. The accelerometers were located at distances of 25, 37, 50, 75, 100, and 140 feet from the borehole, in a line extending eastward from the borehole with 4 feet of lateral offset. This was one of two test sites where triaxial recordings were made. Additional observations from the measurements include:

- At the 50 ft depth, the load cell advanced 18 inches due to the impact hits. Typical peak forces ranged from 7k to 9k lbs. 100 impacts recorded.
- At the 60 ft test depth there was 12 inches total advancement. Typical peak forces ranged from 8k to 9k lbs. 100 impacts recorded.
- At 70 ft, the drill string advanced by 2 feet, and was still moving at 100 hits. Typical force levels were from 7k to 11k lbs. 100 impacts recorded.

3.3.2 Results for G-134

- Coherences were relatively good for the 50 and 60 foot depth measurements, but poor at the final (70 foot) test depth. Again, the low coherence is believed to be the result of the low force levels and elevated background vibration levels along Wilshire Boulevard.
- At 50 and 60 feet the 25 to 50 Hz frequency bands showed the highest coherence, but interestingly the coherence did *not* diminish uniformly with increasing distance.

3.3.3 Plots and Tables

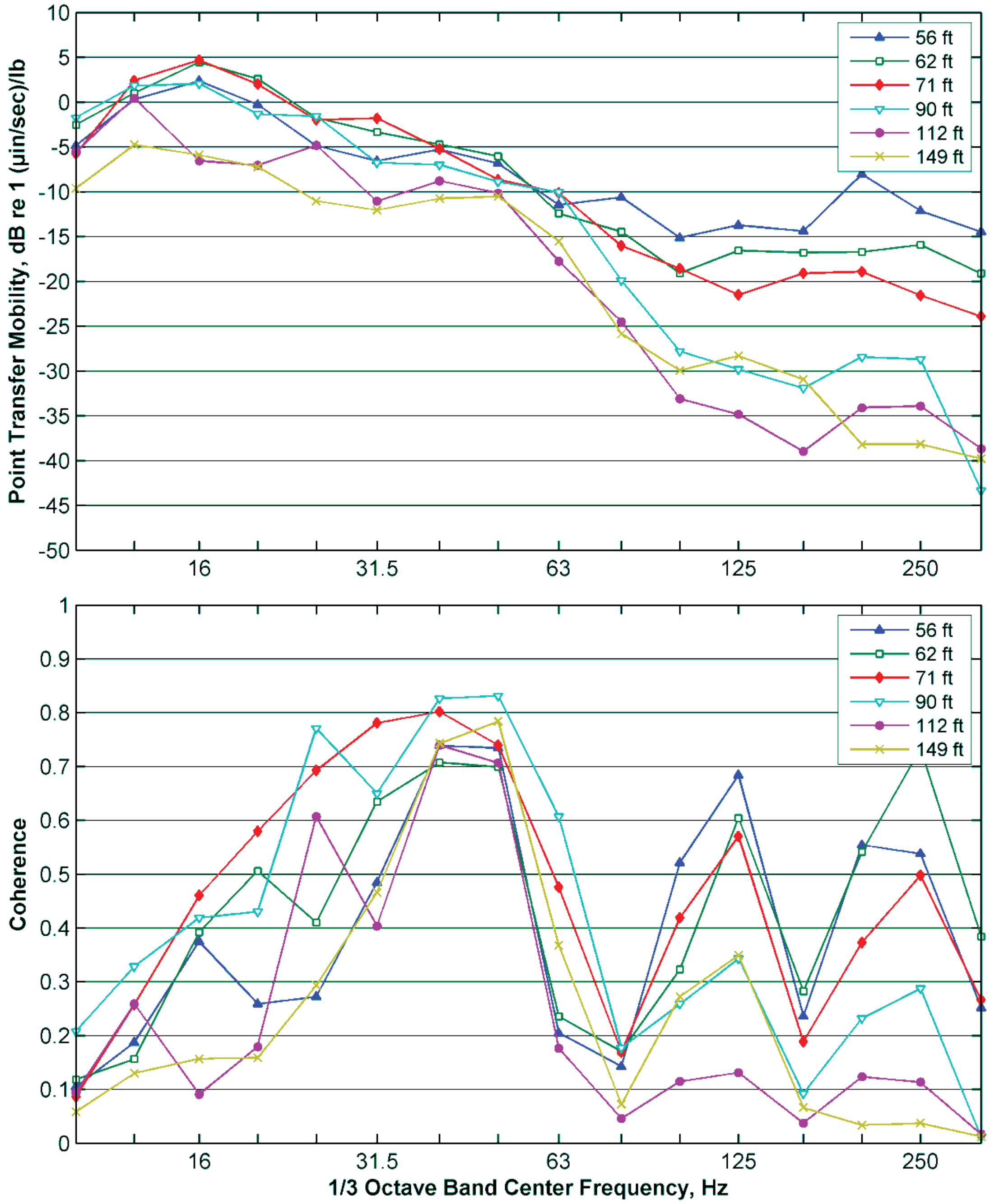

Figure 12: G-134. Measured PSTM at Depth of 50 ft

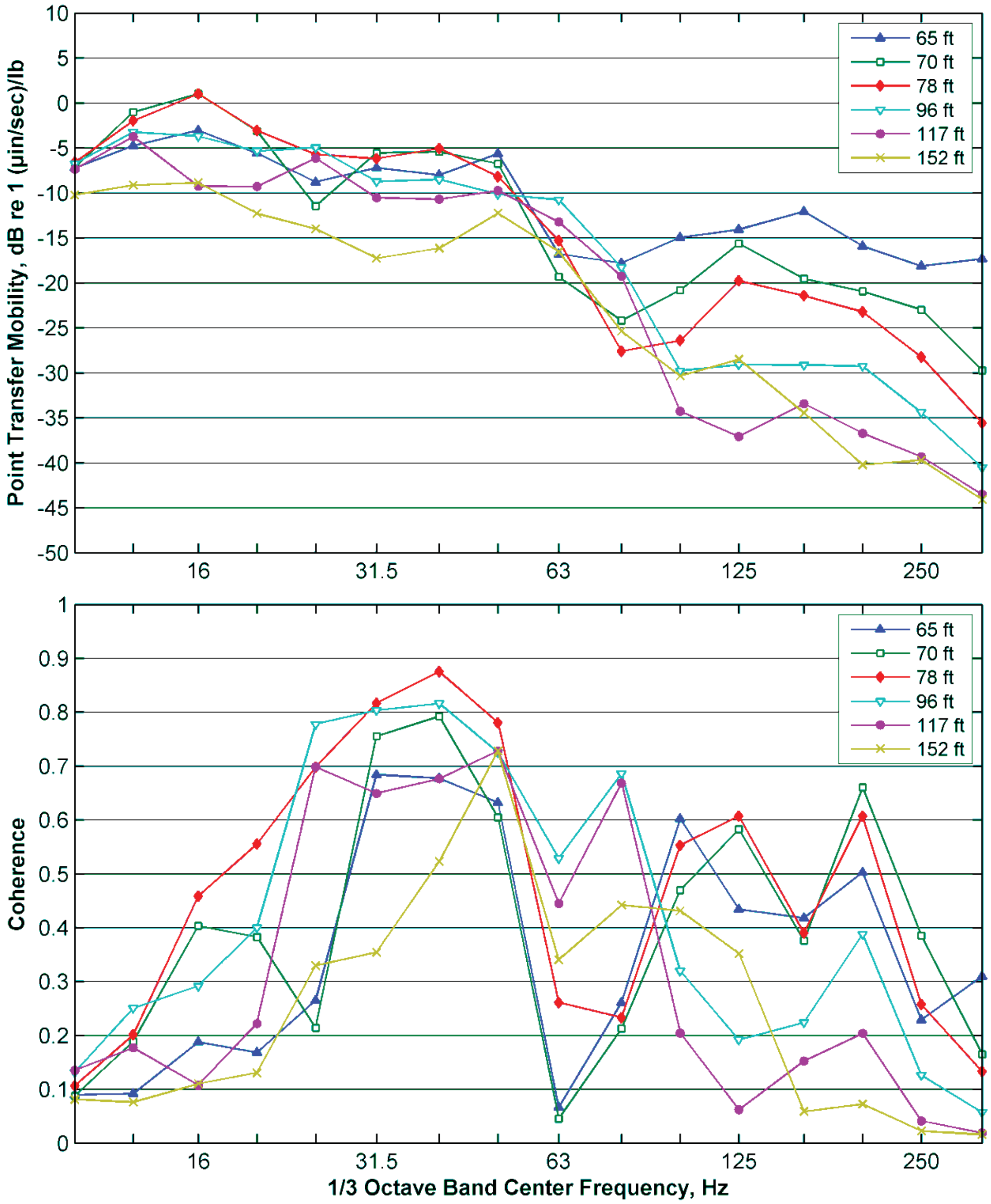

Figure 13: G-134. Measured PSTM at Depth of 60 ft

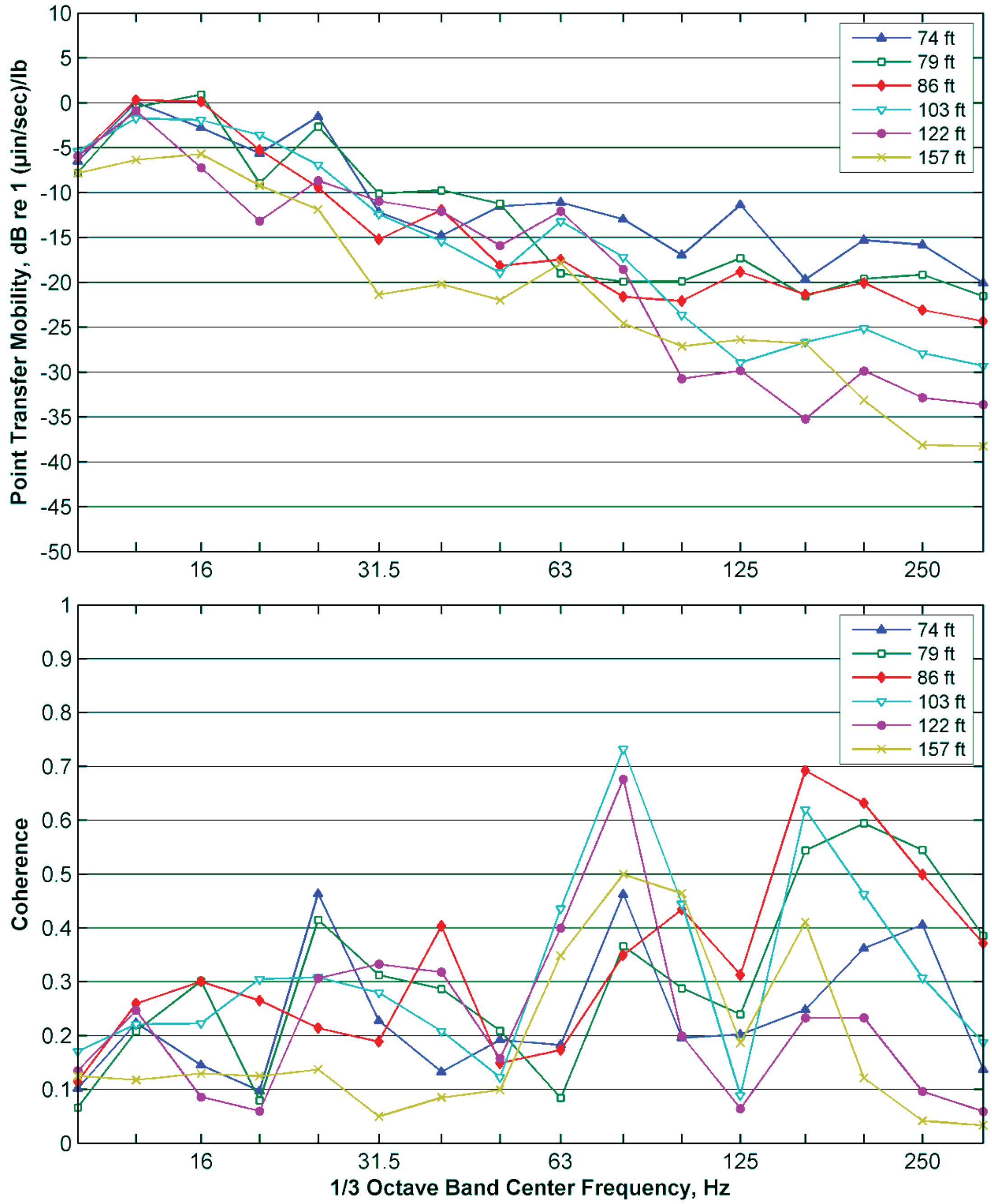

Figure 14: G-134. Measured PSTM at Depth of 70 ft

Table 5: G-134. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	17.98	5.13	-2.42	**63**	9.89	4.00	-1.73
12.5	25.56	5.37	-3.56	**80**	14.49	2.44	-4.13
16	39.68	-1.41	-4.23	**100**	37.23	-12.71	-3.89
20	33.02	0.45	-4.21	**125**	50.67	-19.92	-3.54
25	22.93	4.64	-3.84	**160**	56.28	-24.22	-3.32
31.5	33.25	-2.17	-4.23	**200**	85.79	-41.25	-2.50
40	27.62	0.83	-4.21	**250**	82.46	-40.50	-2.54
50	23.06	2.52	-4.13	**315**	73.58	-37.55	-2.67

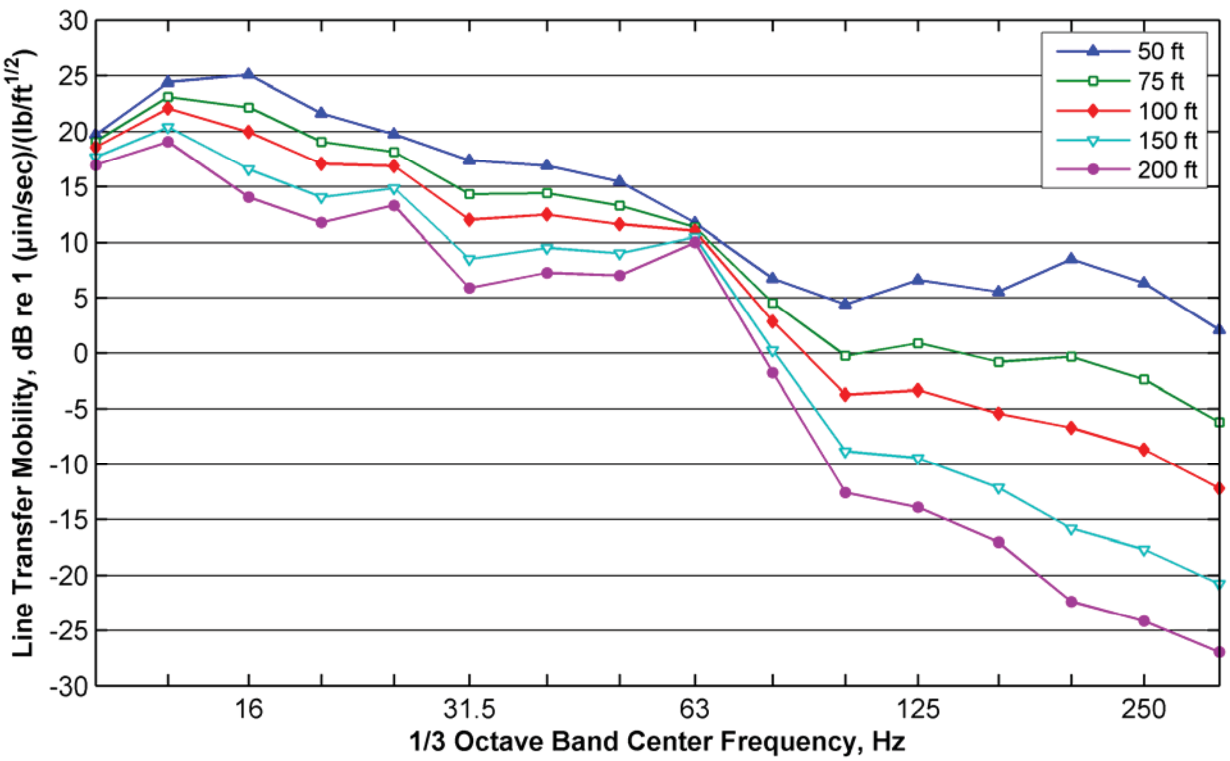

Figure 15: G-134. Best Fit LSTM

3.4 Site G-145

3.4.1 Site Description

Testing at this site was performed on 14 and 15 April 2011 at test depths of 50, 60, and 70 feet. The borehole was located in the median of Wilshire Boulevard between El Camino and Beverly. The nearest vibration-sensitive receiver to this site was the Beverly Wilshire Hotel (NV-38), approximately 175 feet southwest from the borehole position. Due to traffic control restrictions, the accelerometers were located at distances of 25, 32, 50, 62, 75, and 100 feet from the borehole, in a line extending eastward from the borehole with 5 feet of lateral offset. Vehicular traffic on Wilshire Boulevard was particularly heavy throughout the testing period, with a few breaks. This was one of two test sites where triaxial recordings were made. Additional observations from the measurements include:

- At the 50 ft depth, the load cell advanced nearly 3 feet and testing halted at approximately hit 80 to insert a drill rod extension. Typical peak forces ranged from 6k to 9k lbs. 120 impacts total were recorded.
- At the 60 ft test depth the drill string advancement was not noted. Typical peak forces ranged from 8k to 20k lbs. 100 impacts recorded.
- At 70 ft, the drill string advancement was not noted. Typical force levels were from 7k to 11k lbs. 100 impacts recorded.

3.4.2 Results for G-145

- This was a site where the coherence was poor for most of the measurements. Referring to the graphs of coherence in Figure 16, Figure 17, and Figure 18, it can be seen that the only time that coherence exceeded 0.5 was at 31.5 and 40 Hz for the 60 foot depth. At the 50 ft and 70 ft depths the coherences never exceeded 0.3.
- Force levels at 50 and 70 feet were low; levels at 60 feet were higher but unusually variable.
- In spite of the poor coherence, the PSTMs have similar shapes to those measured at the other boreholes and the fall off with distance is similar to the fall off at the other sites.

3.4.3 Plots and Tables

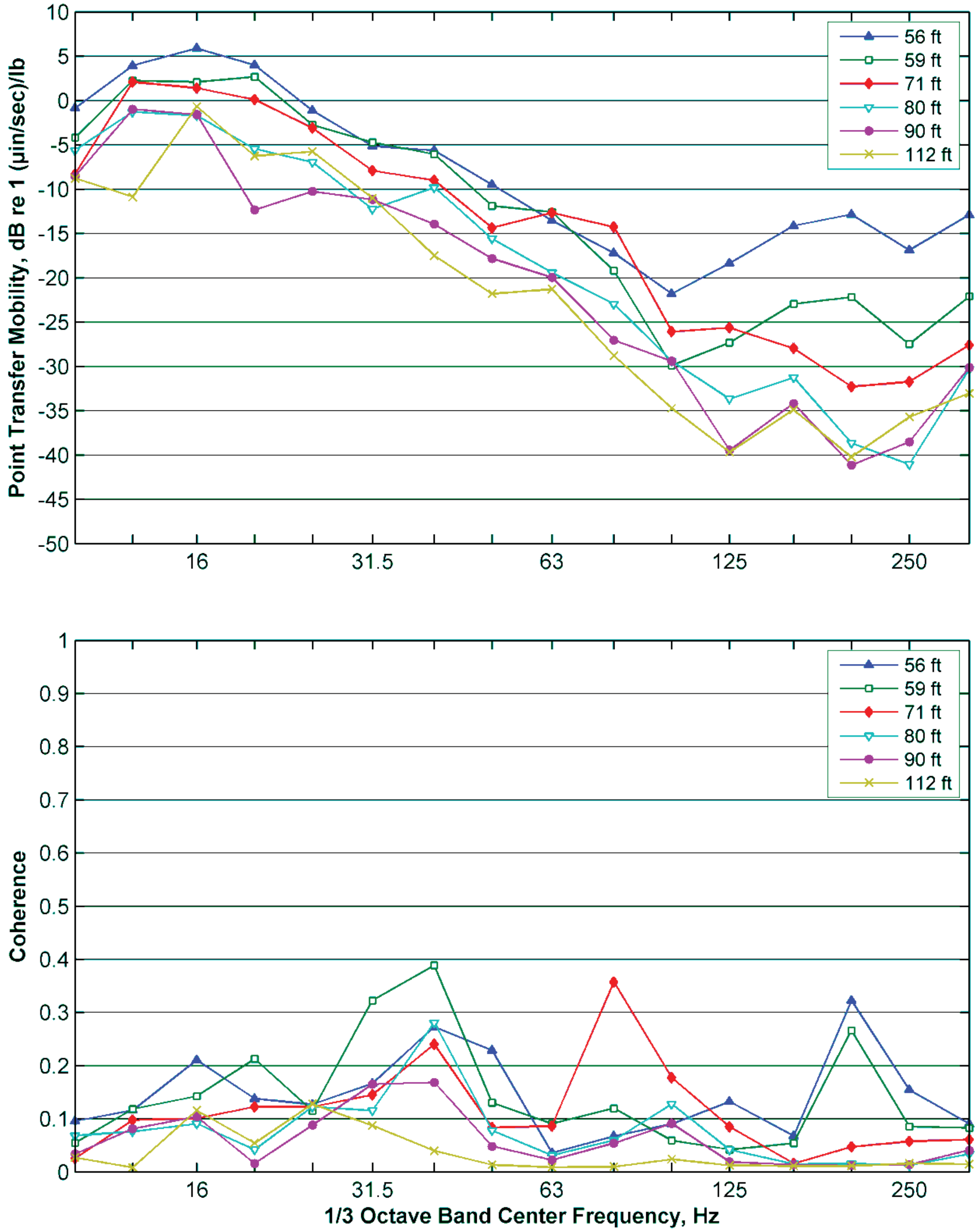

Figure 16: G-145. Measured PSTM at Depth of 50 ft

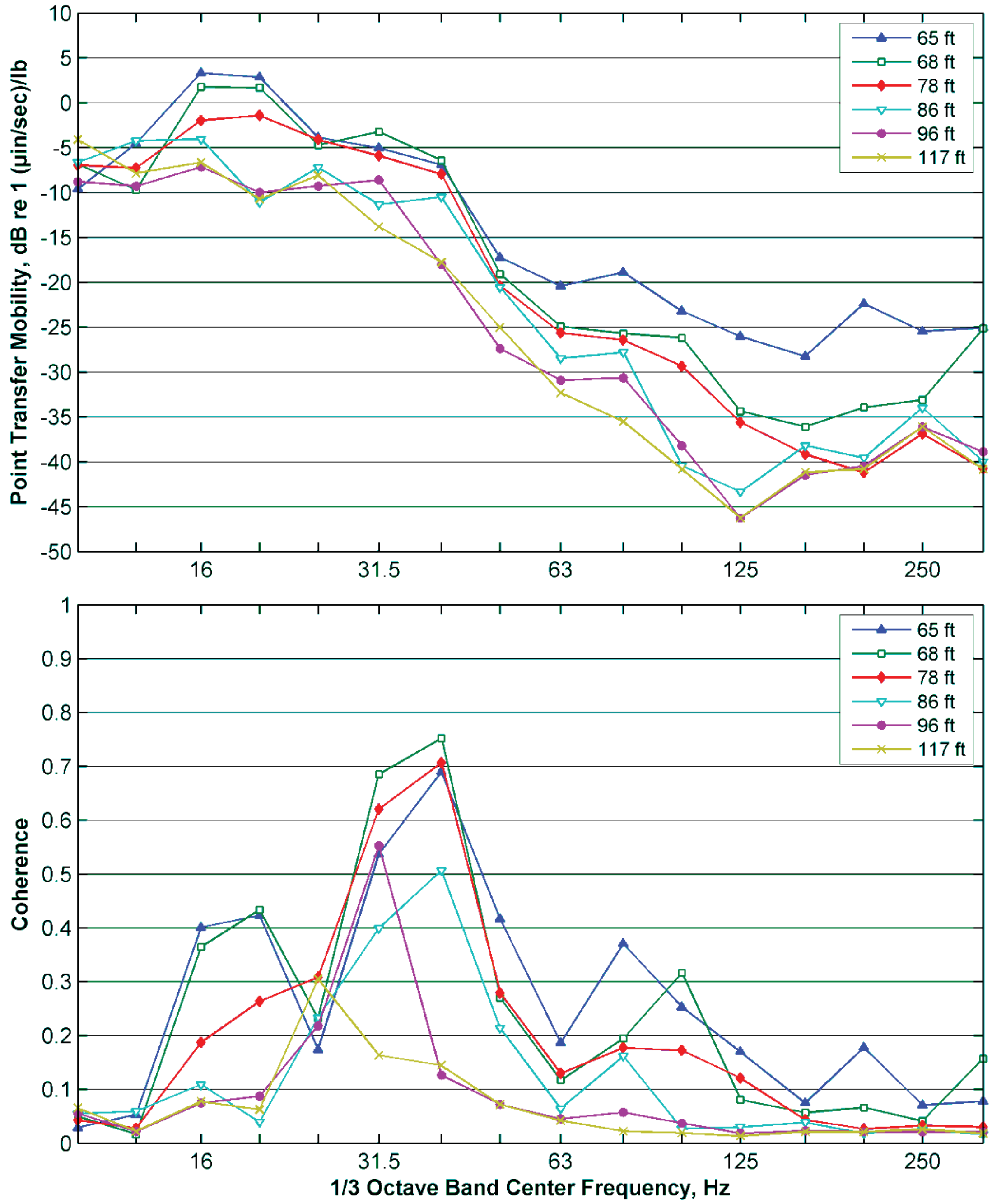

Figure 17: G-145. Measured PSTM at Depth of 60 ft

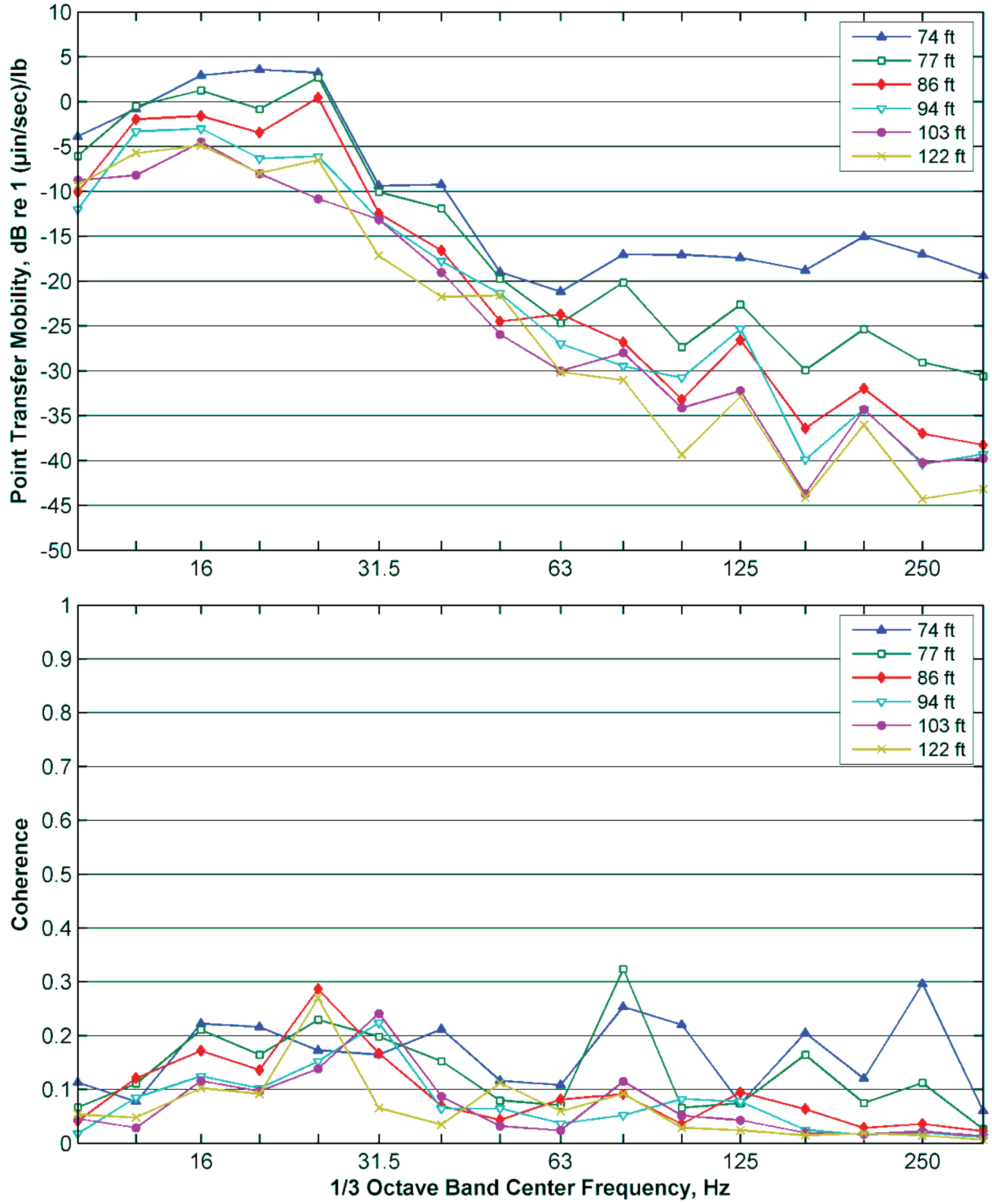

Figure 18: G-145. Measured PSTM at Depth of 70 ft

Table 6: G-145. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	18.77	5.56	-3.41	**63**	57.32	-24.92	-3.29
12.5	41.57	-4.07	-4.20	**80**	61.33	-28.23	-3.12
16	48.33	-6.41	-4.14	**100**	58.75	-30.13	-3.03
20	75.65	-24.26	-3.32	**125**	65.01	-34.53	-2.81
25	31.54	1.02	-4.20	**160**	92.89	-51.68	-2.06
31.5	42.60	-8.14	-4.08	**200**	84.69	-46.32	-2.28
40	73.31	-28.04	-3.13	**250**	67.72	-37.03	-2.70
50	42.97	-14.19	-3.82	**315**	100.61	-55.30	-1.93

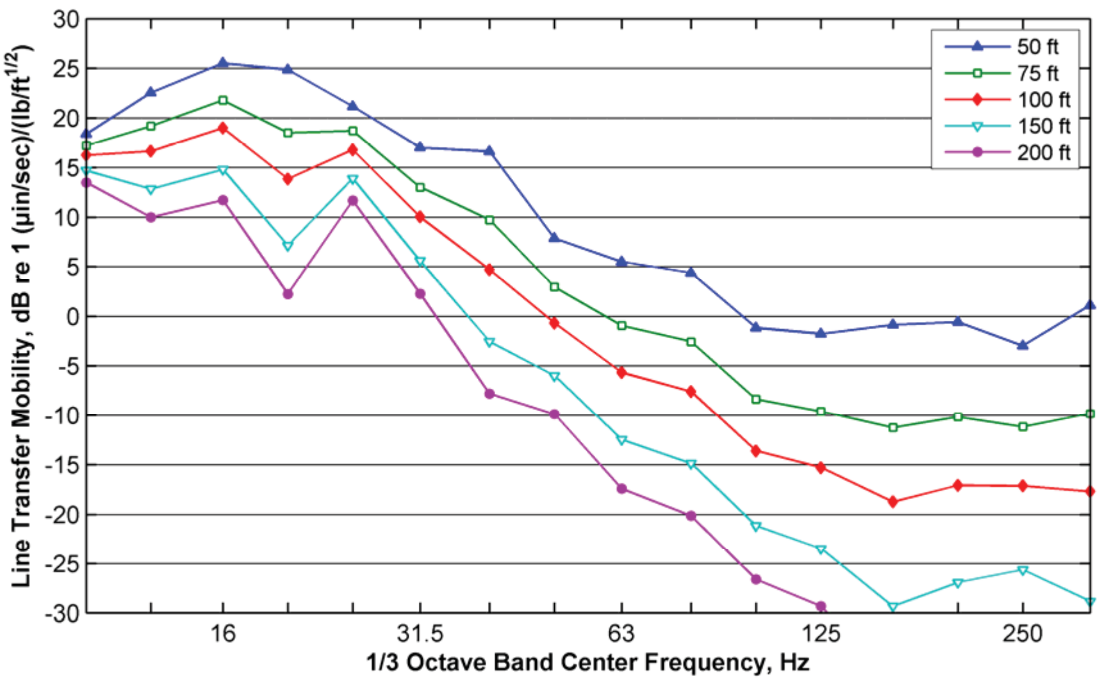

Figure 19: G-145. Best Fit LSTM

3.5 Site G-152

3.5.1 Site Description

This site was located adjacent to the Beverly Hilton Hotel, identified as site NV-41. Testing was performed on 31 Jan and 1 Feb 2011, at test depths of 55, 65, and 75 feet. The test consisted of 100 hits at each test depth. The measurements were performed on the south side of Santa Monica Boulevard, approximately 350 feet from the intersection of Santa Monica and Wilshire, and opposite to the hotel. The accelerometers were located westward along Santa Monica Boulevard at distances of 25, 37, 50, 75, 100, and 150 feet from the borehole location. The accelerometer line was offset from the borehole by 4 feet. The measurements were interfered with by continuous vehicular traffic on Santa Monica Boulevard. Additional observations from the measurements include:

- At 55 ft depth, the drill string advanced 2 feet during 15 test hits. Additional drill rod was inserted and 100 impacts recorded with an additional 3 feet of advancement. Force levels ranged from 3k to 9k lbs. 100 hits recorded.
- At 65 ft depth, the drill string advancement was simply noted as being “much less”. Force levels were in the 8k to 12k lb range. 100 hits recorded.
- At 75 ft depth, the drill string advancement was not noted. Force levels were again very low (6k to 7k lbs) and 130 impact hits were recorded. The drill crew supervisor reported “stiff clay” at this depth.

3.5.2 Results for G-152

- The low coherence below 20 Hz at all test depths indicates potential low-frequency background noise problems.
- The PSTM showed peaks between 80 and 125 Hz for the three closest accelerometer positions suggesting efficient transmission at shorter distances.
- The measured coherence at the 75-foot test depth was close to zero at all measurement positions at 63 Hz and below, indicating that almost no signal made it through to the measurement positions in the 10 to 63 Hz range. At higher frequencies, only the three closest accelerometers had coherence that was clearly non-zero.

3.5.3 Plots and Tables

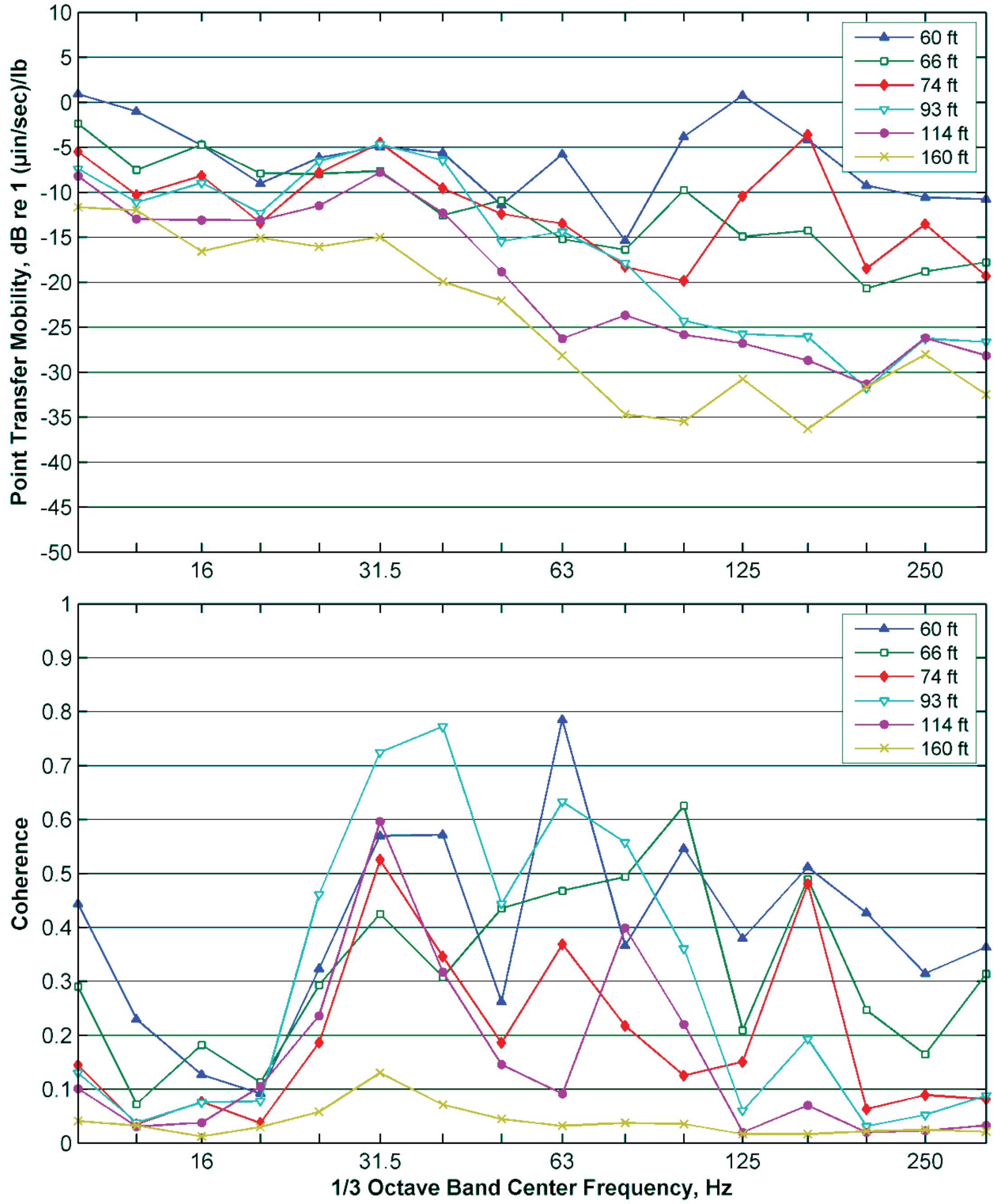

Figure 20: G-152. Measured PSTM at Depth of 55 ft

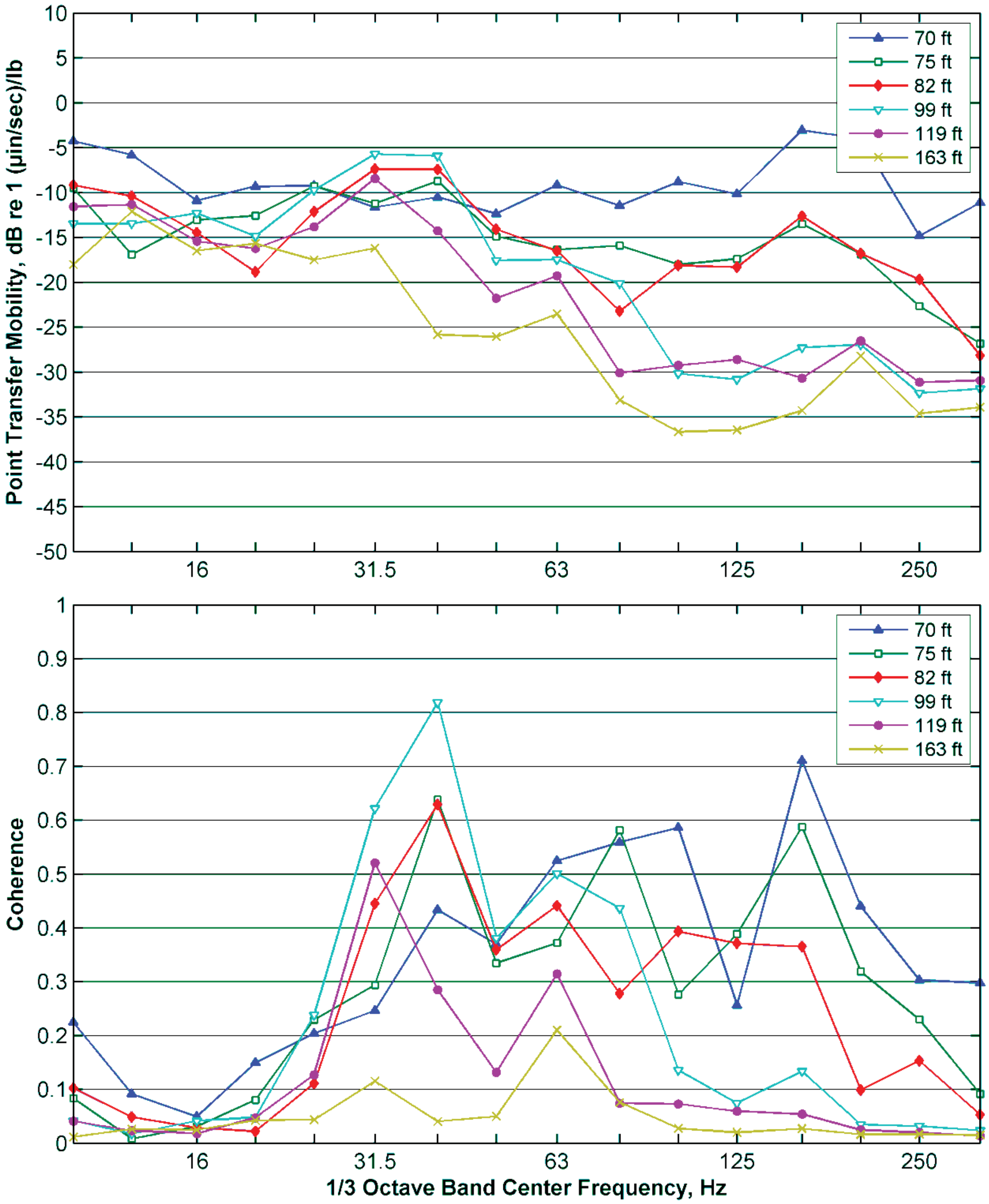

Figure 21: G-152. Measured PSTM at Depth of 65 ft

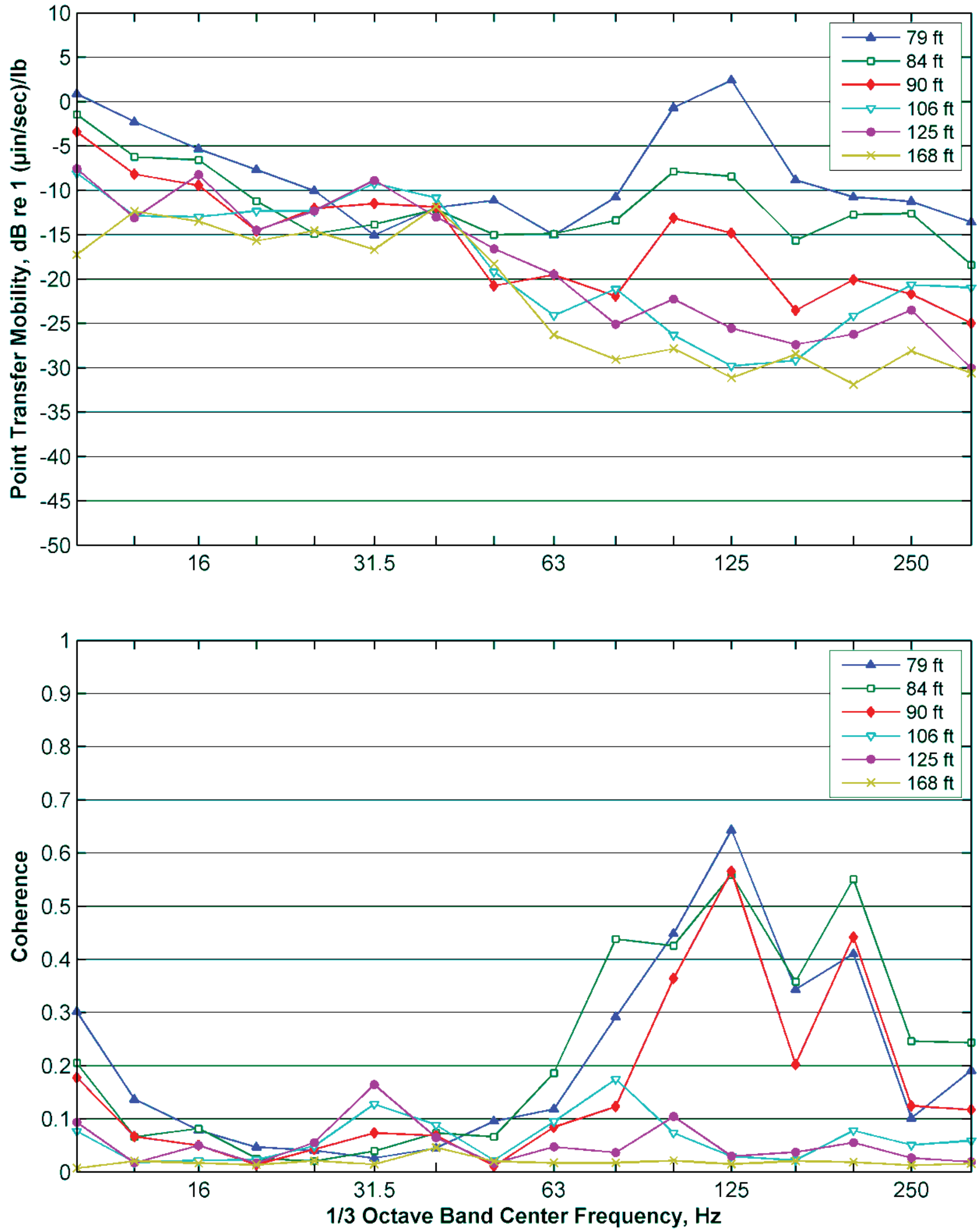

Figure 22: G-152. Measured PSTM at Depth of 75 ft

Table 7: G-152. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	46.25	-7.77	-4.09	**63**	46.62	-13.95	-3.83
12.5	19.87	4.64	-3.84	**80**	59.36	-23.10	-3.38
16	23.21	2.83	-4.10	**100**	100.41	-45.74	-2.31
20	14.57	5.38	-3.56	**125**	109.84	-50.98	-2.09
25	21.12	3.57	-4.03	**160**	113.11	-53.12	-2.01
31.5	18.50	5.11	-3.69	**200**	67.28	-27.88	-3.14
40	27.41	0.31	-4.22	**250**	51.31	-18.94	-3.59
50	26.80	-1.96	-4.23	**315**	52.41	-20.86	-3.49

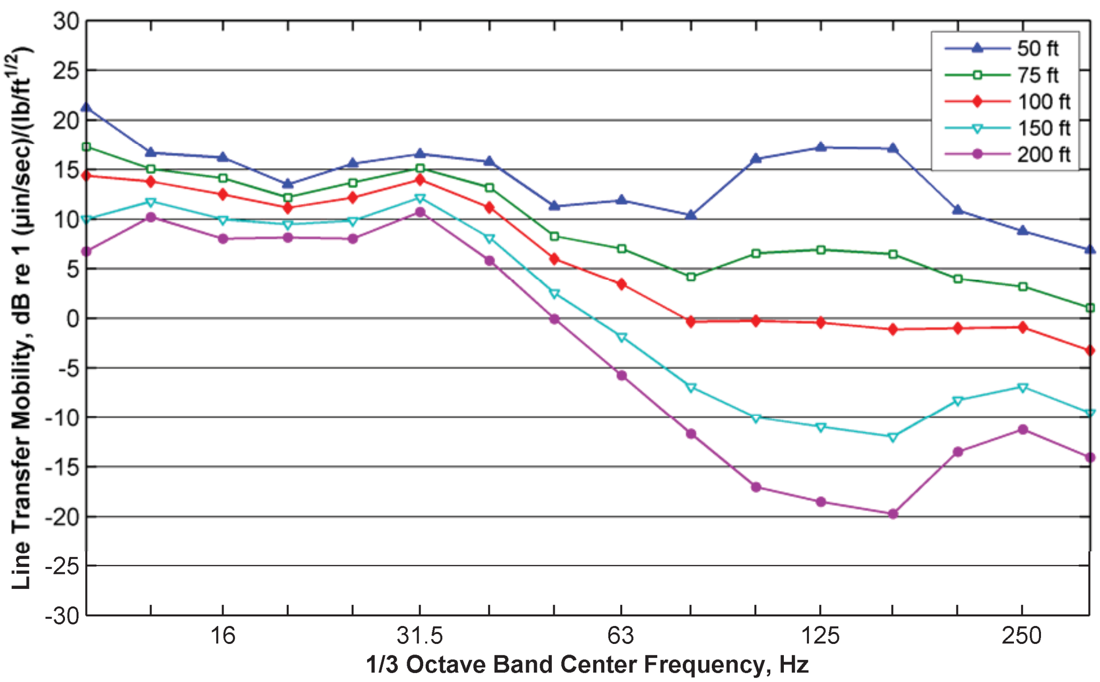

Figure 23: G-152. Best Fit LSTM

3.6 Site G-164

3.6.1 Site Description

This site was located on Moreno Avenue between Young and Lasky directly in front of the Beverly Hills Unified Instructional Center. Testing was performed on 26 and 27 Jan 2011, at test depths of 45, 55, and 65 feet. The accelerometers were located along South Moreno Drive at distances of 25, 37, 50, 75, 100, and 150 feet from the borehole location. The line of accelerometers extended southward from the borehole with an offset of 3 feet. Additional observations from the measurements were:

- At the 45 ft depth, only 70 impact hits could be recorded due to excessive (> 3 feet) load cell advancement. Test forces ranged from 4k to 8k lbs.
- At 55 ft depth, drill string advancement was 2 feet. Typical force levels were 3k to 7k lbs. 100 hits recorded.
- Testing at the 65 ft depth was conducted with two series of 100 impacts each, to accommodate instrumentation restrictions. Typical force levels were from 7k to 20k lbs for the first series of impacts and from 22k to 26k lbs for the second series of impacts.

3.6.2 Results for G-164

- Traffic vibration was less of an issue at this site than at many of the other test locations.
- The measured peak force levels were between 3k and 8k lbs at the 45 and 55 foot depths.
- The coherence was variable for all measurements. However, coherence was generally good (higher than 0.3) for most frequencies except at the farthest accelerometer position.
- The LSTM at higher frequencies have a faster drop-off with distance than lower frequencies. This is consistent with LSTM behavior at other sites.
- The LSTM at 20 Hz has a very small drop-off with distance, only 5 dB from 50 to 200 ft.

3.6.3 Plots and Tables

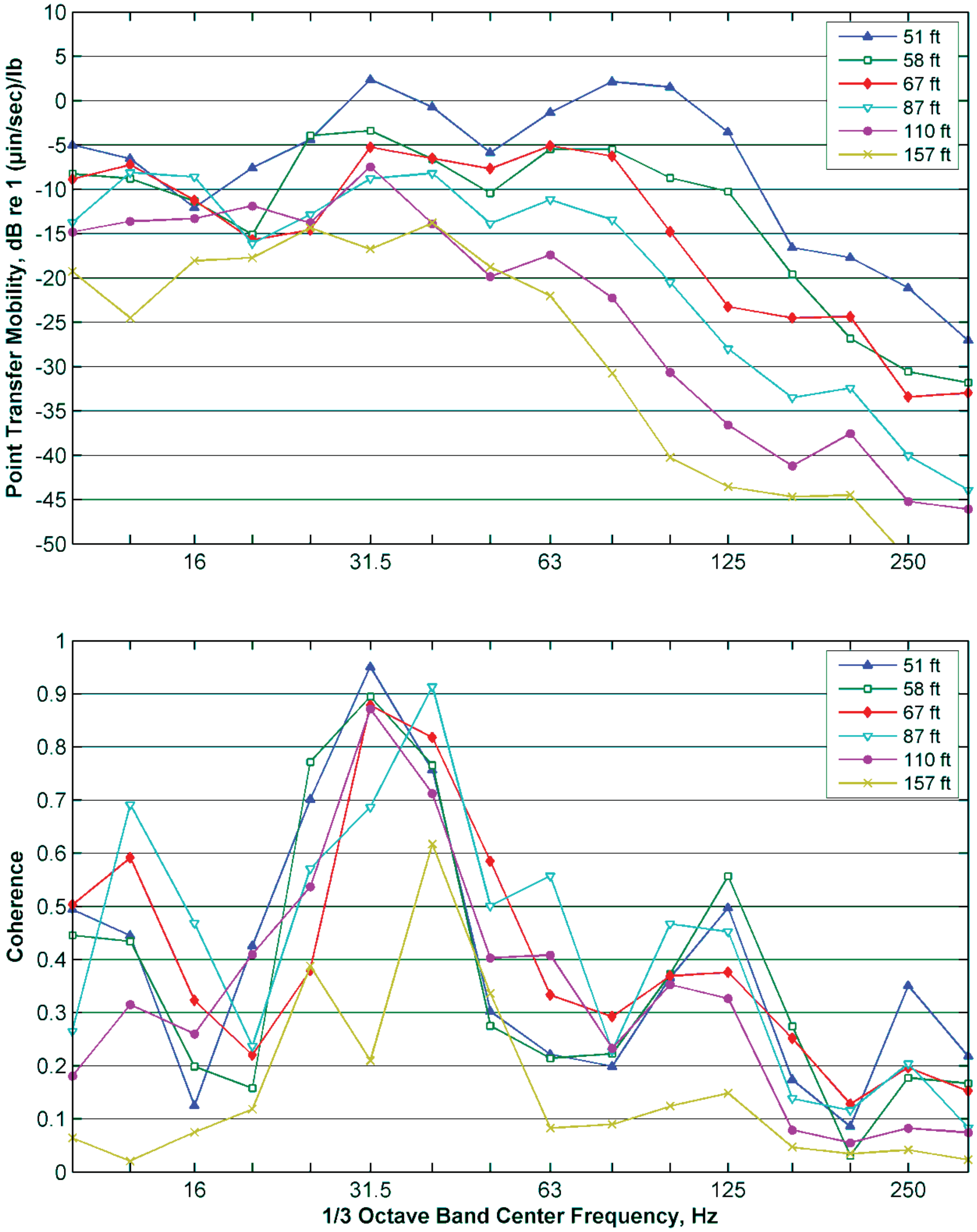

Figure 24: G-164. Measured PSTM at Depth of 45 ft

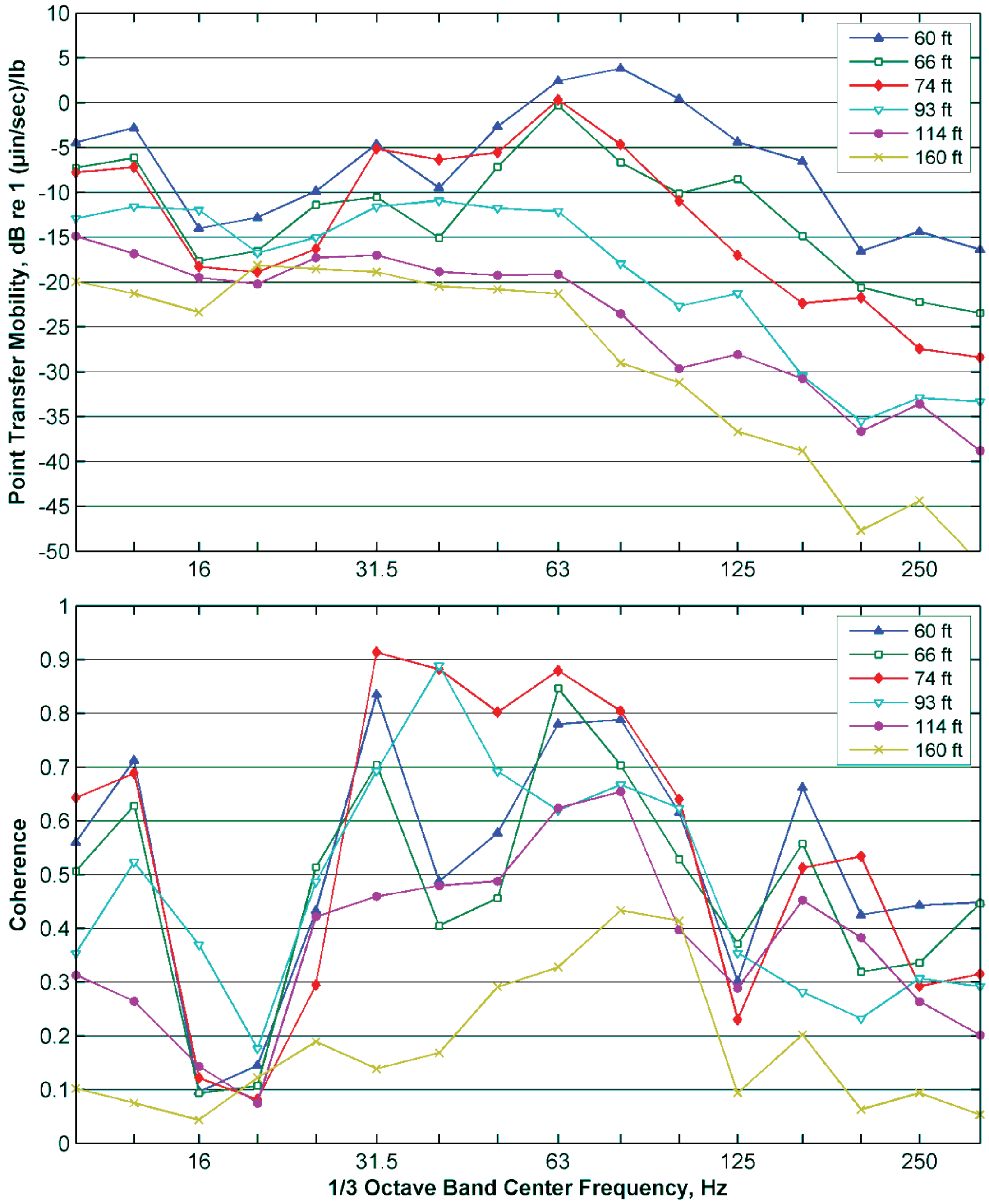

Figure 25: G-164. Measured PSTM at Depth of 55 ft

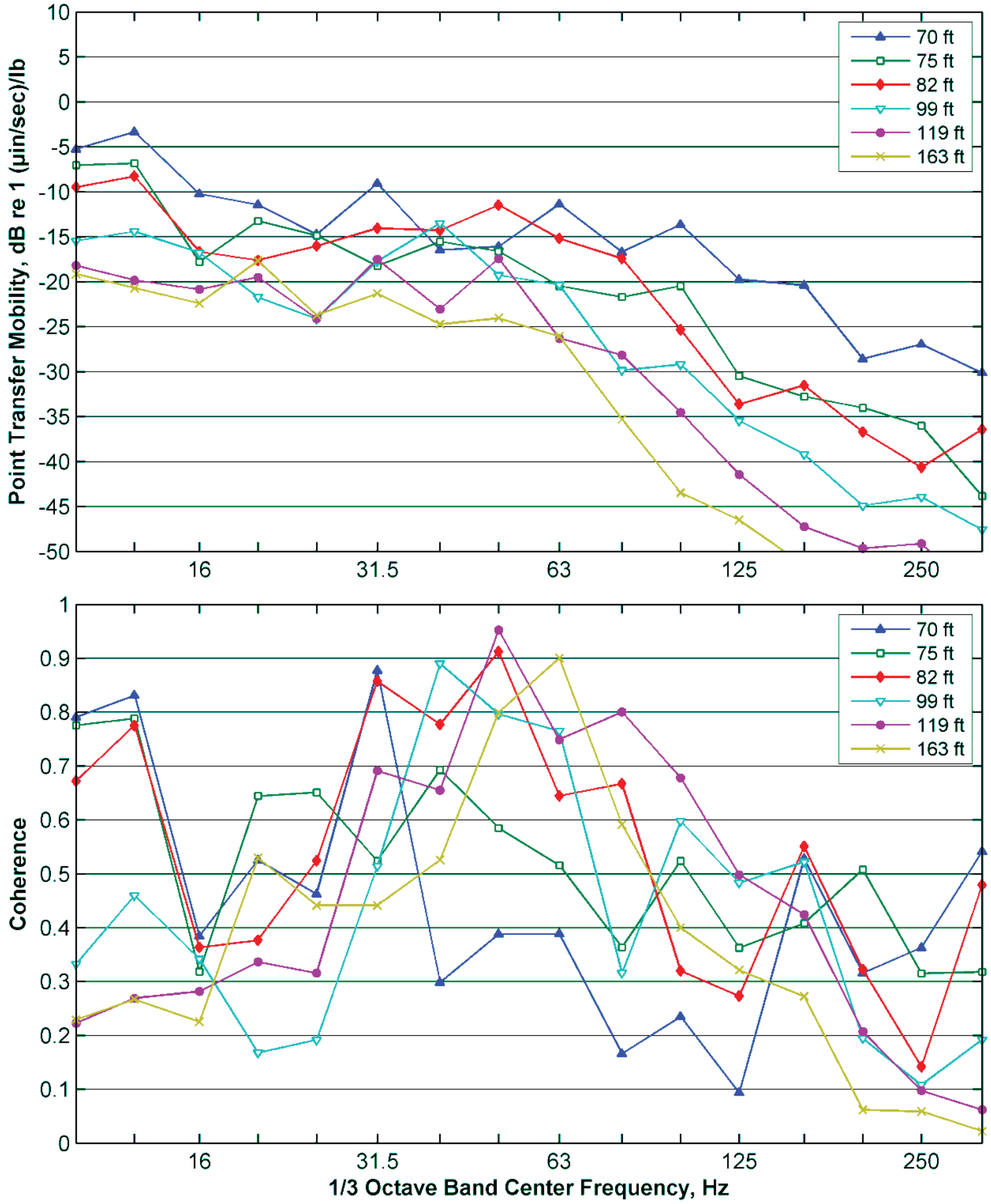

Figure 26: G-164. Measured PSTM at Depth of 65 ft

Table 8: G-164. Coefficients for Best Fit LSTM							
Freq. (Hz)	**A**	**B**	**C**	**Freq. (Hz)**	**A**	**B**	**C**
10	41.36	-8.02	-4.08	**63**	76.63	-29.31	-3.07
12.5	54.60	-15.61	-3.75	**80**	109.21	-50.32	-2.12
16	15.65	3.72	-4.01	**100**	125.39	-61.94	-1.69
20	10.27	5.57	-3.40	**125**	116.22	-59.43	-1.78
25	26.61	-1.49	-4.23	**160**	97.22	-51.18	-2.08
31.5	45.01	-9.91	-4.01	**200**	92.29	-50.51	-2.11
40	35.39	-5.44	-4.16	**250**	74.95	-41.69	-2.48
50	41.27	-9.15	-4.04	**315**	87.68	-50.71	-2.10

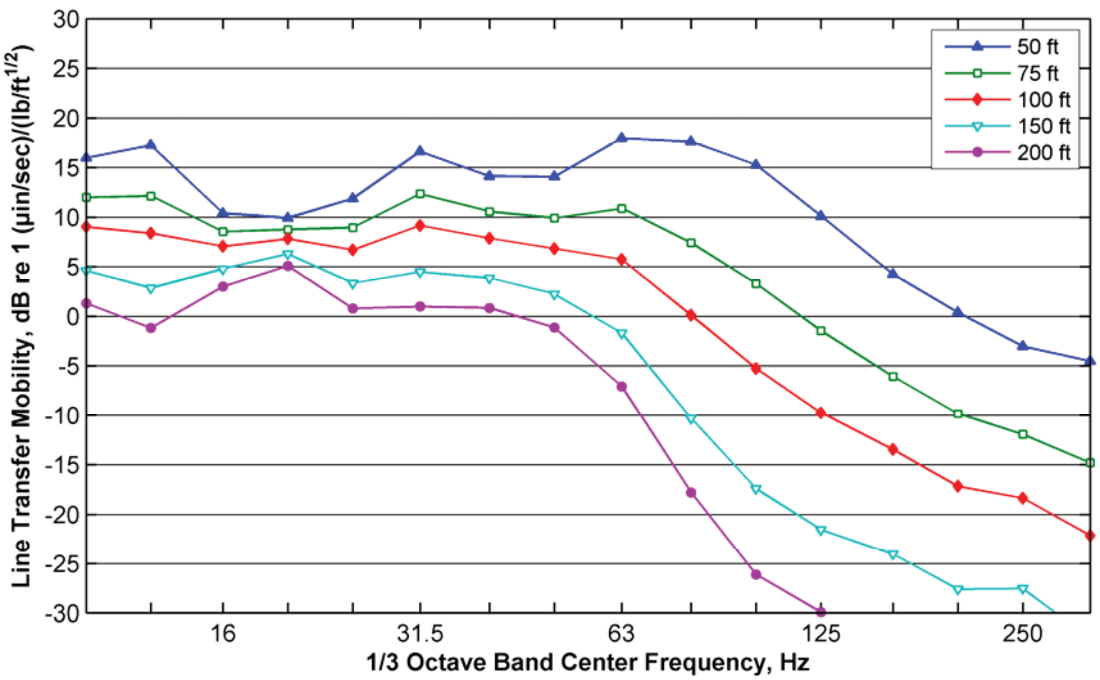

Figure 27: G-164. Best Fit LSTM

3.7 Site G-165

3.7.1 Site Description

This site was on-campus at Beverly Hills High School and was the only test site where the borehole location permitted meaningful indoor measurements. Testing was performed on 5 Mar 2011 at test depths of 55, 65, and 75 feet. Three indoor accelerometers were installed, mounted roughly center-span inside class rooms 107, 123 and 201. Details on the classroom measurement points are shown in Table 9. The PSTM spectra and indoor/outdoor PSTM differences for each of the classrooms are shown in Figure 32 through Figure 36. For the outdoor measurements the accelerometers were located at distances of 25, 37, 50, 75, 100, and 150 feet extending north from the borehole location. The line of accelerometers was offset from the borehole by 9 ft. Additional observations from the measurements include:

- At 55 ft depth, the hole advanced by 2 ft from the impacts. Force levels were in the range of 5k to 6k lbs. 100 hits were recorded.
- At 65 ft depth, 60 hits were recorded before the drill string advancement (30 inches) halted data collection. Additional drill rod was inserted and 60 more hits were recorded. The load cell failed during the second set of impacts.
- At 75 ft depth, 100 impact hits were recorded and there was no perceptible advancement. Because the load cell failure during the test at 65 ft, no force data were obtained at this test depth and transfer mobilities were not obtained.
- The accelerometer channel for Room 201 suffered from electrical interference during the entire measurement period.

Table 9: Classroom measurement locations at Beverly Hills High School

Room	Distance to Borehole	Room Description / Notes
107	100 ft; S-E of borehole	First floor classroom; basement below; floor noted as being relatively flexible
123	100 ft, N-E of borehole	First floor classroom; also suspended floor but notably stiffer than room 107
201	100 ft, N-E of borehole	Second floor classroom (directly above room 123)

3.7.2 Results for G-165

- Force levels at the 55 ft and 65 ft test depths were particularly low (3k to 8k lbs) although this was partially offset by the fact that the ambient noise levels at G-165 were lower than that encountered at the Wilshire Boulevard test sites.
- The coherences for the 55 ft test were relatively good through the 60 Hz 1/3 octave bands and still reasonable at higher frequencies.
- The coherences for the 65 ft test were good through up to the 100 Hz 1/3 octave band and then dropped off rapidly at higher frequencies.

- The best fit LSTM is flat up to 63 Hz at the 50 foot distance, and the fall off with distance is faster at the higher frequencies than the lower frequencies. The minimum drop off occurs in the 20 Hz band with only a 2 VdB loss from 50 to 200 ft.
- Comparisons of indoor and outdoor vibration levels were made by taking differences between the indoor and the closest outdoor PSTM spectra. For classroom 107 the closest accelerometer was the 100-foot position, and for classrooms 123 and 201 the 75-foot accelerometer data were used. PSTM data are shown (Figure 31, Figure 33, and Figure 35) for both the classroom and the outdoor reference measurement at each of the 3 test depths. Differences between these spectra for the three test depths are shown in Figure 32 (room 107), Figure 34 (room 123), and Figure 36 (room 201). Note that PSTM differences are plotted only at those frequencies where the PSTM coherence was above 0.1 for both the indoor and outdoor measurement.
    - **Classroom 107:** This classroom exhibited the largest outdoor/indoor level increase of the three rooms studied, with a 20-dB amplification observed at 10 Hz. Interior levels were approximately 10 dB higher than outdoor levels 25 and 50 Hz. This is consistent with the field observation that the floor in room 107 appeared to have unusually low stiffness.
    - **Classroom 123:** This classroom was also on the ground floor, and also with a suspended floor. As can be seen in Figure 34, no distinct resonances were observed, with mean differences near 0 dB at 10 Hz, falling gradually to -5 dB at 40 Hz.
    - **Classroom 201:** This second floor classroom lies directly above room 123. Here the PSTM differences suggest some amplification (5 – 10 dB) occurring in the 25 Hz band, but otherwise little amplification or attenuation with respect to the outdoor levels.

3.7.3 Plots and Tables

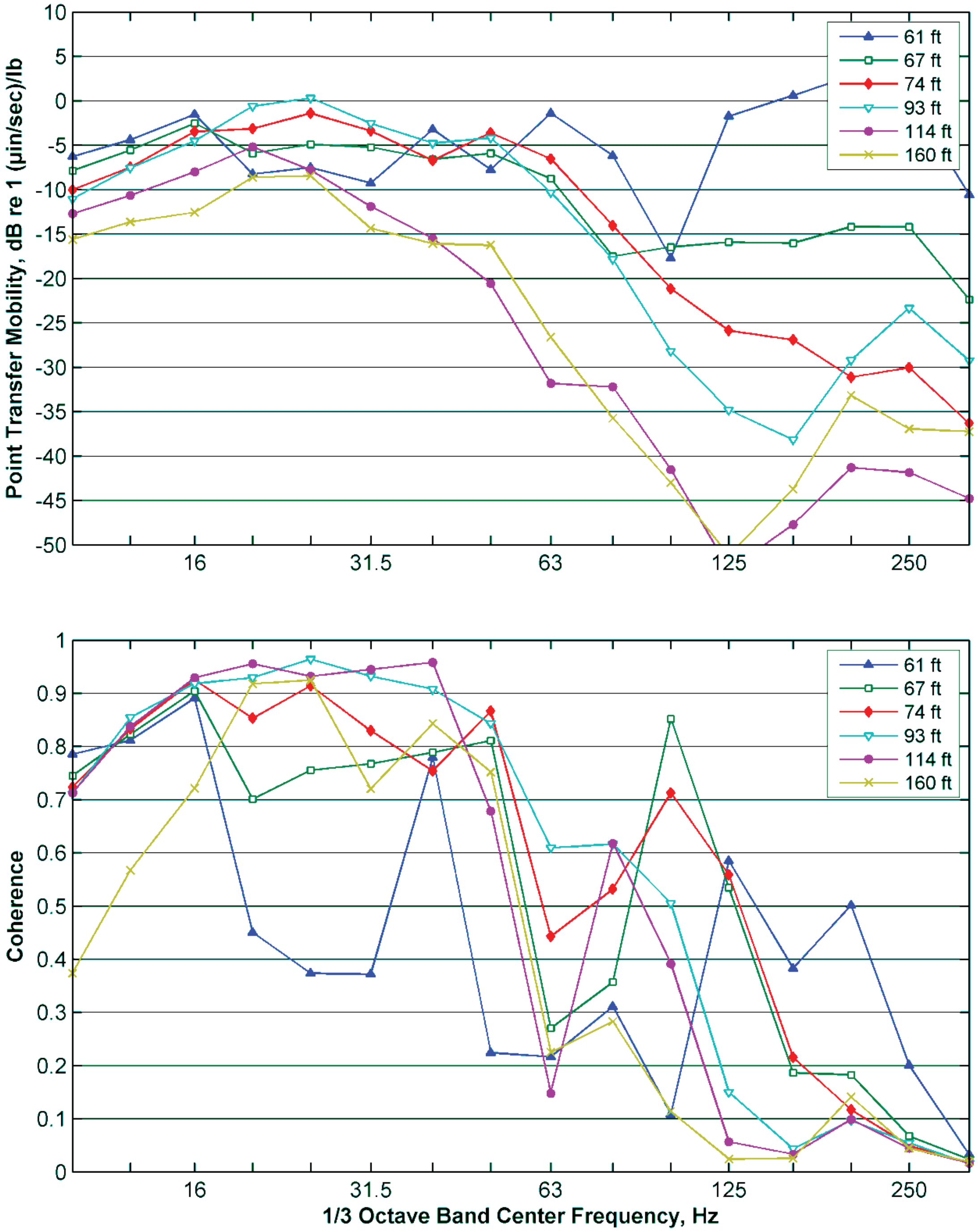

Figure 28: G-165. Measured PSTM at Depth of 55 ft

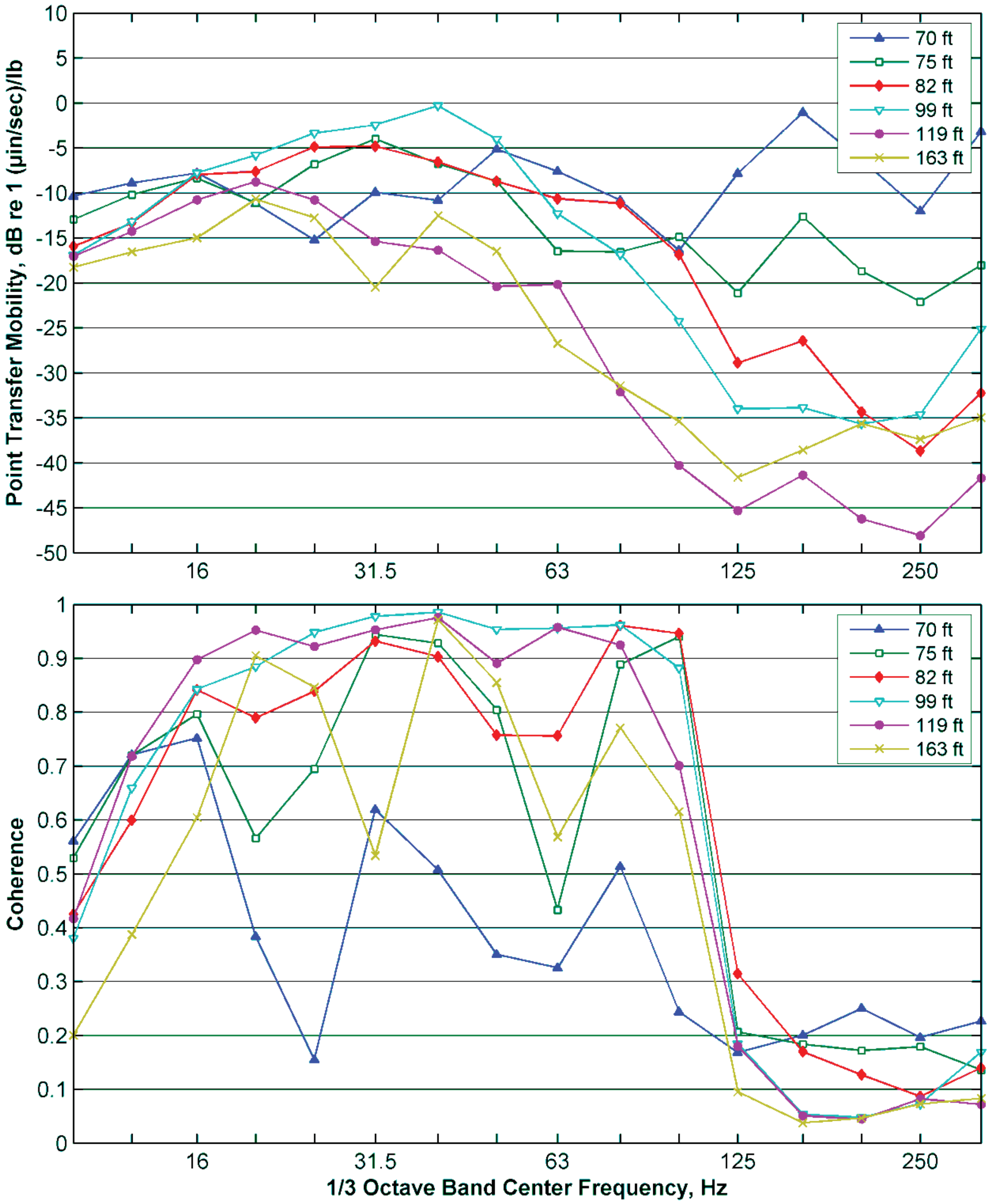

Figure 29: G-165. Measured PSTM at Depth of 65 ft

Table 10: G-165. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	22.43	2.05	-4.16	**63**	87.94	-36.42	-2.73
12.5	25.30	1.83	-4.17	**80**	95.60	-43.77	-2.39
16	32.02	-0.11	-4.22	**100**	99.23	-49.28	-2.16
20	17.71	2.55	-1.03	**125**	164.63	-87.20	-1.01
25	17.67	5.40	-2.67	**160**	155.82	-80.89	-1.15
31.5	37.95	-3.96	-4.20	**200**	114.29	-58.03	-1.83
40	30.15	0.18	-4.22	**250**	112.15	-57.57	-1.84
50	43.53	-7.96	-4.08	**315**	82.78	-40.90	-2.52

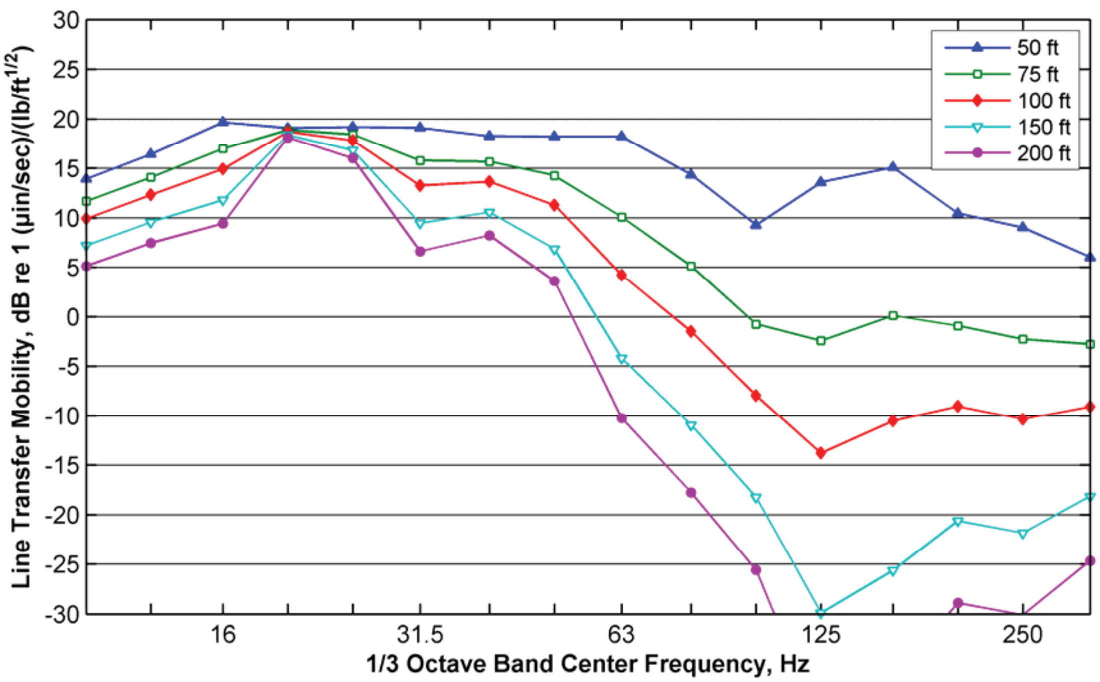

Figure 30: G-165. Best Fit LSTM

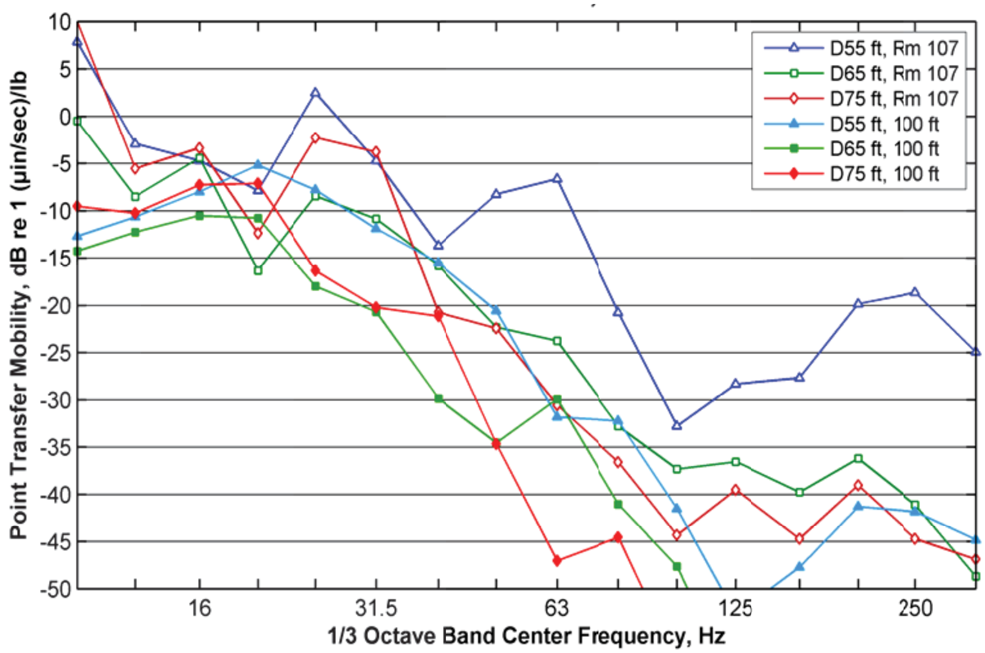

Figure 31: PSTM Spectra for Classroom 107

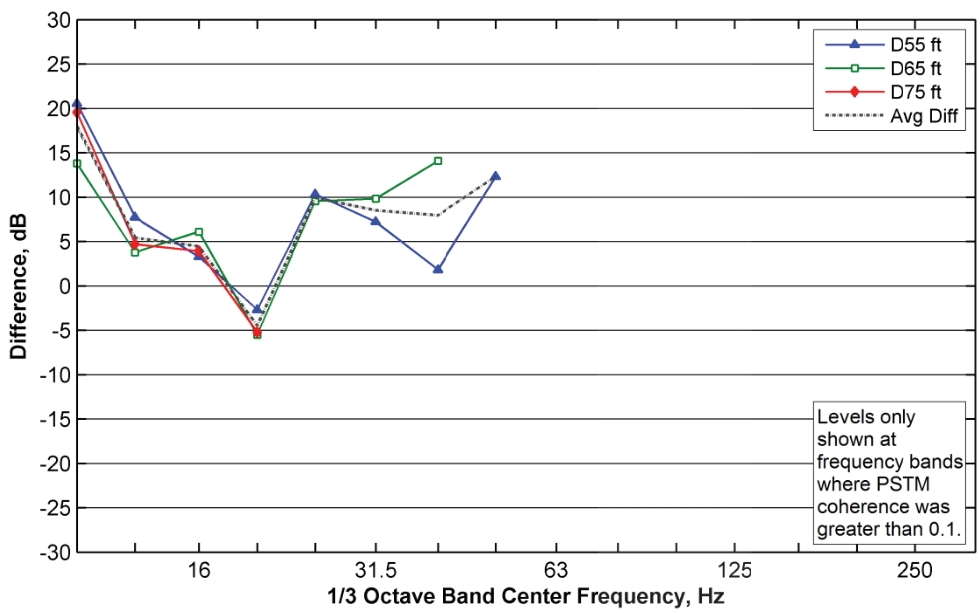

Figure 32: PSTM Difference (Indoor – Outdoor) for Room 107

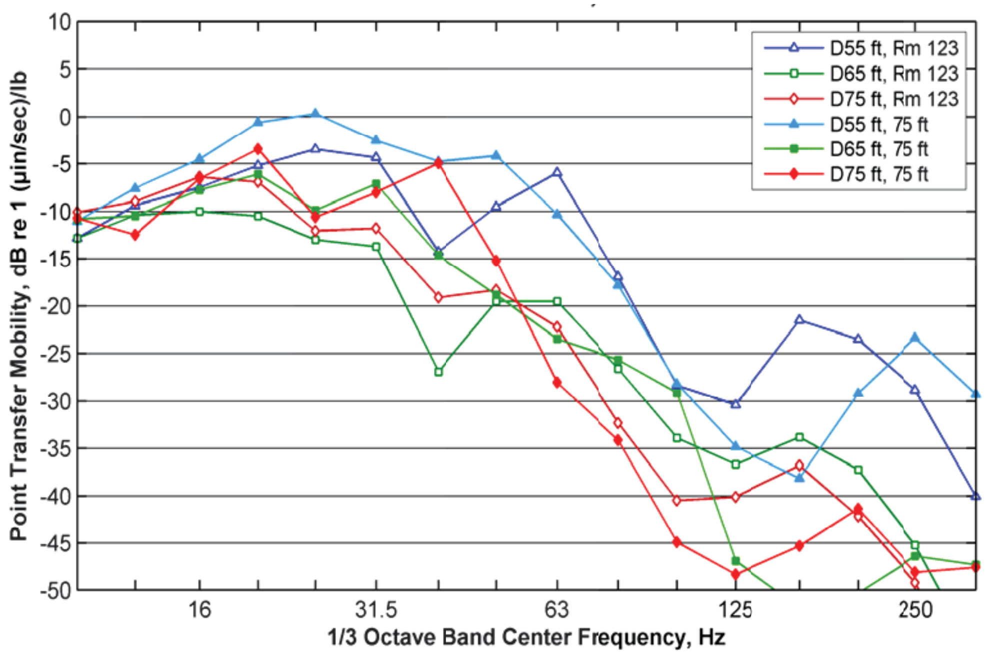

Figure 33: PSTM Spectra for Classroom 123

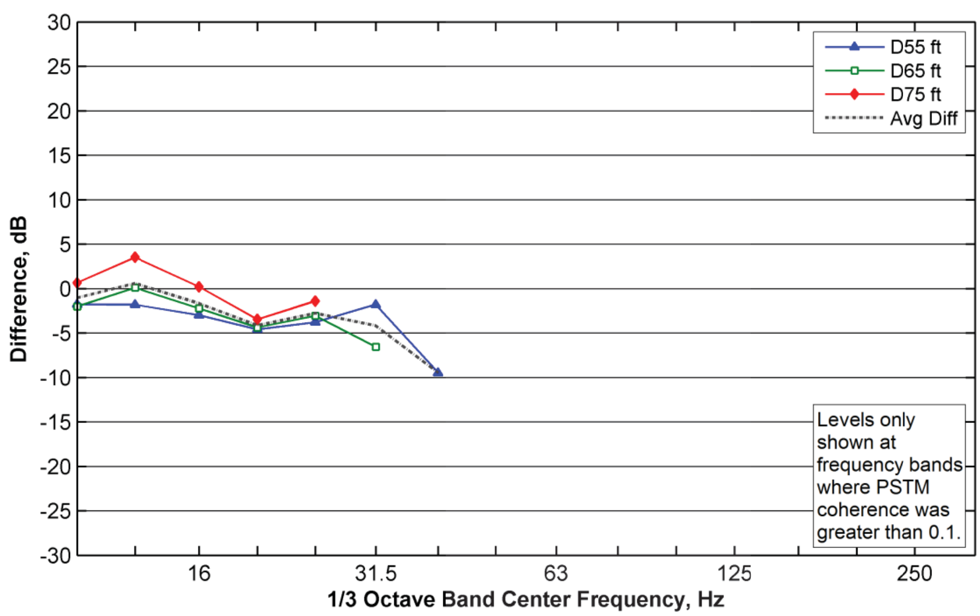

Figure 34: LSTM Difference (Indoor – Outdoor) for Room 123

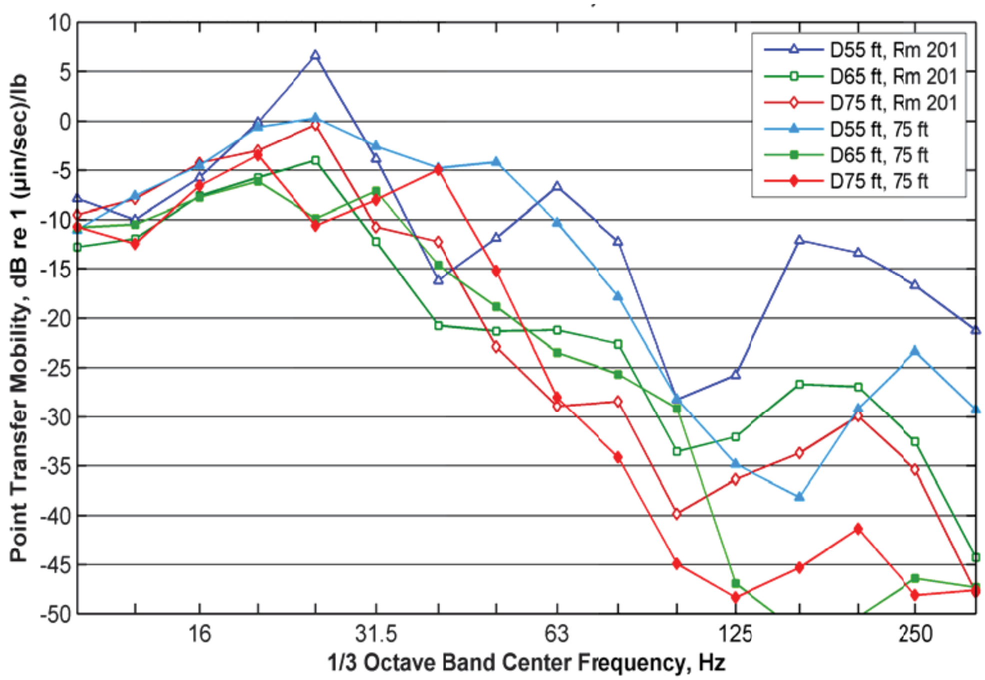

Figure 35: PSTM Spectra for Classroom 201

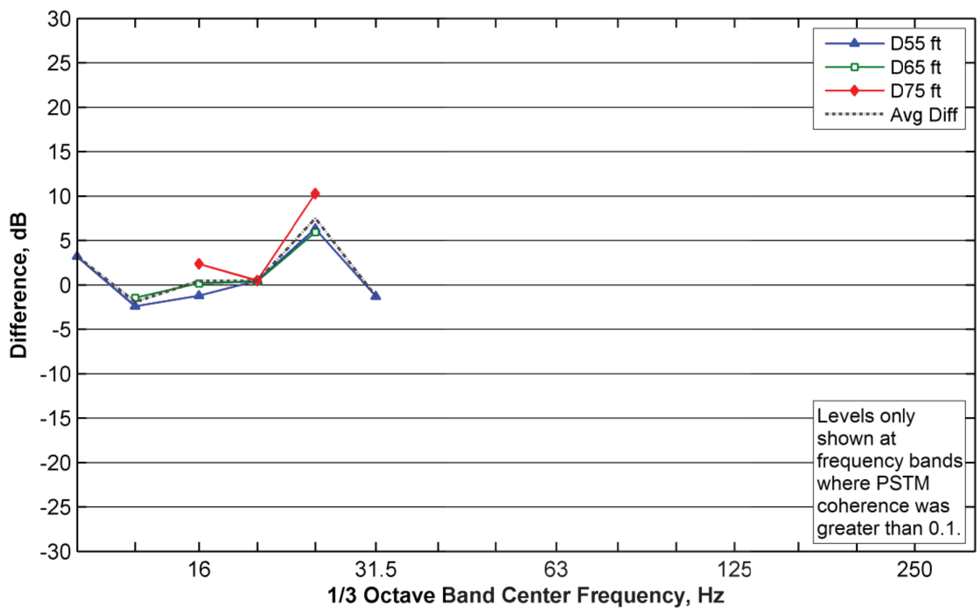

Figure 36 – PSTM Difference (Indoor – Outdoor) for Room 201

3.8 Site G-166

3.8.1 Site Description

This site was also on the Beverly Hills High School campus, along the western edge of the Lacrosse field. Testing was performed on 19 Mar 2011, at test depths of 55, 65, and 75 feet. The accelerometers were located at distances of 25, 40, 60, 90, 140, and 165 feet, extending north from the borehole location. The line of accelerometers was offset from the borehole by 4 ft. Additional observations from the measurements include:

- At the 55 ft test depth, the load cell was advanced 2 ft by the impacts. Peak force levels were 4k to 5k lbs, among the lowest observed in the 12 tests. 100 hits were recorded.
- At the 65 ft depth, 100 impact hits were recorded before the drill string advancement (30 to 36 inches) halted data collection. No force data was available for this test depth due to instrumentation problems, although the large advancement observed implies very low forces.
- At the 75 ft depth, 100 impact hits were recorded with 6 inches advancement during the first 30 hits, and no perceptible advancement for the remainder of the test. The force levels rose from 4k to 25k lbs during the test.

3.8.2 Results for G-166

- Coherences were good through 160 Hz for all the measurements except the farthest accelerometers for each depth, which still had good coherence in 1/3 octave bands below 63 Hz.
- The LSTM decreases with distance more rapidly at the higher frequencies than at lower frequencies. There minimum decrease with distance is in the 16 Hz band.
- The best fit LSTM has a spectral peak on the 63 Hz band for the 50 ft distance, which is seen in the PSTM of the closest accelerometer location at the shallowest depth. However, there is a distinct dip in coherence for that band at the 55 foot test depth. .

3.8.3 Plots and Tables

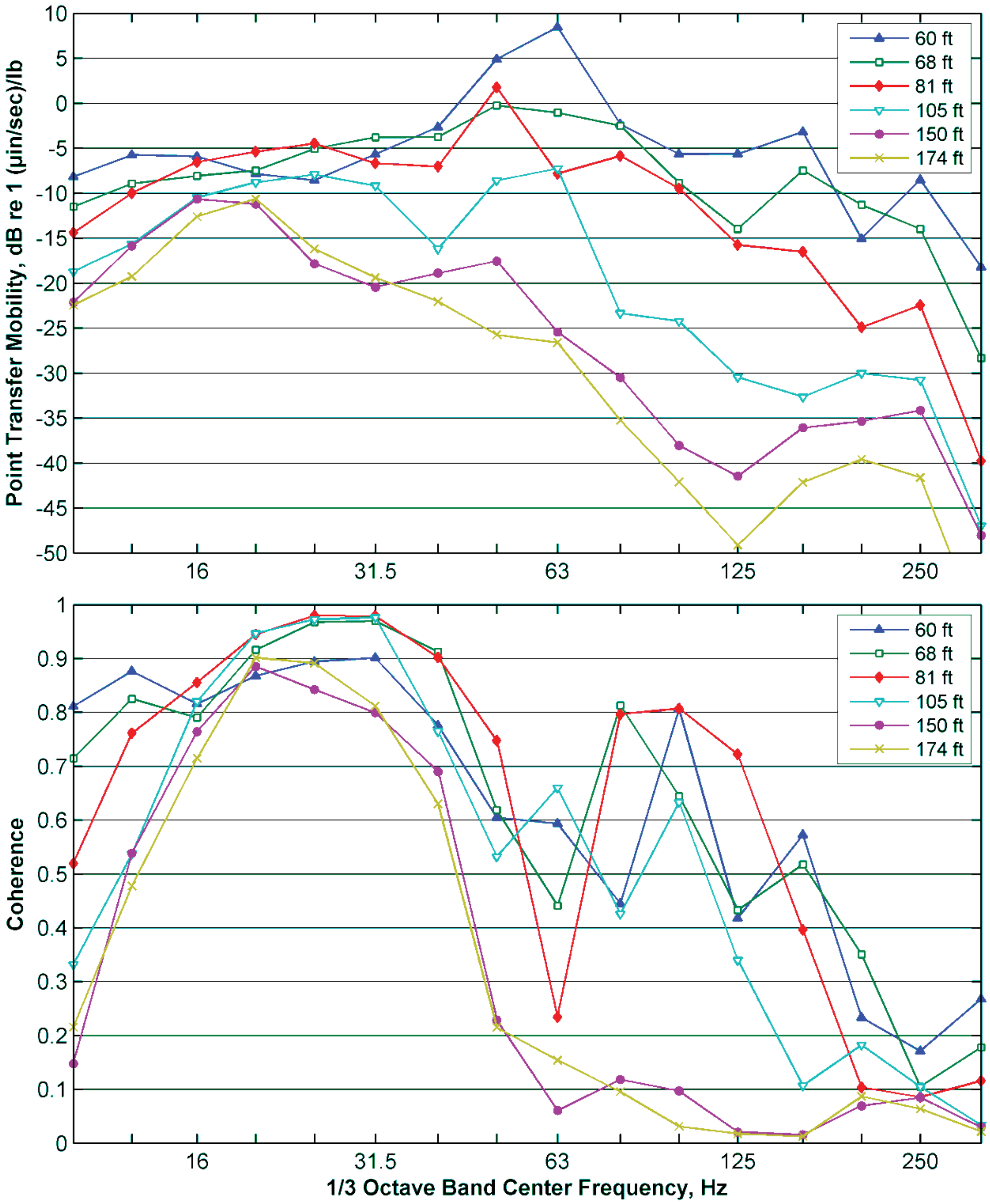

Figure 37: G-166. Measured PSTM at Depth of 55 ft

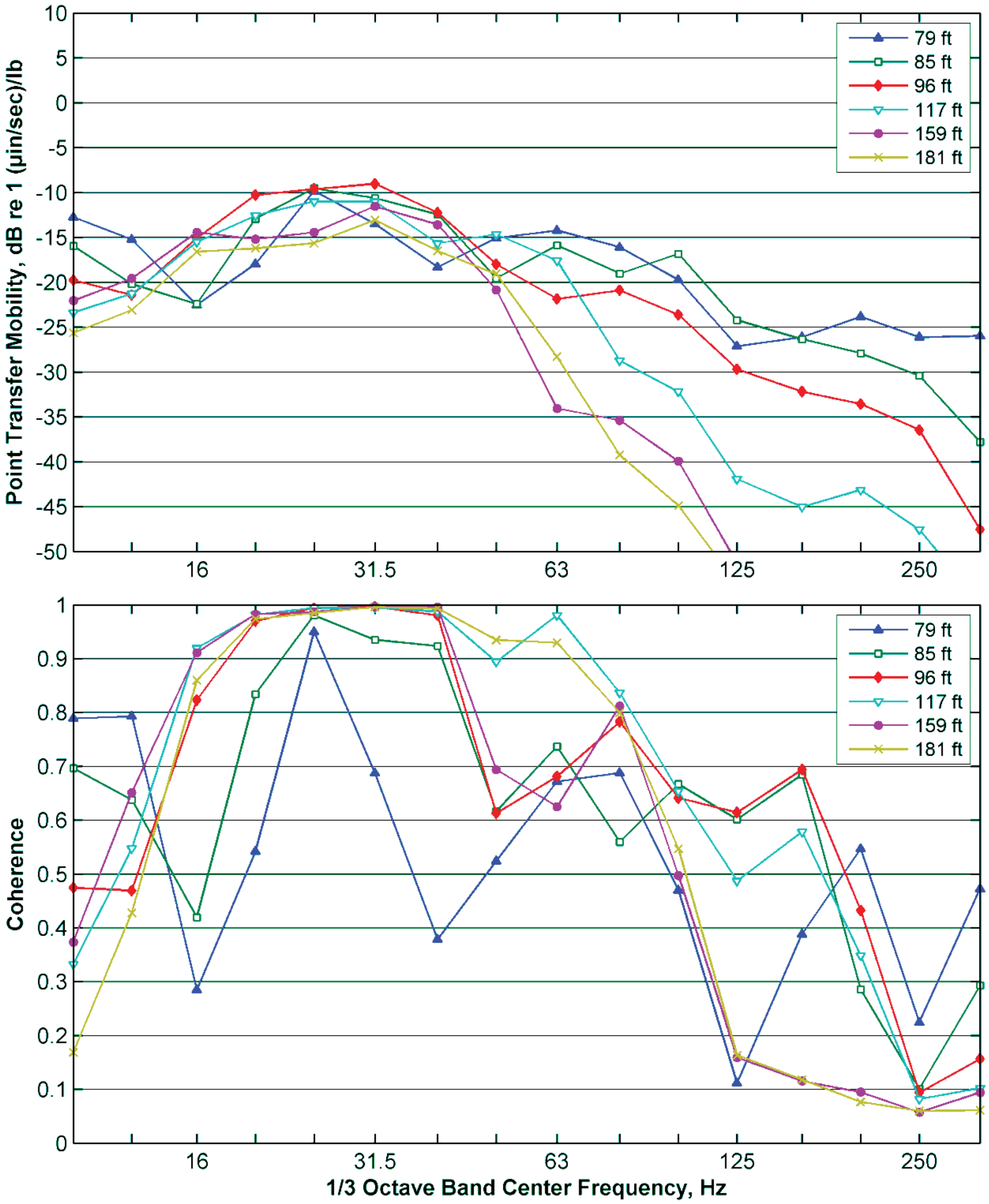

Figure 38: G-166. Measured PSTM at Depth of 75 ft

Table 11: G-166. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	34.67	-6.44	-4.13	**63**	111.57	-48.31	-2.20
12.5	24.81	-0.25	-4.23	**80**	125.44	-58.92	-1.80
16	11.27	4.73	-2.14	**100**	136.53	-66.96	-1.53
20	14.28	5.60	-2.94	**125**	150.72	-77.97	-1.22
25	27.56	1.14	-4.20	**160**	156.92	-81.03	-1.15
31.5	27.83	0.85	-4.20	**200**	117.63	-60.87	-1.73
40	33.87	-3.40	-4.21	**250**	131.87	-69.04	-1.47
50	71.55	-24.18	-3.33	**315**	121.84	-69.26	-1.46

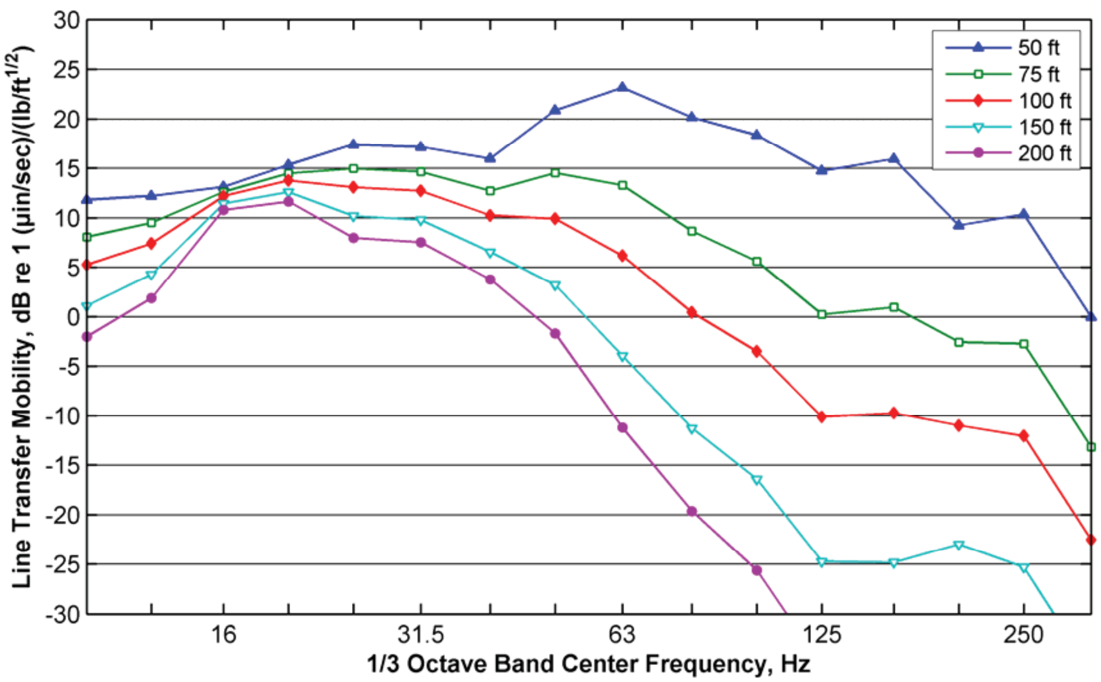

Figure 39: G-166. Best Fit LSTM

3.9 Site G-173

3.9.1 Site Description

This site was located on Missouri Avenue, approximately 50 feet east of the intersection of Missouri and Fox Hills, and 75 feet west of the prior test done at SB-2. Testing was performed on 21 and 22 Jan 2011, at test depths of 60, 70, and 80 feet. The line of accelerometers was set up extending south along the sidewalk on Fox Hills at distances of 12, 24, 37, 62, 87, 137 feet. This resulted in similar spacing to the normal distances used by starting closer and compensating for the abnormally high borehole offset (24 feet). Because vehicular traffic on Fox Hills was intermittent, background interference from traffic was minimal during the test. Following are some observations from the measurements:

- At 60 ft depth, there was no perceptible load cell advancement of the hole from the impacts. Force levels ranged from 20k to 25k lbs. 100 hits were recorded.
- At 70 feet, 100 impact hits were recorded with no perceptible advancement. Force levels were approximately 15k lbs throughout.
- At the 80 foot depth, there was very little (2 inches) advancement from the impacts. The drill crew supervisor reported silty sand at this depth. Measured force levels were 7k to 10k lbs.

3.9.2 Results for G-173

- The PSTM for impact hits at all three depths were similar indicating potentially lower attenuation rate for vibration.
- The coherences were good between 25 and 125 Hz for most tests but lower (and somewhat erratic) at 25 Hz and below.
- The LSTM shows a relatively constant decrease in distance across all frequency bands, with a slight increase in fall-off in the higher frequency bands.

3.9.3 Plots and Tables

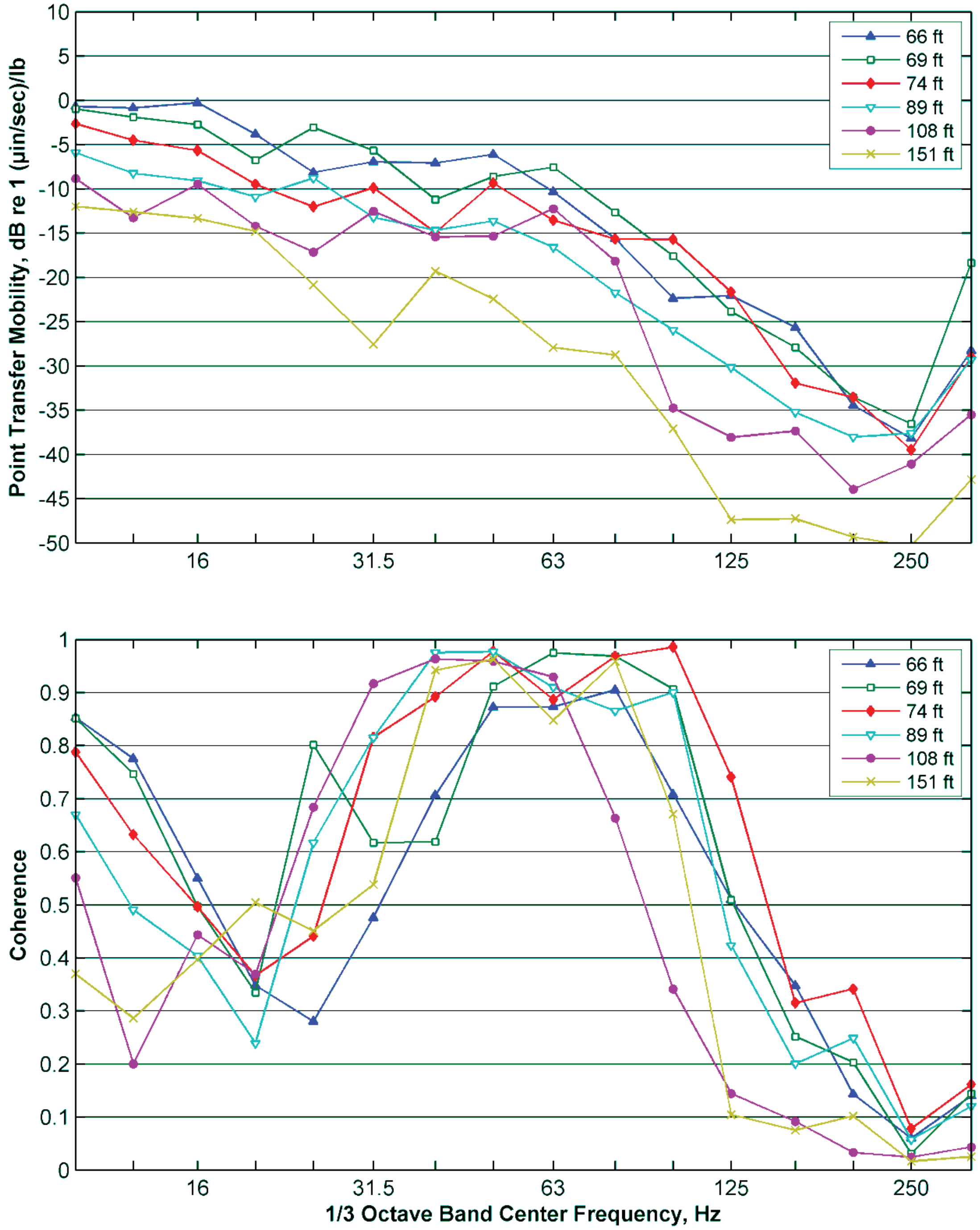

Figure 40: G-173. Measured PSTM at Depth of 60 ft

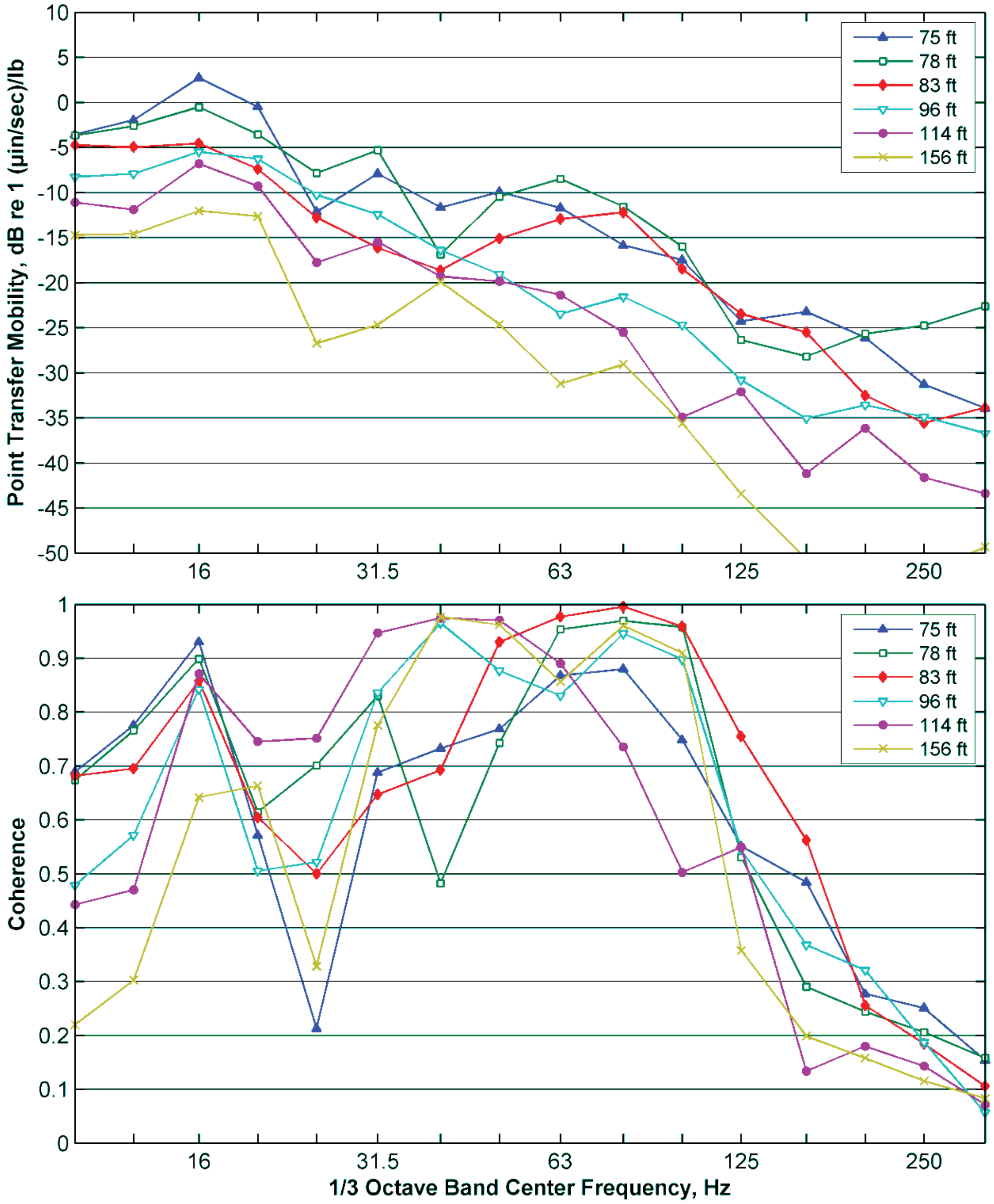

Figure 41: G-173. Measured PSTM at Depth of 70 ft

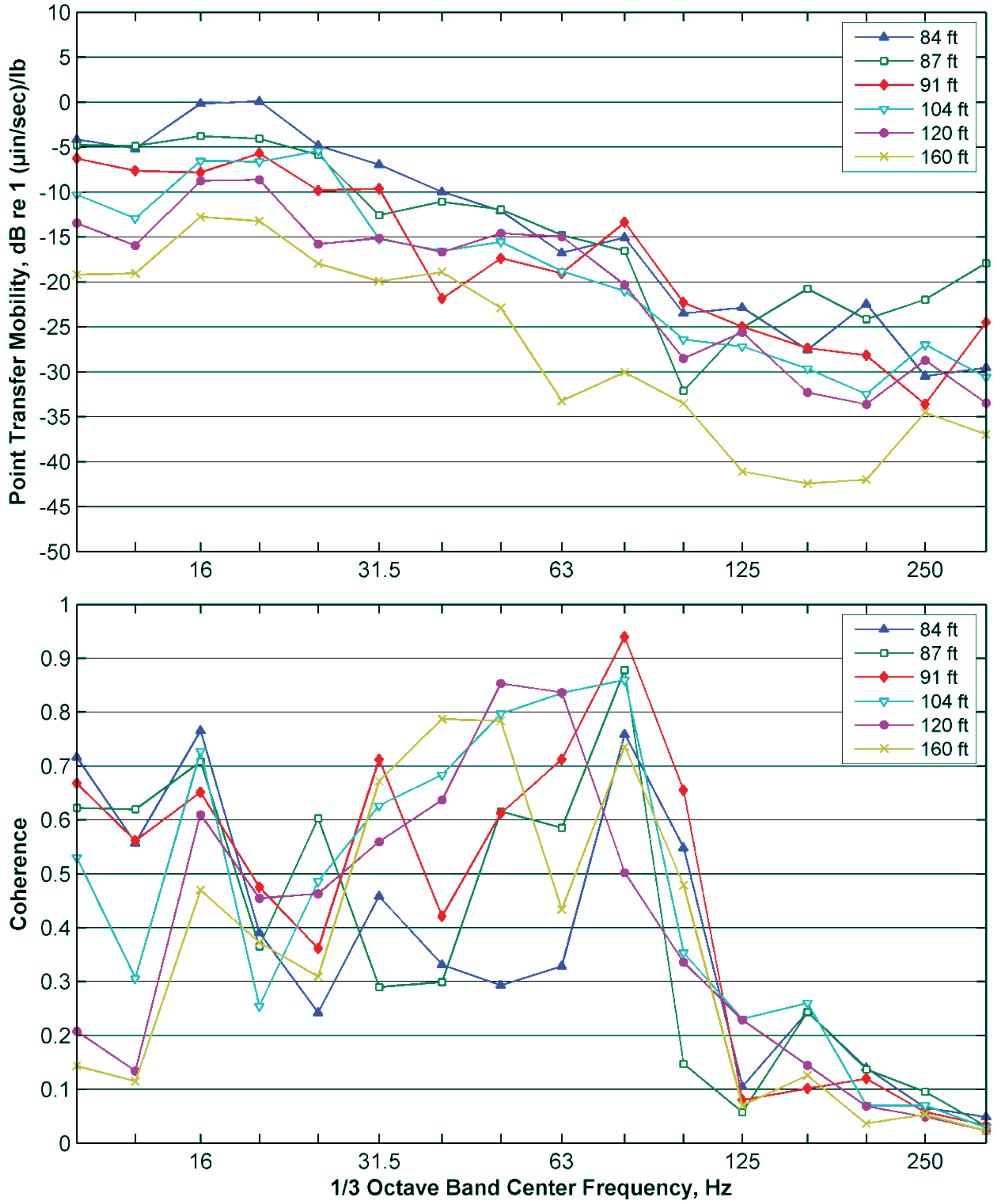

Figure 42: G-173. Measured PSTM at Depth of 80 ft

Table 12: G-173. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	63.23	-17.45	-3.66	**63**	81.27	-33.56	-2.86
12.5	65.43	-19.23	-3.58	**80**	58.70	-21.56	-3.46
16	49.00	-8.40	-4.07	**100**	66.57	-29.98	-3.04
20	35.92	-2.06	-4.23	**125**	76.21	-37.49	-2.67
25	59.58	-17.97	-3.64	**160**	74.84	-38.57	-2.62
31.5	67.93	-23.43	-3.36	**200**	50.34	-25.54	-3.26
40	21.23	1.48	-4.18	**250**	13.56	-5.11	-4.17
50	55.05	-17.02	-3.68	**315**	60.14	-29.78	-3.05

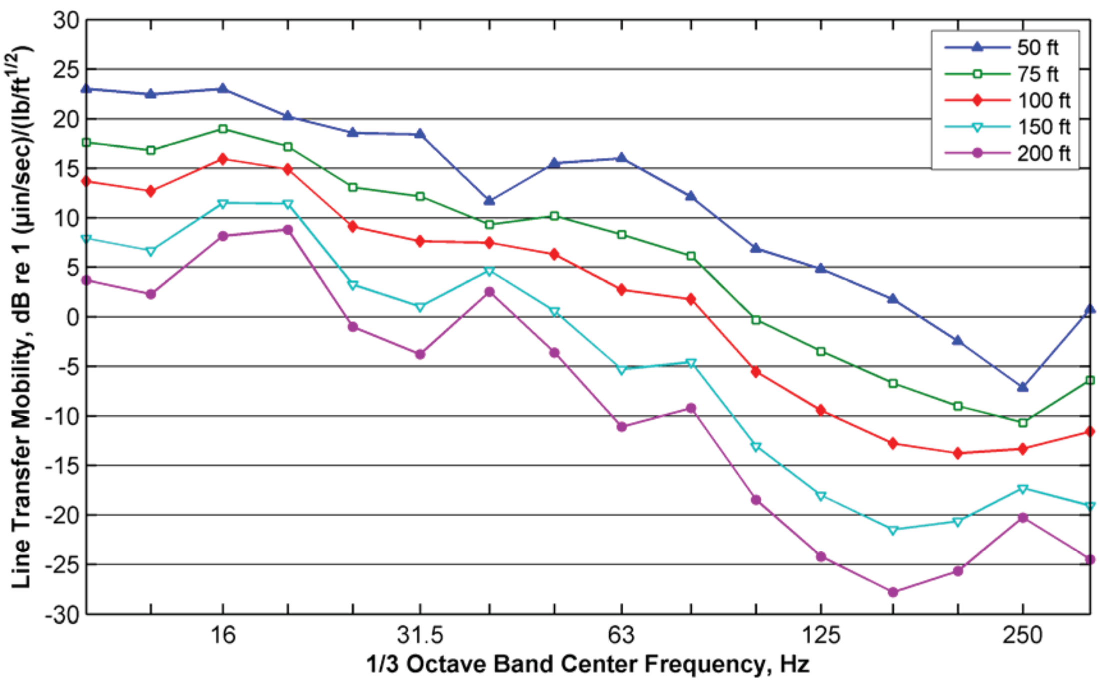

Figure 43: G-173. Best Fit LSTM

3.10 Site G-176

3.10.1 Site Description

This site was located on Warner Avenue between Thayer and Rochester, a residential street with no apparent background vibration sources. The closest street with significant traffic was approximately 500 ft away from the line of accelerometers. Testing was performed on 27 and 28 Dec 2010, at test depths of 80, 90, and 97 feet. The accelerometers were arrayed downhill along Warner Avenue at distances of 25, 37, 50, 75, 100, and 150 feet from the borehole. The signal to noise ratio was very low for the closest three accelerometers and because of electromagnetic interference. The signals at the farther three accelerometers were good. The following are some observations from the measurements:

- Two sets of 100 hits each were collected at the 80 foot test depth. Force levels ranged from 10k to 13k lbs.
- At the 90 foot test depth two set of 100 hits each were recorded. Force levels were in the 7k to 9k lbs range.
- At the 97 foot depth a single set of 100 hits was recorded. Force levels were in the 6k to 7k lbs range.

3.10.2 Results for G-176

- The coherences were surprisingly low for measurements at the closest three accelerometers.
- The PSTM for all depths were similar showing potentially lower attenuation rate for vibration.

3.10.3 Plots and Tables

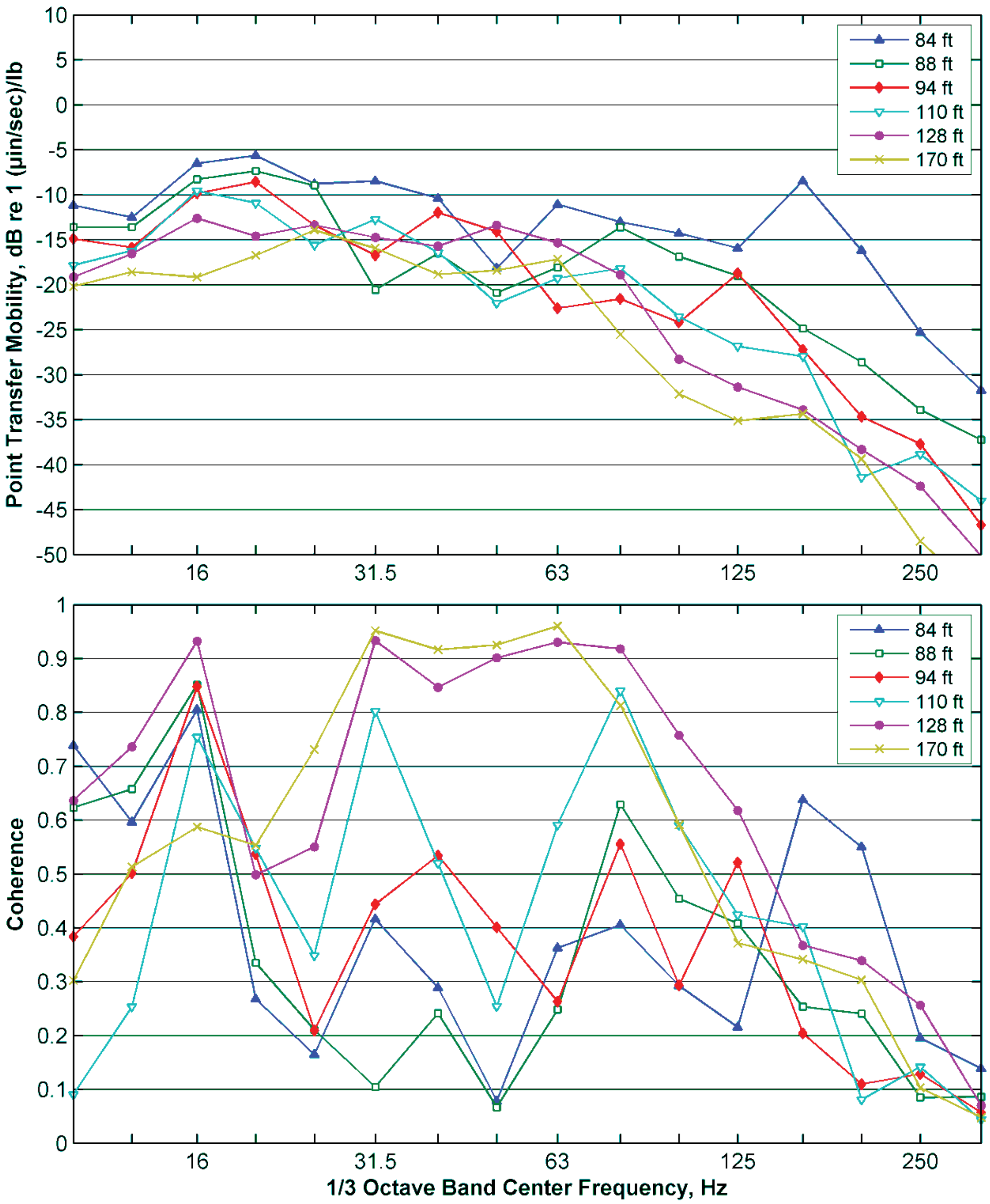

Figure 44: G-176. Measured PSTM at Depth of 80 ft

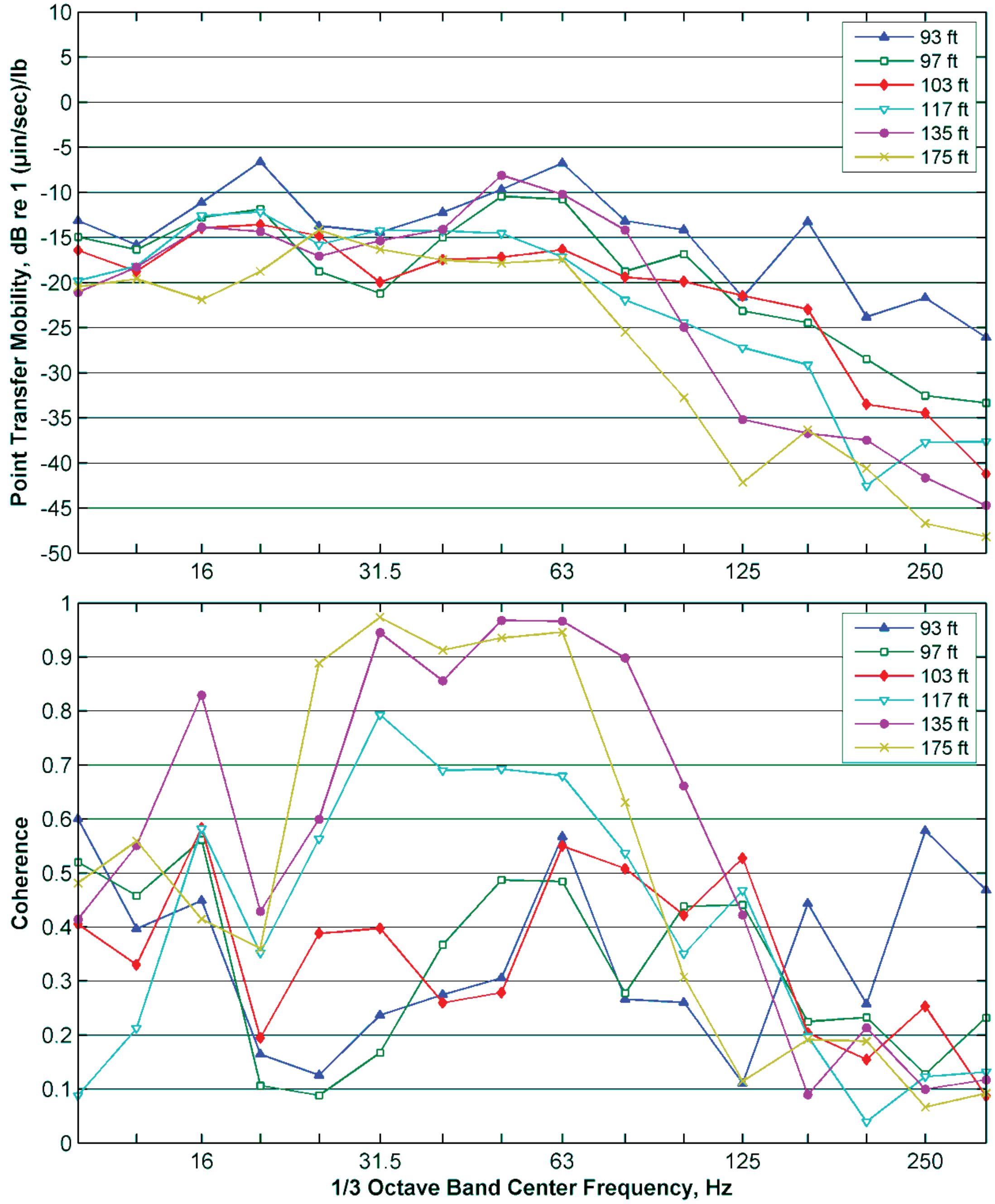

Figure 45: G-176. Measured PSTM at Depth of 90 ft

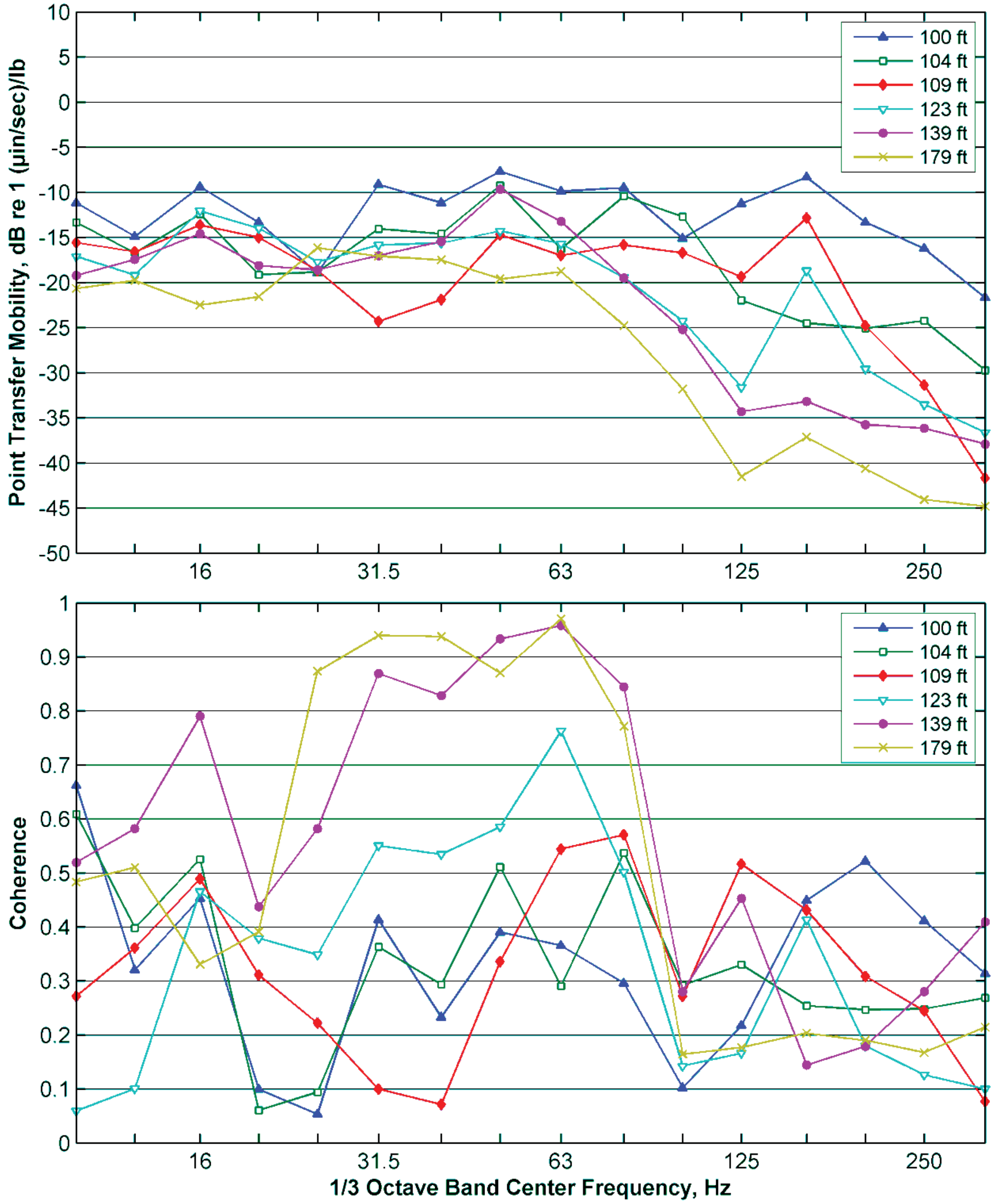

Figure 46: G-176. Measured PSTM at Depth of 97 ft

Table 13: G-176. Coefficients for Best Fit LSTM							
Freq. (Hz)	**A**	**B**	**C**	**Freq. (Hz)**	**A**	**B**	**C**
10	31.59	-3.38	-4.21	**63**	10.72	5.56	-2.87
12.5	13.52	4.89	-3.77	**80**	42.13	-9.76	-4.01
16	55.83	-14.66	-3.80	**100**	86.38	-36.51	-2.72
20	49.82	-11.52	-3.94	**125**	132.40	-63.62	-1.64
25	9.69	5.05	-2.37	**160**	112.05	-52.11	-2.05
31.5	9.09	2.94	-1.21	**200**	78.81	-37.72	-2.66
40	13.48	5.35	-3.58	**250**	90.46	-45.66	-2.31
50	10.54	4.85	-2.22	**315**	62.95	-33.10	-2.88

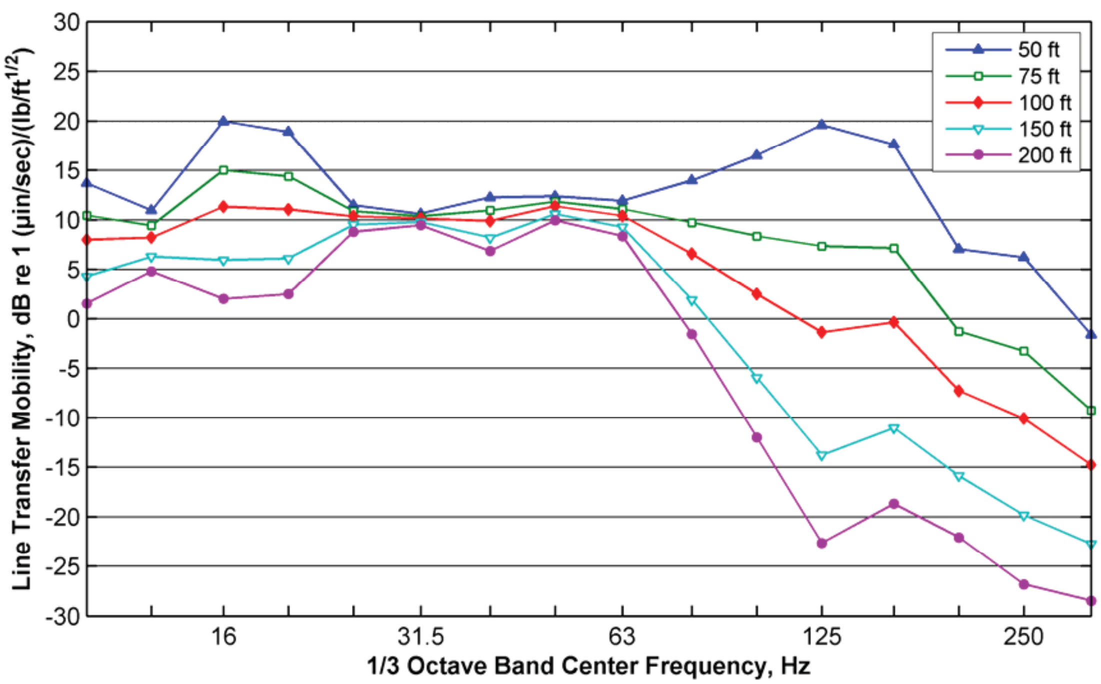

Figure 47: G-176. Best Fit LSTM

3.11 Site G-178

3.11.1 Site Description

Testing was performed on 17 and18 Jan 2011, at test depths of 65, 75, and 85 feet. This site was located on Wilshire Boulevard between Manning and Westholme in Westwood. The nearest vibration-sensitive receiver to this borehole is NV-50, the apartment building at 10655 Wilshire Boulevard. The line of accelerometers was located along the Wilshire Boulevard median on a downward slope at distances of 25, 37, 50, 75, 100, and 150 feet from the borehole with an offset of 3 feet. The measurements were performed at depths of 65, 75, and 85 ft. The measurements were affected by the vibration from continuous vehicular traffic on Wilshire Boulevard. Observations from the measurements results are:

- At the 65 ft depth, 100 impact hits were recorded with approximately 2 feet of drill string advancement. Force levels ranged from 8k to 12k lbs.
- At 75 feet, 100 impact hits were recorded with no perceptible load cell advancement. Force levels were 20k to 25k lbs.
- At 85 feet, two sets of 100 impact hits were recorded. The first set showed force levels from 14k to 18k lbs, with 15k to 22k lbs for the second set.

3.11.2 Results for G-178

- The PSTM was dominated by energy below 80 Hz.
- The PSTM showed higher attenuation rates above 100 Hz.
- Coherence was very poor below 31.5 Hz, which may be attributable to background vibration from Wilshire traffic.
- The LSTM has the smallest decrease with distance in the low frequency ranges where coherence is also the lowest and progressively greater decay rates above 31 Hz. This site had the highest decrease with distance at high frequencies of any borehole test, dropping 60 dB from 50 ft to 200 ft.

3.11.3 Plots and Tables

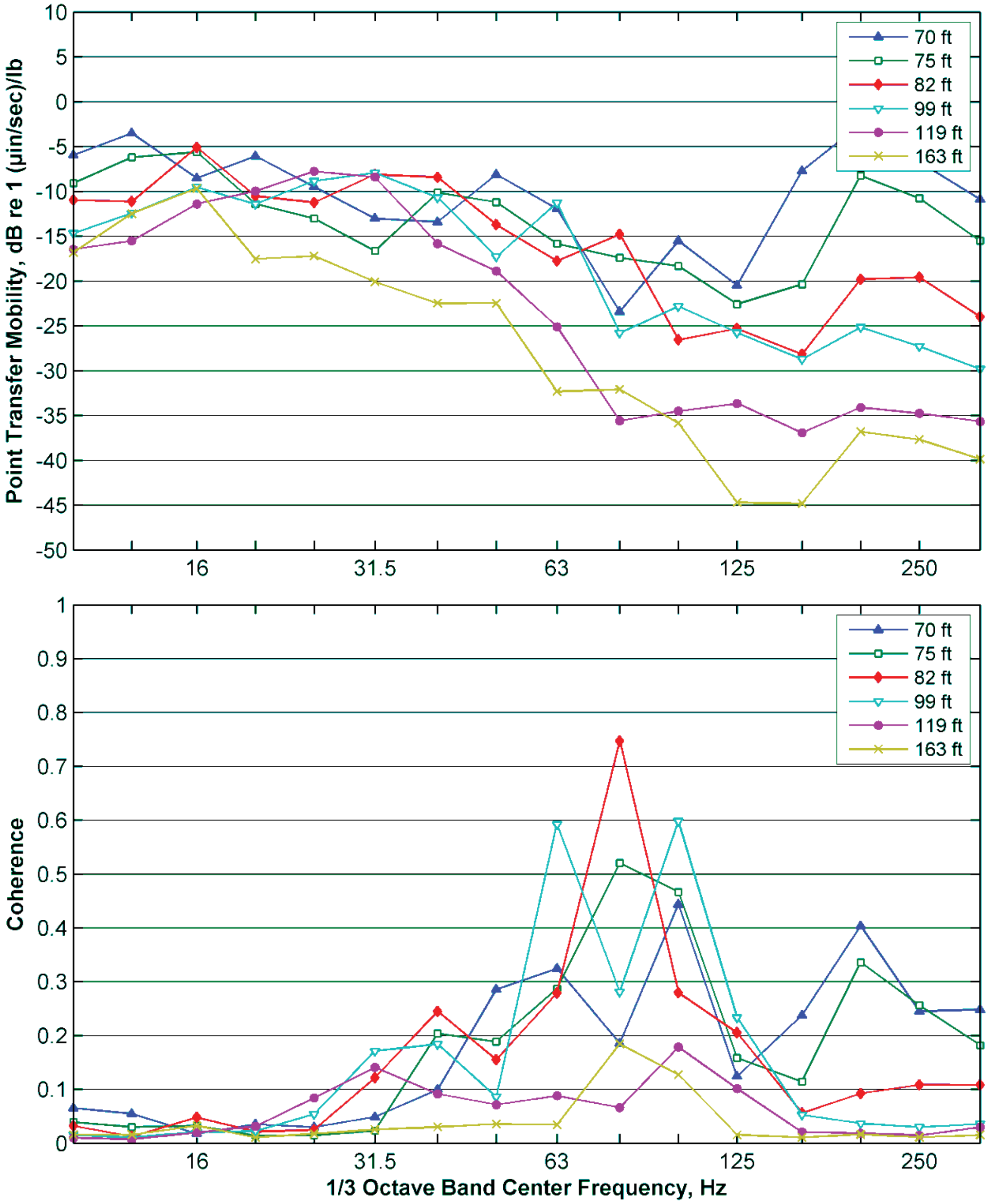

Figure 48: G-178. Measured PSTM at Depth of 65 ft

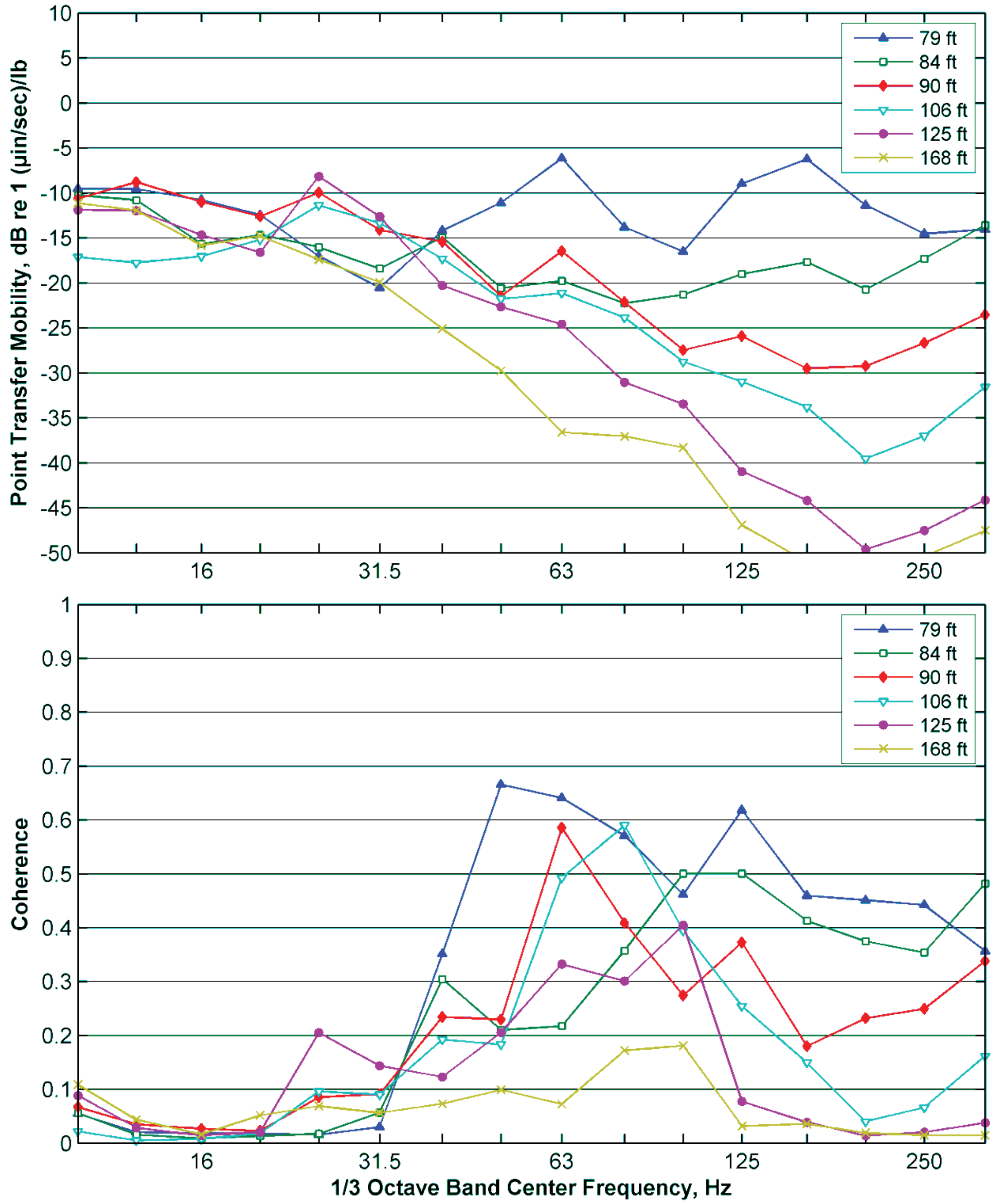

Figure 49: G-178. Measured PSTM at Depth of 75 ft

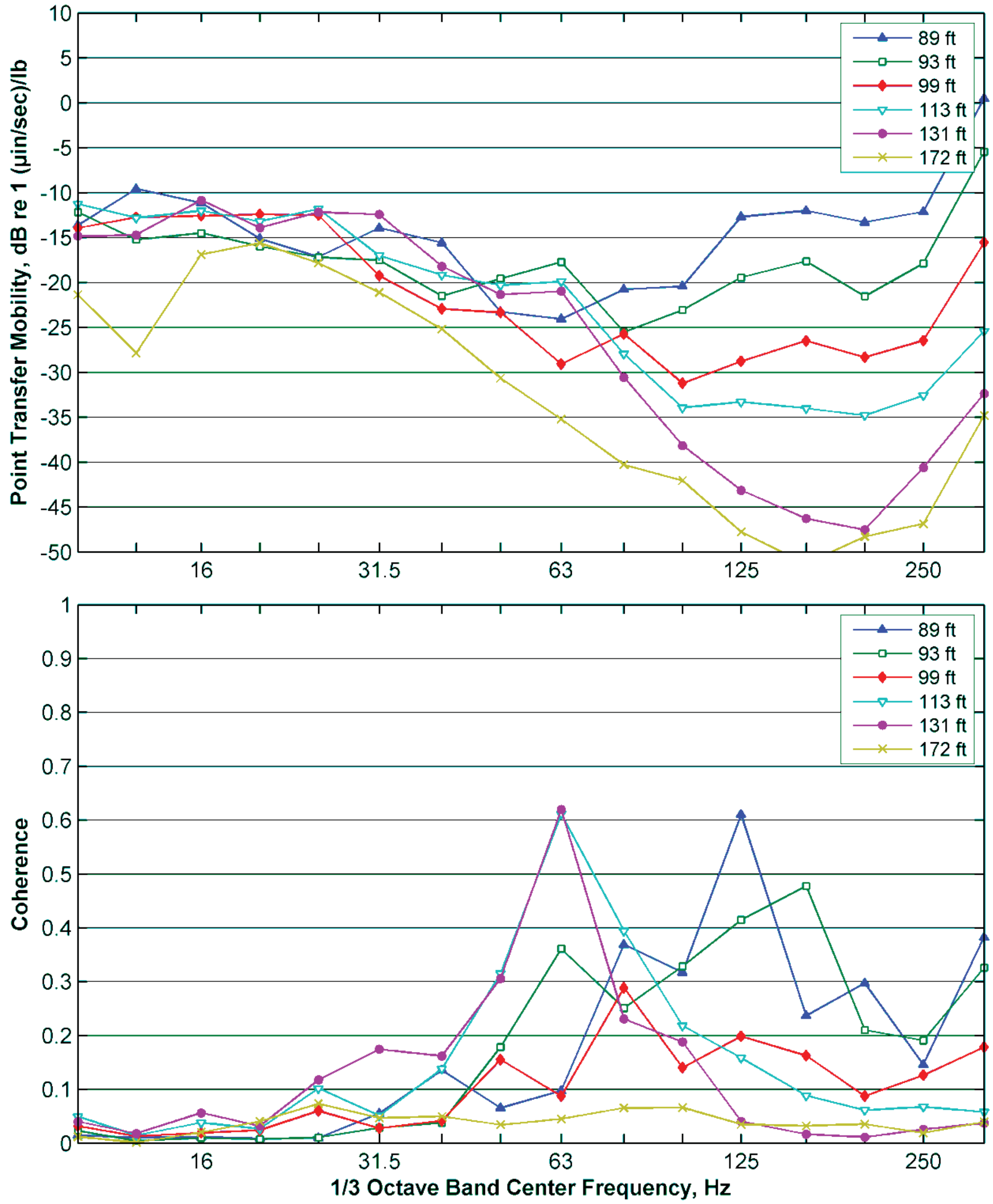

Figure 50: G-178. Measured PSTM at Depth of 85 ft

Table 14: G-178. Coefficients for Best Fit LSTM							
Freq. (Hz)	**A**	**B**	**C**	**Freq. (Hz)**	**A**	**B**	**C**
10	23.06	2.28	-4.14	**63**	81.81	-35.02	-2.79
12.5	35.17	-3.76	-4.20	**80**	73.34	-32.90	-2.89
16	16.54	5.31	-3.60	**100**	88.50	-42.54	-2.45
20	14.48	5.45	-3.51	**125**	141.86	-72.18	-1.38
25	11.55	4.86	-2.23	**160**	184.02	-94.54	-0.86
31.5	10.17	5.55	-2.85	**200**	190.95	-97.73	-0.80
40	36.67	-7.20	-4.11	**250**	175.47	-89.21	-0.97
50	49.25	-15.72	-3.75	**315**	149.05	-73.43	-1.34

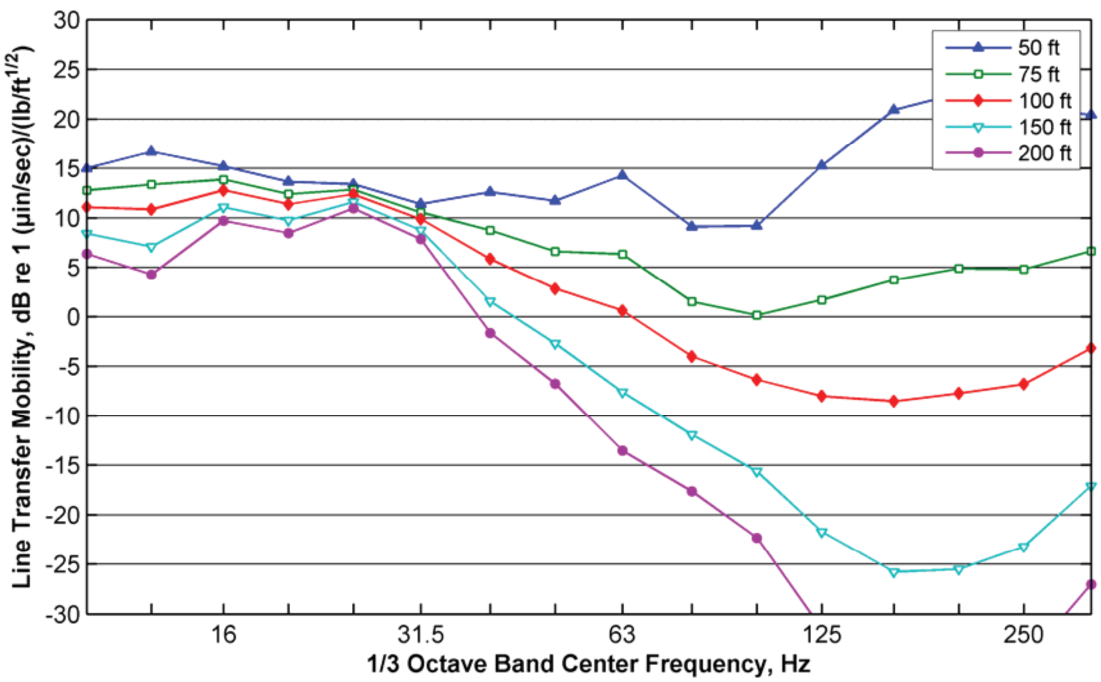

Figure 51: G-178. Best Fit LSTM

3.12 Site G-203

3.12.1 Site Description

This site was located in the West parking lot of the VA Medical Center at 11301 Wilshire Boulevard. Testing was performed on 3 May 2011, at test depths of 55, 65 and 75 feet. The accelerometers were located along South Moreno Drive at distances of 25, 37, 50, 75, 100, and 150 feet from the borehole location. The line of accelerometers extended northward from the borehole with an offset of 8 feet. Additional observations from the measurements results are:

- At the 55 ft depth, 100 hits were recorded but the amount of load cell advancement was not noted. The drill crew supervisor reported mostly sandy conditions at 55 feet with thin layering above consisting of silty sand and some clay. Typical test forces ranged from 8k to 11k lbs.
- At the 65 ft depth, 100 impact hits were recorded with no perceptible load cell advancement. No force data were obtained at this test depth as the load cell failed after the second impact.
- At the 75 ft test depth, 100 impact hits were recorded. No force data were obtained at this test depth.

3.12.2 Results for G-203

- Coherence was generally good from 20 to 120 Hz even though peak force levels were low-to-average for these tests. Interference from traffic vibration noise was minimal during the 55 foot test.
- The best fit LSTM suggests there is virtually no change in LSTM with distance in the 25 Hz band but nearly 50 dB decrease from 50 to 200 ft in the higher frequency bands. These anomalies are likely to be an artifact of having only six data points for estimating LSTM. The coherences are high in the 25 Hz band and not unreasonably low at higher frequencies.

3.12.3 Plots and Tables

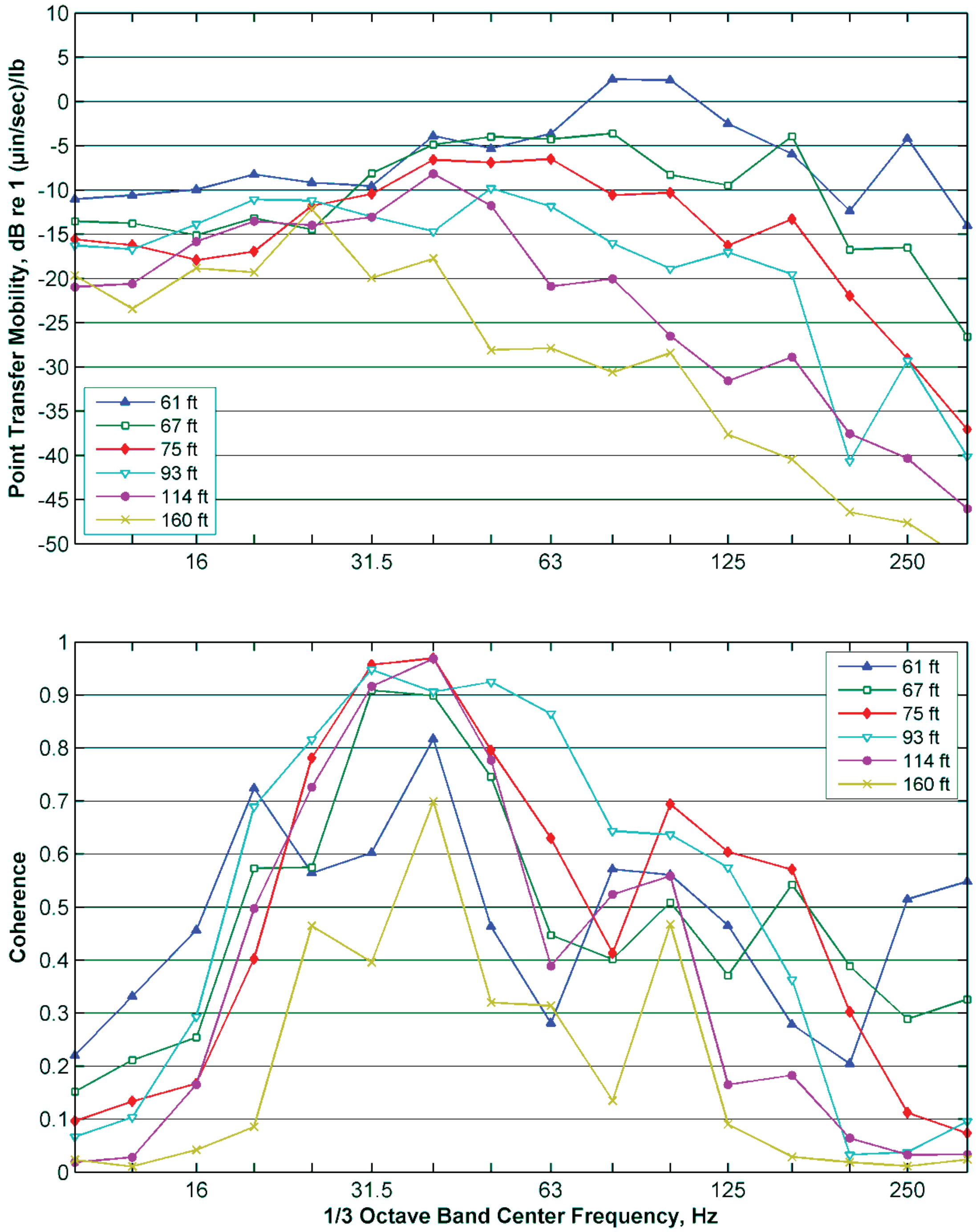

Figure 52: G-203. Measured PSTM at Depth of 55 ft

Table 15: G-203. Coefficients for Best Fit LSTM

Freq. (Hz)	A	B	C	Freq. (Hz)	A	B	C
10	18.23	2.33	-4.14	**63**	100.03	-42.53	-2.45
12.5	28.52	-3.57	-4.21	**80**	123.89	-56.38	-1.89
16	11.20	5.54	-3.43	**100**	115.04	-52.49	-2.03
20	15.63	4.62	-3.85	**125**	133.82	-65.28	-1.58
25	12.64	2.79	-1.14	**160**	147.62	-72.67	-1.36
31.5	27.93	-0.74	-4.23	**200**	126.79	-67.04	-1.53
40	39.40	-5.45	-4.16	**250**	148.87	-78.37	-1.21
50	81.19	-30.78	-3.00	**315**	113.11	-63.15	-1.65

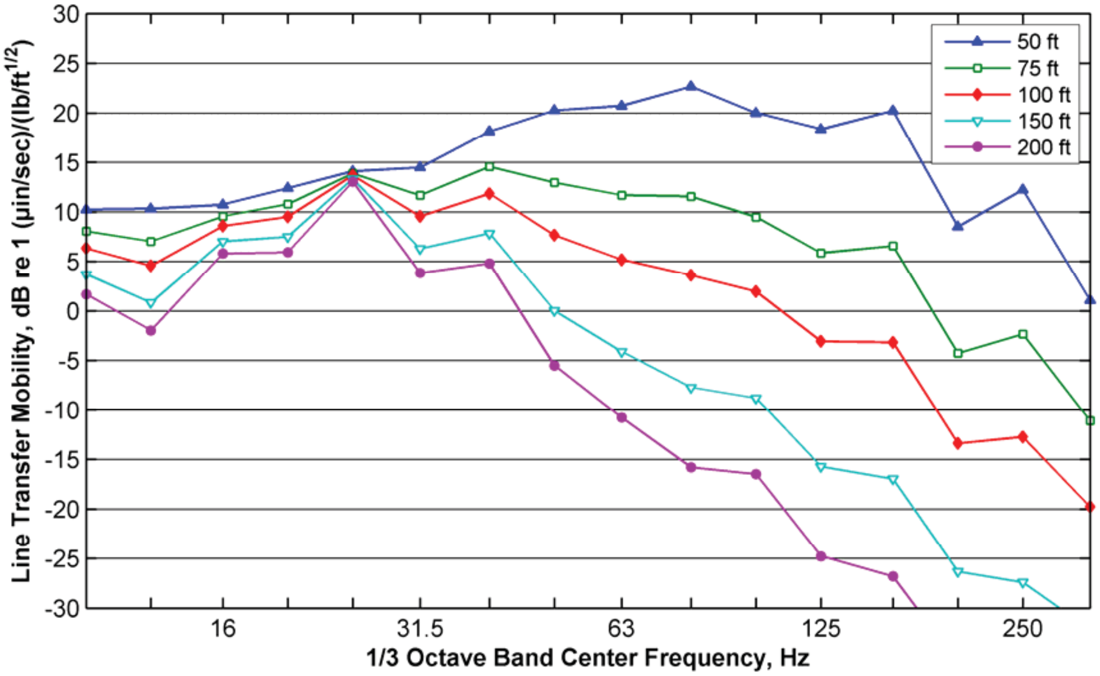

Figure 53: G-203. Best Fit LSTM