Appendix D: Noise

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Environmental Noise Study
for the Construction of the
LADWP Harbor Refineries Recycled Water Pipeline Project

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Table of Contents

1 INTRODUCTION/PROJECT DESCRIPTION 1

2 FUNDAMENTALS OF SOUND 4

3 NOISE DESCRIPTORS 4

3.1 DECIBELS 4
3.2 A-WEIGHTING 5
3.3 EQUIVALENT SOUND LEVEL (L_{EQ}) 5
3.4 MAXIMUM SOUND LEVEL (L_{MAX}) 5

4 NOISE CRITERIA 7

4.1 CITY OF LOS ANGELES MUNICIPAL CODE 7
4.2 CITY OF LOS ANGELES CEQA THRESHOLDS GUIDE (2006) 7
4.3 CITY OF CARSON 8

5 FUNDAMENTALS OF GROUNDBORNE VIBRATION 9

6 VIBRATION DESCRIPTORS 10

6.1 PEAK PARTICLE VELOCITY (PPV) 10
6.2 VIBRATION VELOCITY LEVEL (L_V) 10

7 VIBRATION CRITERIA 11

7.1 ANNOYANCE OR INTERFERENCE WITH VIBRATION-SENSITIVE ACTIVITIES 11
7.2 VIBRATION-INDUCED BUILDING DAMAGE 11

8 THRESHOLDS OF SIGNIFICANCE 12

9 EXISTING NOISE ENVIRONMENT 12

9.1 PROPOSED PIPELINE ROUTE 13
9.2 ALTERNATIVE PIPELINE ROUTES 15

10 EXISTING VIBRATION ENVIRONMENT 15

10.1 PROPOSED PIPELINE ROUTE 15
10.2 ALTERNATIVE PIPELINE ROUTES 16

11 CONSTRUCTION NOISE LEVELS 16

12 CONSTRUCTION VIBRATION LEVELS 20

13 SUMMARY OF IMPACTS 21

14 ABATEMENT MEASURES 21

15 UNMITIGATED IMPACTS 23

16 REFERENCES 23

List of Tables

Table 4-1. City of Carson Construction Noise Standards 9
Table 7-1. FTA Construction Vibration Damage Criteria 11
Table 7-2. Caltrans Vibration Damage Criteria 11
Table 9-1. Summary of Noise Measurements on the Proposed Pipeline Route 13
Table 9-2. Summary of Noise Measurements on the Alternative Pipeline Routes 15
Table 10-1. Summary of Vibration Measurements on the Proposed Pipeline Route 16
Table 10-2. Summary of Vibration Measurements on the Alternative Pipeline Routes 16
Table 11-1. Total of Equipment Items During Each Construction Phase 17
Table 11-2. Assumed Equipment Items Operating Simultaneously 18
Table 11-3. Estimated Unmitigated Noise Levels from Construction Activity 19
Table 12-1. Estimated Vibration Levels from Construction Activity 20

List of Figures

Figure 1-1. Proposed and Alternative Pipeline Routes 3
Figure 3-1. Common Noise Sources and A-Weighted Noise Levels 6
Figure 9-1. Measurement Locations 14

List of Appendices

Appendix I. Noise and Vibration Measurements
Appendix II. Construction Noise Model

1 Introduction/Project Description

The Los Angeles Department of Water and Power (LADWP) and West Basin Municipal Water District (WBMWD) are proposing to construct the Harbor Refineries Recycled Water Pipeline Project in order to provide recycled water produced by WBMWD's Carson Regional Water Recycling Plant to various industrial and irrigation customers in the Carson and Los Angeles Harbor Area. LADWP will construct the recycled water pipeline up to the property boundaries adjacent to the appropriate metering devices for each potential customer. Each of the customers will be responsible for constructing the needed infrastructure on their respective properties to tie into the proposed recycled water pipeline.

The proposed project would consist of a total of approximately 60,000 feet (11.4 miles) of 24-inch (or smaller) pipeline running through the cities of Carson and Los Angeles. Figure 1-1 provides the proposed pipeline route along with two alternative routes. In addition to the pipeline, other structures such as maintenance holes, flow meters, air/vacuum valves, blow-off assemblies, isolation valves, water sampling stations, and vaults are anticipated to be installed along the pipeline route as part of the proposed project. Construction of the pipeline is expected to start on August 1, 2009 and be completed by December 1, 2011.

The focus of this study is to address the noise and vibration due to construction of the pipeline. Based on information provided by Michael Brandman Associates the following provides a summary of the anticipated pipeline construction. Installation of the pipeline will be accomplished using open trench excavation. However, in areas where trenching is not possible such as the Dominguez Channel, railroad crossings and major street intersections, construction of the pipeline will involve pipe jacking and/or directional drilling. Each construction method will require an off-site staging area to temporarily store supplies and materials. It is anticipated that multiple staging areas will be required at various locations. While the exact locations of all staging areas are currently unknown, all staging areas are anticipated to be located within WBMWD and/or LADWP property. However, the staging areas will likely be at the nearest WBMWD facility and the LADWP Harbor District Yard.

Open trench excavation usually progresses along the alignment with the maximum length of open trench at one time being approximately 300 feet with a work area of approximately 1,000 linear feet. The entire width of the construction zone will be approximately 20 to 24 feet. In sequence, the general process for construction of the pipeline consists of site preparation, excavation and shoring, pipe (and/or appurtenant structures) installation and backfilling, and street restoration.

Construction activities will occur between 6:00 a.m. and 4:00 p.m. Monday through Friday along the majority of the proposed pipeline route. However, nighttime construction (i.e., between 8:00 p.m. and 6:00 a.m.) may occur in both Carson and Los Angeles to avoid traffic congestion, per Caltrans and other agency requirements.

Construction will typically require three to four crews of approximately eight workers each on a daily basis. On a typical workday, an average of 15 to 30 workers (up to a maximum of 40 workers) will travel directly to one of the predetermined staging areas (primarily the Harbor District Yard) nearest the work site, where they will gather equipment and proceed in work crews to the construction site

along the alignment. Additionally, construction activities will include truck trips associated with supply delivery (including pipeline sections), transport of excavated soil from trenching, and transport of backfill and paving materials to the site.

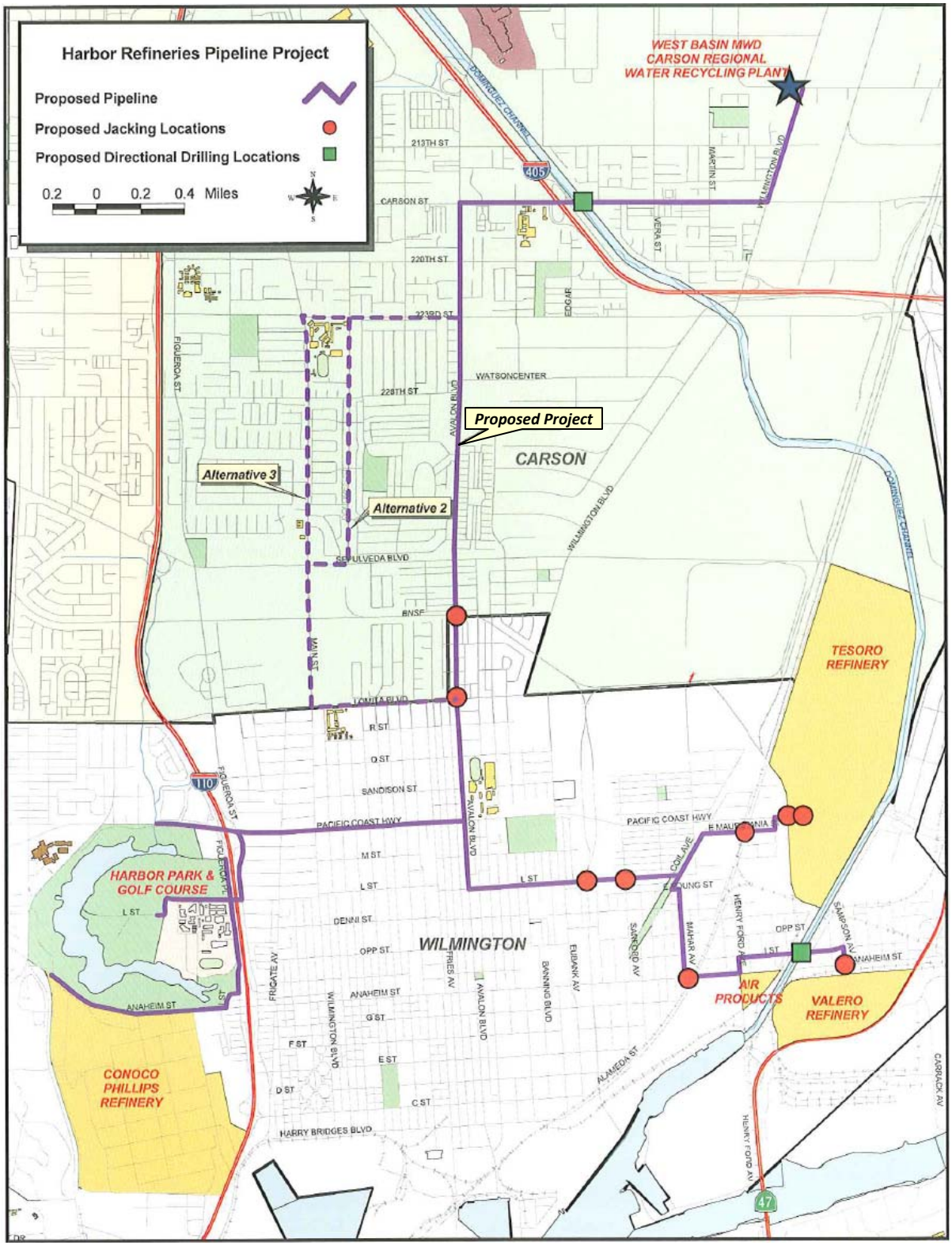


Figure 1-1. Proposed and Alternative Pipeline Routes

2 Fundamentals of Sound

Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to the human ear. The medium of main concern for environmental noise is air. Noise is most simply defined as unwanted sound.

In its most basic form, a sound can be described by its frequency and its amplitude. As a sound wave propagates past a point in the air it causes the air to alternate from a state of compression to a state of rarefaction. The number of times per second that the wave passes from a state of maximum compression through a period of rarefaction and back to a state of maximum compression is the frequency. The amplitude describes the maximum pressure disturbance caused by the wave, that is, the difference between the "resting" pressure in the air when no sound is present and the pressure during the state of maximum compression or rarefaction caused by the sound wave.

Frequency is expressed in cycles per second, or Hertz (Hz). One Hertz equals one cycle per second. High frequencies are sometimes more conveniently expressed in units of kilohertz (kHz) or thousands of Hertz. The extreme range of frequencies that can be heard by the healthiest human ear spans from 16 to 20 Hz on the low end to about 20,000 Hz on the high end. Frequencies are heard as the pitch or tone of sound. High frequencies produce high-pitched sounds; low frequencies produce low-pitched sounds. Very-low-frequency airborne sound of sufficient amplitude may be felt before it can be heard, and is often confused with groundborne vibration.

For any given frequency, an increase in amplitude correlates to an increase in loudness and a decrease in amplitude correlates to a decrease in loudness. The measurement and description of amplitude is discussed further in Section 3.1.

3 Noise Descriptors

The following sections briefly describe the noise descriptors that will be used throughout this study:

3.1 Decibels

The magnitude of a sound is typically described in terms of sound pressure level (SPL), which refers to the root-mean-square (rms) pressure of a sound wave and can be measured in units called microPascals (µPa). However, expressing sound pressure levels in terms of µPa would be very cumbersome since it would require a very wide range of numbers (from 0 to approximately 20,000,000 µPa over the entire range of human hearing). For this reason, sound pressure levels are stated in terms of decibels, abbreviated dB. The decibel is a logarithmic unit that describes the ratio of the actual sound pressure to a reference pressure (20 µPa is the standard reference pressure level for acoustical measurements in air). Specifically, a sound pressure level, in decibels, is calculated as follows:

$$SPL = 20\log_{10}\left(\frac{X}{20\mu Pa}\right),$$

where X is the actual sound pressure and 20 µPa is the reference pressure.

Since decibels are logarithmic units, sound pressure levels cannot be added or subtracted by ordinary arithmetic means. For example, if one automobile produces a sound pressure level of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB. In fact, they would combine to produce 73 dB.

3.2 A-Weighting

While sound pressure level defines the amplitude of a sound, this alone is not a reliable indicator of loudness. Human perception of loudness depends on the characteristics of the human ear. In particular, the frequency or pitch of a sound has a substantial effect on how humans will respond. Human hearing is limited not only to the range of audible frequencies, but also in the way it perceives sound pressure levels in that range. In general, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz, and perceives both higher and lower frequency sounds of the same magnitude as being less loud. In order to better relate noise to the frequency response of the human ear a frequency-dependent rating scale, known as the A-Scale, is used to adjust (or "weight") the sound level measured by a sound level meter. The resulting sound pressure level is expressed in A-weighted decibels or dBA. When people make relative judgments of the loudness or annoyance of most ordinary everyday sounds, their judgments correlate well with the A-scale sound levels of those sounds. A range of noise levels associated with common indoor and outdoor activities is shown in Figure 3-1.

3.3 Equivalent Sound Level (L_{eq})

Many noise sources produce levels that fluctuate over time; examples include mechanical equipment that cycles on and off, or construction work which can vary sporadically. The equivalent sound level (L_{eq}) describes the average acoustic energy content of noise for an identified period of time, commonly 1 hour. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy over the duration of the exposure. For many noise sources, the L_{eq} will vary depending on the time of day – a primary example is traffic noise which rises and falls depending on the amount of traffic on a given street or freeway.

3.4 Maximum Sound Level (L_{max})

The maximum sound level refers to the maximum rms level that occurs during a noise measurement. More specifically, L_{max} is the rms sound level that corresponds to the noisiest 1-second interval during the measurement.

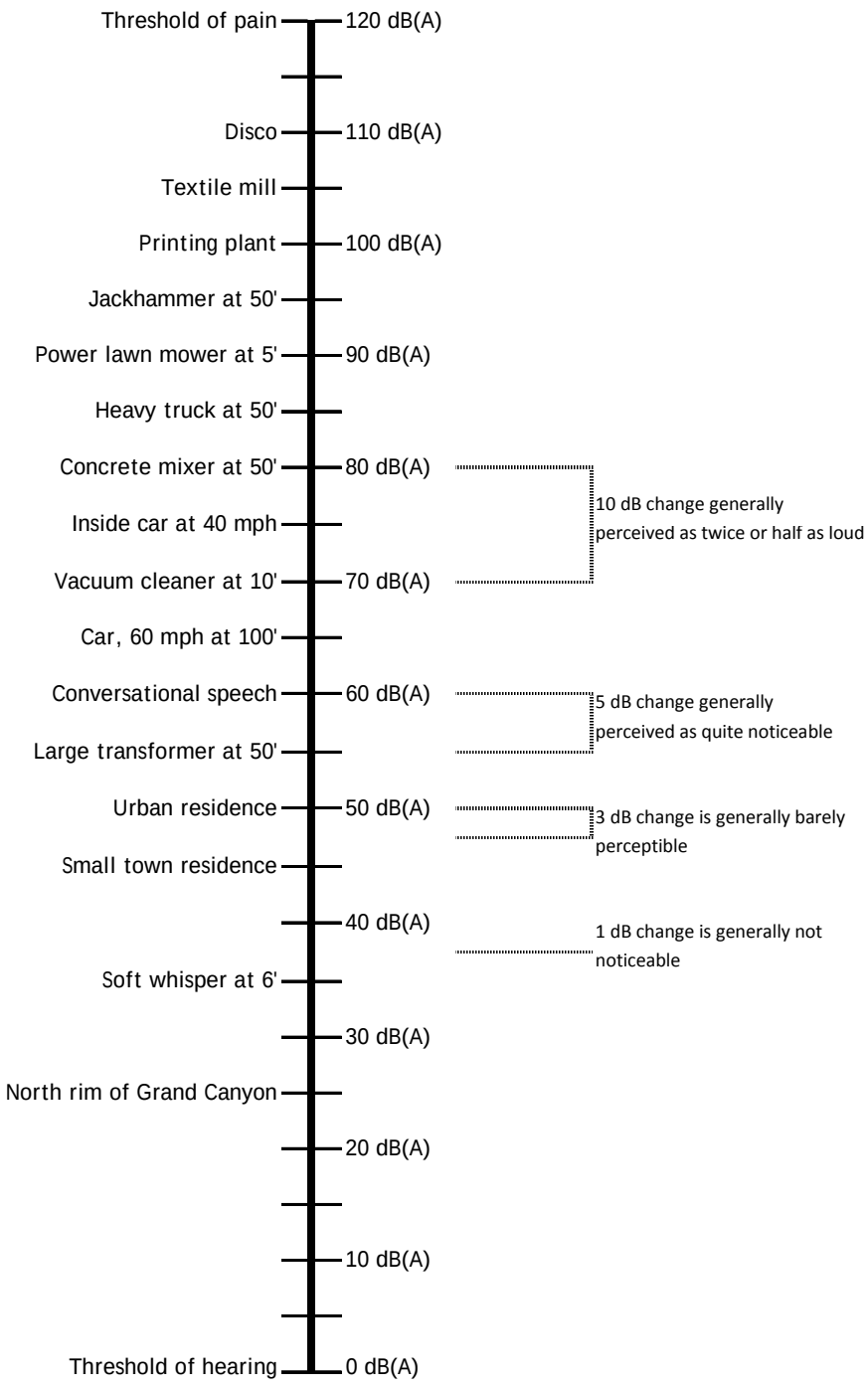


Figure 3-1. Common Noise Sources and A-Weighted Noise Levels

4 Noise Criteria

The following sections discuss the various noise criteria that have been considered for this study.

4.1 City of Los Angeles Municipal Code

Noise due to construction work is regulated by Section 41.40 of the City of Los Angeles Municipal Code. Section 41.40 prohibits the use of any "power driven drill, riveting machine, excavator or any other machine, tool, device or equipment which makes loud noises to the disturbance of persons occupying sleeping quarters in any dwelling hotel or apartment or other place of residence" between the hours of 9:00 p.m. and 7:00 a.m.; it further states that "the operation, repair or servicing of construction equipment and the job-site delivering of construction materials in such areas shall be prohibited" during these hours. Section 41.40 also prohibits any construction work - including the operation, repair or servicing of construction equipment and the job-site delivering of construction materials - within 500 feet of residential buildings before 8:00 a.m. or after 6:00 p.m. on Saturday or national holidays or at any time on Sunday. However, this prohibition does not apply to major public works construction by the City of Los Angeles and its proprietary Departments, including all structures and operations necessary to regulate or direct traffic due to construction activities. Within the permitted construction times and distances, there are no noise limits. Construction noise intruding onto property zoned for manufacturing or industrial uses is exempted from the Section 41.40 standards.

Section 112.05 of the City of Los Angeles Municipal Code states that between the hours of 7:00 a.m. and 10:00 p.m., in any residential zone of the City or within 500 feet thereof, no person shall operate or cause to be operated any powered equipment or powered hand tool that produces a maximum noise level exceeding 75 dBA at a distance of 50 feet. This limit applies to construction equipment, including crawler-tractors, dozers, rotary drills and augers, loaders, power shovels, cranes, derricks, motor graders, paving machines, off-highway trucks, ditchers, trenchers, compactors, scrapers, wagons, pavement breakers, compressors and pneumatic or other powered equipment. This limit shall not apply where compliance is technically infeasible. The burden of proving that compliance is technically infeasible shall be upon the person or persons charged with a violation of this section. Technical infeasibility shall mean that the noise limit cannot be complied with despite the use of mufflers, shields, sound barriers and/or other noise reduction devices or techniques during the operation of the equipment.

While Sections 41.40 and 112.05 of the Los Angeles Municipal Code refer only to construction impacts on residential areas, they will be also applied in this study to other noise-sensitive land uses such as hospitals and schools.

4.2 City of Los Angeles CEQA Thresholds Guide (2006)

The City of Los Angeles states that further study in an expanded Initial Study, Negative Declaration, Mitigated Negative Declaration, or EIR may be required if either of the following occurs:

- Construction activities occur within 500 feet of a noise sensitive use.

- Construction occurs between the hours of 9:00 p.m. and 7:00 a.m. Monday through Friday, before 8:00 a.m. or after 6:00 p.m. on Saturday, or at any time on Sunday.

Noise sensitive land uses are defined as including residences, transient lodgings, schools, libraries, churches, hospitals, nursing homes, auditoriums, concert halls, amphitheaters, playgrounds, and parks.

A project would normally have a significant impact due to noise levels from construction if:

- Construction activities lasting more than one day would exceed existing ambient exterior noise levels by 10 dBA or more at a noise sensitive use;
- Construction activities lasting more than 10 days in a three month period would exceed existing ambient exterior noise levels by 5 dBA or more at a noise sensitive use; or
- Construction activities would exceed the ambient noise level by 5 dBA at a noise sensitive use between the hours of 9:00 p.m. and 7:00 a.m. Monday through Friday, before 8:00 a.m. or after 6:00 p.m. on Saturday, or at any time on Sunday.

The City's significance thresholds are not explicit in defining the noise metric against which an exceedance should be assessed. Therefore, to provide a conservative assessment, and to provide consistency with the City's Municipal Code, the 1-hour L_{eq} metric will be used in this study.

4.3 City of Carson

Chapter 5 of the City of Carson Municipal Code provides the City's noise ordinance. The ordinance is based primarily on the County of Los Angeles noise criteria, which are incorporated by reference, along with a number of amendments. The resulting noise ordinance provides both time restrictions and specific noise criteria for construction activities. It limits the "operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekday hours of 7:00 p.m. and 7:00 a.m., or at any time on Sundays or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real-property line". The noise limits depend on the duration of the construction activities, as described in two categories:

1. *Mobile Equipment*, defined as "nonscheduled, intermittent, short-term operation of twenty (20) days or less for construction equipment"; and,
2. *Stationary Equipment*, defined as "repetitively scheduled and relatively long-term operation of twenty-one (21) days or more for construction equipment".

It has been assumed in this study that the construction activity will take 20 days or less to pass any given noise-sensitive receiver. Therefore, for this project, the mobile equipment standards are considered the most applicable. These standards provide the following noise limits:

Table 4-1. City of Carson Construction Noise Standards

Time of Operation	Land Use / Maximum Permitted Noise Level (L_{max})		
	Single-Family Residential Structures	Multi-Family Residential Structures	Business Structures
Daily, except Sundays and legal holidays, 7:00 a.m. to 8:00 p.m.	75 dBA	80 dBA	85 dBA
Daily, 8:00 p.m. to 7:00 a.m. and all day Sunday and legal holidays	60 dBA	64 dBA	85 dBA

The noise ordinance also requires that "all mobile or stationary internal-combustion-engine powered equipment or machinery shall be equipped with suitable exhaust and air-intake silencers in proper working order" and prohibits "creating or causing the creation of any noise disturbance within any noise-sensitive zone… provided that conspicuous signs are displayed indicating the presence of the zone… in at least three separate locations within 164 meters (one-tenth mile) of the institution or facility" where noise-sensitive zones are designated by the health officer.

Another restriction that applies to construction noise is contained in Chapter 1 of the City of Carson Municipal Code which prohibits "the operation between the hours of 6:00 p.m. and 7:00 a.m. of any pile driver, steam shovel, pneumatic hammer, derrick, hoist or other appliance, the use of which is attended by loud or unusual noise."

5 Fundamentals of Groundborne Vibration

Groundborne vibration is an oscillatory motion which can be described in terms of displacement, velocity, or acceleration. Each of these measures can be further described in terms of frequency and amplitude. Displacement is the easiest descriptor to understand; it is simply the distance that a vibrating point moves from its static position (i.e., its resting position when the vibration is not present). The velocity describes the instantaneous speed of the movement and acceleration is the instantaneous rate of change of the speed.

Although displacement is fundamentally easier to understand than velocity or acceleration, it is rarely used for describing ground-borne vibration, for the following reasons: 1) human response to ground-borne vibration correlates more accurately with velocity or acceleration; 2) the effect on buildings and sensitive equipment is more accurately described using velocity or acceleration; and, 3) most transducers used in the measurement of ground-borne vibration actually measure either velocity or acceleration. For this study velocity is the fundamental measure used to evaluate the effects of groundborne vibration; the precise vibration descriptors used are described in Section 6.

6 Vibration Descriptors

6.1 Peak Particle Velocity (PPV)

Construction activities such as blasting, pile driving, and operation of heavy construction equipment induce ground and structure vibrations. Their effects can range from annoyance for the local residents to structural damage. The level of ground vibration experienced at any location depends mainly on the construction method, soil medium, distance from the vibratory source, and the structural dynamics of the building. There are several different methods that are used to quantify vibration amplitude. Of these, peak particle velocity (PPV) is most appropriate for evaluating potential building damage since it is related to the stresses that are exerted upon the building. PPV is most commonly assessed in the vertical direction because the floors of buildings vibrate mostly in the vertical direction. Near the source of vibration, the horizontal ground particle velocity is commonly lower than the vertical component. Far from the source of vibration, the ground horizontal and vertical velocities are about the same order of magnitude.

6.2 Vibration Velocity Level (L_V)

Although PPV is appropriate for evaluating the potential for building damage, it is not suitable for evaluating human response to groundborne vibration. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to an "average" vibration amplitude. However, the actual average level is not a useful measure of vibration because the net average of a vibration signal is zero. Instead, vibration velocity level (L_V) is used for evaluating human response. L_V describes the root mean square (rms) velocity amplitude of the vibration. This rms value may be thought of as a "smoothed" or "magnitude-averaged" amplitude. The rms of a vibration signal is typically calculated over a 1 second period. The maximum L_V describes the maximum rms velocity amplitude that occurs during a vibration measurement.

L_V can be measured in inches per second (in/s). However, expressing these levels in terms of in/s would be very cumbersome since it would require a very wide range of numbers. For this reason, L_V is stated in terms of decibels. Although it is not a universally accepted notation, the abbreviation "VdB" is used throughout this report to denote vibration velocity level decibels in order to reduce the potential for confusion with sound level decibels. The VdB is a logarithmic unit that describes the ratio of the actual rms velocity amplitude to a reference velocity amplitude. The accepted reference velocity amplitude is 1×10^{-6} in/s in the USA; therefore, this is the reference amplitude that is used throughout this report (it is noted that the accepted reference level varies globally and much confusion can arise if the reference is not clearly stated). Specifically, a vibration velocity level (L_V), in decibels (VdB), is calculated as follows:

$$L_V = 20\log_{10}\left(\frac{V}{1\times10^{-6}\,in./s}\right),$$

where *V* is the actual rms velocity amplitude and 1×10^{-6} in/s is the reference velocity amplitude.

Since decibels are logarithmic units, vibration velocity levels cannot be added or subtracted by ordinary arithmetic means.

7 Vibration Criteria

Project construction activities can produce two types of potential vibration impact: 1) annoyance or interference with vibration-sensitive activities, and 2) vibration-induced building damage. Neither the City of Los Angeles nor the City of Carson has standards to address vibration impacts. Therefore, the criteria discussed in the following sections have been used in this study.

7.1 Annoyance or Interference with Vibration-Sensitive Activities

Criteria developed by the Federal Transit Administration **[1]** indicate that when groundborne vibration exceeds 72 VdB, it is usually perceived as annoying to occupants of residential buildings. For schools, churches, other institutions, and quiet offices, a groundborne vibration level of more than 75 is usually perceived as annoying.

7.2 Vibration-Induced Building Damage

General vibration damage criteria developed by the Federal Transit Administration **[1]** are summarized as follows:

Table 7-1. FTA Construction Vibration Damage Criteria

Building Category	PPV (in/s)
Reinforced concrete, steel or timber (no plaster)	0.5
Engineered concrete and masonry (no plaster)	0.3
Non-engineered timber and masonry buildings	0.2
Buildings extremely susceptible to vibration damage	0.12

Caltrans **[2]** uses the following criteria to evaluate the severity of problems associated with vibration:

Table 7-2. Caltrans Vibration Damage Criteria

Building Category	PPV (in/s)	
	Continuous Sources	Transient Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.08	0.12
Fragile buildings	0.1	0.2
Historic and some old buildings	0.25	0.5
Older residential structures	0.3	0.5
New residential structures	0.5	1.0
Modern industrial/commercial buildings	0.5	2.0

8 Thresholds of Significance

The project will traverse two jurisdictions: the cities of Los Angeles and Carson. Therefore, at the direction of LADWP, the most stringent noise standards of the two cities will be used to assess impacts throughout the study area. Based on the noise criteria discussed above, and the CEQA guidelines, a significant impact will be assessed if any of the following conditions occur:

- The noise level generated by the construction of the project results in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. This impact will occur if: (a) Daytime (7:00 a.m. to 8:00 p.m.) construction activity generates maximum noise levels in excess of 75 dBA at a noise sensitive use, or (b) Nighttime (8:00 p.m. to 7:00 a.m.) construction activity generates maximum noise levels in excess of 60 dBA at a noise sensitive use.
- Project construction results in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. This impact will occur if any construction activity causes the vibration velocity level (L_V) to exceed 72 VdB at an adjacent residential building or 75 VdB at an adjacent institutional building. Because of the potential for damage, a significant impact will also be assessed if the PPV exceeds 0.20 in/sec at any existing residential building or 0.30 in/sec at any existing institutional building.
- Project construction results in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. This impact will occur if: (a) Daytime (7:00 a.m. to 8:00 p.m.) construction activities exceed existing ambient exterior noise levels by 10 dBA or more at a noise sensitive use; or (b) Nighttime (8:00 p.m. to 7:00 a.m.) construction activities exceed existing ambient exterior noise levels by 5 dBA or more at a noise sensitive use
- The project would expose people residing or working in the project area to excessive noise levels as a result of activities at a public airport or public use airport. Since the project is located more than two miles from the nearest public airport (Long Beach Municipal Airport), this threshold will not be considered further.
- The project would expose people residing or working in the project area to excessive noise levels as a result of activities at a private airstrip. Since there are no private airstrips within two miles of the project, this threshold will not be considered further.

9 Existing Noise Environment

Sections 9.1 and 9.2 describe the noise measurements obtained for this study. The instrumentation used to obtain the measurements consisted of integrating sound level meters (Models 712, 820, and 870) and an acoustical calibrator (Model CAL200) manufactured by Larson Davis Laboratories. The accuracy of the calibrators is maintained through a program established by the manufacturer, and is traceable to the National Bureau of Standards. All instrumentation meets the requirements of the American National Standards Institute (ANSI) S1.4-1971. All measurements were obtained with the microphone positioned at a height of 5 feet above the ground.

9.1 Proposed Pipeline Route

In order to document the existing noise environment, measurements were obtained at eight locations along the proposed pipeline route. (Refer to Figure 9-1 for the measurement locations.) At two of the locations, a 24-hour noise measurement was obtained. At the remaining six locations the measurement was obtained for a period of at least 20 minutes. The results of the noise measurements, provided in Appendix I, are summarized in Table 9-1. Referring to the table, it is noted that the measured ambient noise L_{max} levels exceed the daytime significance criterion of 75 dBA and the nighttime significance criterion of 60 dBA at every measurement location.

Table 9-1. Summary of Noise Measurements on the Proposed Pipeline Route

Location #	Location Description	Jurisdiction	Measurement Period	Measured Noise Levels, dBA
1	Adjacent to Doubletree Hotel on E. Carson St.	Carson	9:24 am to 9:44 am	L_{eq}: 68.6 L_{max}: 80.0
2	Adjacent to residence at 21702 Acarus Ave.	Carson	4:24 pm to 4:52 pm	L_{eq}: 69.5 L_{max}: 80.0
3[a]	Backyard of residence at 701 E. 222nd St.	Carson	Daytime (7 am to 9 pm)	L_{eq}: 63.6 – 67.7 L_{max}: 77.6 – 94.1
			Nighttime (9 pm to 7 am)	L_{eq}: 55.0 – 64.3 L_{max}: 71.1 – 82.7
4	Adjacent to residence at 558 E. Lincoln St.	Carson	10:26 am to 10:56 am	L_{eq}: 66.7 L_{max}: 85.3
5	Adjacent to Crescent Inn motel, 1104 W. Pacific Coast Hwy.	Los Angeles	4:55 pm to 5:15 pm	L_{eq}: 69.1 L_{max}: 88.5
6	Adjacent to residence at 1335 W. Papeete St.	Los Angeles	2:33 pm to 2:53 pm	L_{eq}: 69.9 L_{max}: N/A
7[a]	Casa Milagro apartments on E. L St.	Los Angeles	Daytime (7 am to 9 pm)	L_{eq}: 53.5 – 60.7 L_{max}: 67.5 – 87.9
			Nighttime (9 pm to 7 am)	L_{eq}: 48.7 – 59.8 L_{max}: 63.1 – 86.4
8	Adjacent to residence at 1333 E. Opp St.	Los Angeles	1:20 pm to 1:43 pm	L_{eq}: 59.7 L_{max}: 78.9

Notes:
a. 24-hour measurement location. Therefore data is reported as the range of hourly values over the entire measurement.

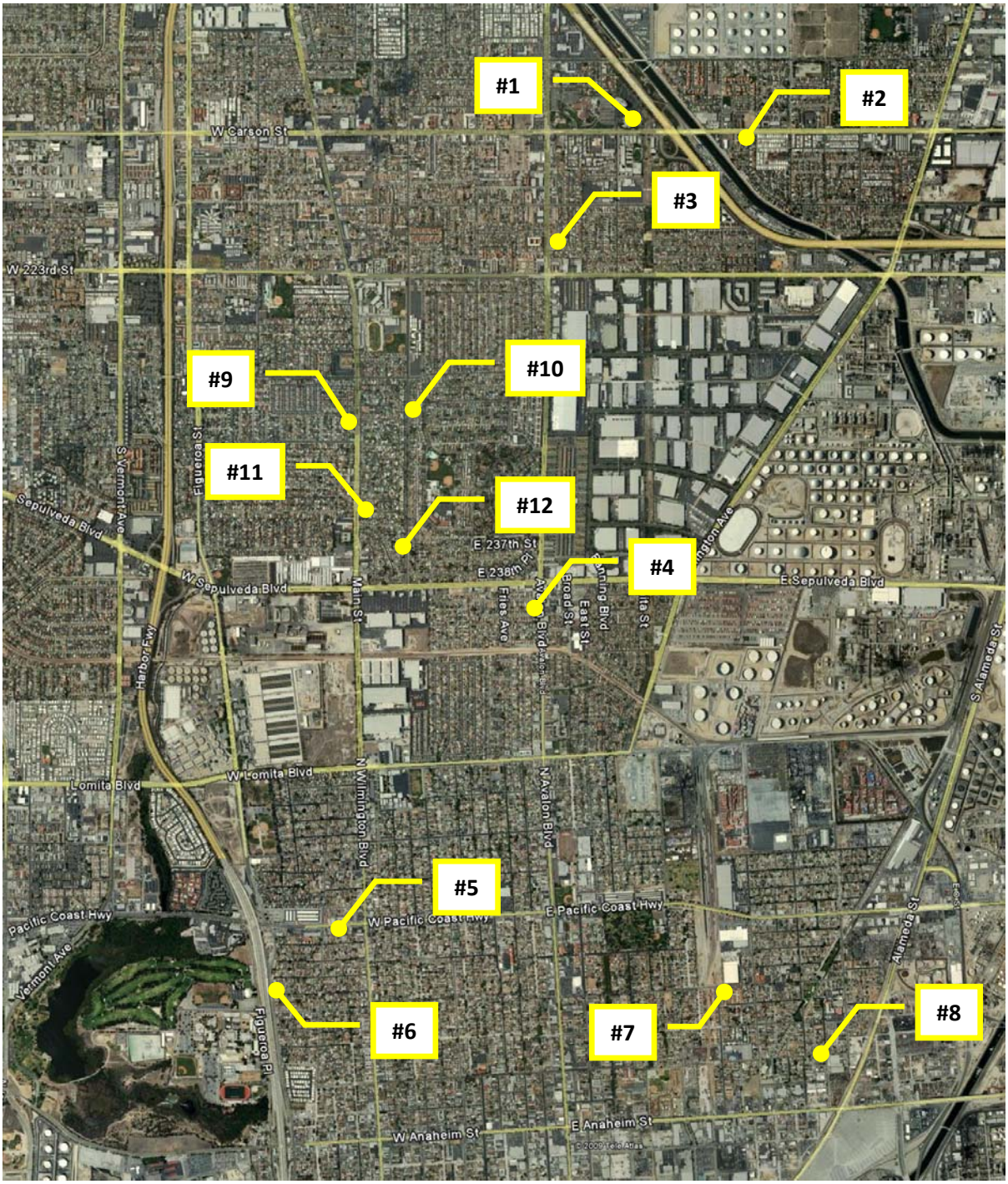


Figure 9-1. Measurement Locations

9.2 Alternative Pipeline Routes

Measurements were obtained at four locations in order to document the existing noise environment along the two alternative pipeline routes. (Refer to Figure 9-1 for the measurement locations.) At two of the locations, a 24-hour noise measurement was obtained. At the remaining locations the measurement was obtained for a period of at least 20 minutes. The results of the noise measurements, provided in Appendix I, are summarized in Table 9-2.

Table 9-2. Summary of Noise Measurements on the Alternative Pipeline Routes

Location #	Location Description	Jurisdiction	Measurement Period	Measured Noise Levels, dBA
Alternative Route 2				
9[a]	Backyard of residence at 23038 Bolsa Ave.	Carson	Daytime (7 am to 9 pm)	L_{eq}: 56.9 – 67.6 L_{max}: 70.8 – 93.9
			Nighttime (9 pm to 7 am)	L_{eq}: 53.4 – 57.7 L_{max}: 65.1 – 76.5
11	Adjacent to residence at 104 E. 235th St.	Carson	6:17 pm to 6:39 pm	L_{eq}: 67.5 L_{max}: 77.7
Alternative Route 3				
10	Adjacent to residence at 22910 Dolores St.	Carson	11:37 am to 12:01 pm	L_{eq}: 61.0 L_{max}: 74.9
12[a]	Backyard of residence at 23705 Catskill Ave.	Carson	Daytime (7 am to 9 pm)	L_{eq}: 54.8 – 61.3 L_{max}: 68.0 – 82.2
			Nighttime (9 pm to 7 am)	L_{eq}: 43.3 – 53.7 L_{max}: 63.2 – 73.8

Notes:
a. 24-hour measurement location. Therefore data is reported as the range of hourly values over the entire measurement.

Referring to the table, it is noted that the measured ambient L_{max} noise levels exceed the daytime significance criterion of 75 dBA and the nighttime significance criterion of 60 dBA at every measurement location, with the exception of location #10.

10 Existing Vibration Environment

Sections 10.1 and 10.2 describe the vibration measurements obtained for this study. The instrumentation used to obtain the vibration measurements consisted of an accelerometer (Model 393C) and a signal conditioner/integrating power unit (Model 480A10), both manufactured by PCB Piezotronics, and a real-time analyzer (Model 2800) manufactured by Larson Davis Laboratories.

10.1 Proposed Pipeline Route

In order to document the existing vibration environment, measurements were obtained at five locations along the proposed pipeline route. (Refer to Figure 9-1 for the measurement locations.) The results of the vibration measurements, provided in Appendix I, are summarized in Table 10-1. Referring to the table, it is noted that the measured ambient vibration levels exceed the significance

criterion of 72 VdB at all locations. The measured PPV levels are well below the significance criteria of 0.20 to 0.30 in/sec.

Table 10-1. Summary of Vibration Measurements on the Proposed Pipeline Route

Location #	Location Description	Jurisdiction	Measurement Period	Measured Vibration Levels[a]
2	Adjacent to residence at 21702 Acarus Ave.	Carson	4:24 pm to 4:52 pm	L_V: 50-82 VdB PPV: 0.001-0.050 in/sec
4	Adjacent to residence at 558 E. Lincoln St.	Carson	10:26 am to 10:56 am	L_V: 56-73 VdB PPV: 0.003-0.018 in/sec
5	Adjacent to Crescent Inn motel, 1104 W. Pacific Coast Hwy.	Los Angeles	4:55 pm to 5:15 pm	L_V: 57-73 VdB PPV: 0.003-0.017 in/sec
6	Adjacent to residence at 1335 W. Papeete St.	Los Angeles	2:33 pm to 2:53 pm	L_V: 64-79 VdB PPV: 0.006-0.034 in/sec
8	Adjacent to residence at 1333 E. Opp St.	Los Angeles	1:20 pm to 1:43 pm	L_V: 57-77 VdB PPV: 0.003-0.027 in/sec

Notes:
a. PPV estimated from measured acceleration levels using a crest factor of 4. "Crest factor" is the ratio of the PPV amplitude to the rms amplitude.

10.2 Alternative Pipeline Routes

Measurements were obtained at 2 locations in order to document the existing vibration environment along the two alternative pipeline routes. (Refer to Figure 9-1 for the measurement locations.) The results of the vibration measurements, provided in Appendix I, are summarized in Table 10-2.

Table 10-2. Summary of Vibration Measurements on the Alternative Pipeline Routes

Location #	Location Description	Jurisdiction	Measurement Period	Measured Vibration Levels[a]
Alternative Route 2				
11	Adjacent to residence at 104 E. 235th St.	Carson	6:17 pm to 6:39 pm	L_V: 38-75 VdB PPV: 0.000-0.022 in/sec
Alternative Route 3				
10	Adjacent to residence at 22910 Dolores St.	Carson	11:37 am to 12:01 pm	L_V: 49-69 VdB PPV: 0.001-0.012 in/sec

Notes:
a. PPV estimated from measured acceleration levels using a crest factor of 4.

Referring to the table, it is noted that the measured ambient vibration levels exceed the significance criterion of 72 VdB at location #11. The measured PPV levels are well below the significance criteria of 0.20 to 0.30 in/sec.

11 Construction Noise Levels

As indicated in Section 1, pipeline construction will be undertaken in a work area with a length of approximately 1,000 linear feet and a width of approximately 20 to 24 feet. Within this work area

will be an open trench with a length of approximately 300 feet. Installation of the pipeline will typically be accomplished using open trench excavation. However, in areas where trenching is not possible such as the Dominguez Channel, railroad crossings and major street intersections, construction of the pipeline will involve pipe jacking and/or directional drilling. Regardless of the method used (i.e., open trench excavation, pipe jacking, or directional drilling), the construction can be separated into four phases as follows: (1) Site preparation, (2) Excavating and shoring, (3) Pipe installation and backfilling, and (4) Street restoration.

To provide a "worst case" analysis, and at the direction of LADWP, it has been assumed in this study that all four phases of construction will occur simultaneously but at different locations within a typical 1,000 foot long work area. Table 11-1 provides the estimated number of units of each equipment item that will be used at the work area during each of the four construction phases.

Table 11-1. Total of Equipment Items During Each Construction Phase

Equipment Item	Number of Units	Hours per Day
All Phases		
Construction worker vehicles	8	8
Site Preparation		
End dump trucks *	6	8
5-cyd dump trucks *	3	6
Concrete saws	3	8
Jackhammers	3	8
Loader *	4	8
Fork lift	2	8
Excavating and Shoring		
End dump trucks *	6	8
5-cyd dump trucks *	4	6
Backhoe *	4	6
Loader *	4	6
Excavator	4	6
15-Ton Crane *	4	8
Water truck *	2	8
Pipe Installation and Backfilling		
Loader *	4	6
15-ton crane *	4	8
Backhoe *	4	6
Compactor	4	4
Hydraulic jack [1]	3	6
Auger machine [2]	3	6
Welding truck with generator	3	4
40 kW generator	3	6
Drill/bore rig	1	8
Mud rig	1	8
Water truck *	2	8
Street Restoration		
Paver	2	2

Notes: "*" signifies equipment that will be used in more than one phase of construction. (1) Equipment will only be used at pipe jacking sites. (2) Equipment will only be used at directional drilling sites. Source: LADWP.

As indicated in Table 11-1, some of the construction equipment will be used in more than one phase. Therefore, to avoid counting equipment more than once, and to simplify the analysis, it has been assumed in this study that all of the equipment identified in Table 11-2 will operate simultaneously and will be distributed evenly over the entire length of the 1,000 foot long work area. Activities such as surveying and marking were not considered in the analysis as they do not generate significant noise levels.

Table 11-2. Assumed Equipment Items Operating Simultaneously

Equipment Item	Number of Units	Hours per Day
Construction worker vehicles	8	8
End dump trucks	6	8
Concrete saws	3	8
Jackhammers	3	8
Loader	4	8
Fork lift	2	8
5-cyd dump trucks	4	6
Backhoe	4	6
Excavator	4	6
15-Ton Crane	4	8
Water truck	2	8
Compactor	4	4
Hydraulic jack [1]	3	6
Auger machine [2]	3	6
Welding truck with generator	3	4
40 kW generator	3	6
Drill/bore rig	1	8
Mud rig	1	8
Paver	2	2

Notes:

1. Equipment will only be used at pipe jacking sites.
2. Equipment will only be used at directional drilling sites.

The equipment listing described in Table 11-2 was then combined with noise levels and acoustical usage factors obtained from Reference 3 to develop a construction noise model for a typical work area. The noise model is presented in Appendix II.

Based on the noise modeling of Appendix II, it was possible to estimate the unmitigated noise levels from a work area for each method of construction (i.e., open trench excavation, pipe jacking, or directional drilling). Table 11-3 summarizes the estimated “worst case” unmitigated noise levels at various distances from the work area for each construction method.

Based on the results of the analysis, it may be estimated that the daytime (7:00 a.m. to 8:00 p.m.) maximum construction noise threshold of 75 dBA will be exceeded at all sensitive receptors within 211 feet of the work area. The nighttime (8:00 p.m. to 7:00 a.m.) threshold of 60 dBA will be exceeded at all sensitive receptors within about 1,186 feet of the work area. As there are sensitive receptors within these distances of the proposed and alternative pipeline routes, the impact is potentially significant.

Table 11-3. Estimated Unmitigated Noise Levels from Construction Activity

Distance from Pipeline, ft.	Noise Metric	Noise Level, dBA		
		Open Trench Excavation	Pipe Jacking	Directional Drilling
50	1-hour L_{eq}	88	88	88
	L_{max}	94.5	94.5	94.5
100	1-hour L_{eq}	83	83	83
	L_{max}	89.5	89.5	89.5
150	1-hour L_{eq}	80	80.5	80.5
	L_{max}	86.5	87	87
200	1-hour L_{eq}	78.5	78.5	78.5
	L_{max}	85	85	85

It is noted that at some sensitive receptors the properties and/or buildings may be separated from the work area by only a sidewalk. As a result these receptors will potentially be located within 20 feet of the construction activity. At this distance, estimated L_{eq} noise levels will be up to 95.5 dBA and estimated L_{max} levels will be up to 102 dBA. Again, the impact is potentially significant if there are sensitive receptors at this distance from the proposed and alternative pipeline routes.

Another source of construction noise is activities at the various project staging areas. These areas are used to store equipment and materials that cannot be stored in the construction zones. As part of the project design, these staging areas will be located on properties restricted to industrial and commercial uses only, and will not be located within 500 feet of a sensitive receptor. Where this is not possible, the contractor will erect noise barriers, or ensure that existing structures provide adequate noise barriers between the staging area and the sensitive receptor(s).

The combined (ambient plus construction) noise levels will vary along the pipeline route depending on the existing ambient noise levels and the exact distance from the pipeline to the receiver. Because the final location of the pipeline within the right-of-way is not currently known, it was necessary to make some assumptions in order to estimate the combined noise levels. Combined noise levels were estimated based on a distance of 20 feet from the pipeline at all locations. Some measurement locations were shielded from the adjacent streets by block walls; in these locations it was assumed that the wall would provide a reduction in construction noise levels of 5 dB. Based on these assumptions, it is estimated that combined noise levels will be at least 26 dB higher than existing ambient levels at all of the measurement locations along the proposed pipeline route. Along Alternative Route 2, it is estimated that combined noise levels will be at least 23 dB higher than existing ambient levels; and along Alternative Route 3, it is estimated that combined noise levels will be at least 29 dB higher than existing ambient levels. As these increases exceed the thresholds of 10 dB for daytime construction and 5 dB for nighttime construction, the impact is potentially significant.

Although potentially significant impacts are assessed for construction noise, it is noted that the existing ambient noise levels already exceed the significance criteria of 75 dBA during the daytime hours and 60 dBA during the nighttime hours at sensitive locations along the proposed pipeline route as well as along the two alternative routes.

12 Construction Vibration Levels

The highest vibration levels will be created by heavy equipment operations during pavement breaking, trenching and earth movement. It is noted that such heavy equipment will be used regardless of the construction method employed (i.e., open trench excavation, pipe jacking, or directional drilling). Therefore, the following discussion applies to all three construction methods.

Based on published data **[1]**, it is estimated that heavy equipment as described above will produce an L_V of up to 87 VdB and a PPV of up to 0.089 in/s at a distance of 25 feet. Using standard calculation techniques **[1]**, it is possible to estimate the vibration levels at various distances from the work area. This is illustrated in Table 12-1.

Table 12-1. Estimated Vibration Levels from Construction Activity

Distance from Equipment, ft.	Vibration Level, L_V	Peak Particle Velocity, PPV
50	78 VdB	0.031 in/s
100	69 VdB	0.011 in/s
150	64 VdB	0.006 in/s
200	60 VdB	0.004 in/s

It is estimated that the L_V threshold of 72 VdB will be exceeded at existing residential buildings within 79 feet of the equipment. At existing institutional buildings within 63 feet of the equipment, the L_V threshold of 75 VdB will be exceeded. These are potentially significant impacts. However, it is also recognized that project construction vibration will be temporary and intermittent and will cease at the end of construction activities.

Using standard calculation techniques **[1]**, it is estimated that the residential PPV threshold of 0.20 in/s will be exceeded at distances of 15 feet or less from heavy equipment, and that the institutional PPV threshold of 0.30 in/s will be exceeded at distances of 11 feet or less from heavy equipment. There do not appear to be any residential or institutional structures within these distances of the proposed or alternative pipeline routes. However, field conditions encountered during construction may shift the alignment within the streets so that heavy equipment does operate within 15 feet of a residential structure or 11 feet of an institutional structure. Therefore, the impact is potentially significant.

The nearest existing structure to the proposed or alternative pipeline routes is a truck stop at the northeast corner of Alameda Street and E. Mauretania Street. This is a large industrial-type structure with metal siding. The Caltrans vibration damage criterion for this type of structure is a PPV of 0.5 in/s (refer to Table 7-2). This threshold will be exceeded if heavy construction equipment operates within about 8 feet of the building. Since this condition may occur, the impact is potentially significant.

13 Summary of Impacts

Using the criteria established in this study, the following may be concluded regarding the impact of the project:

- Project construction will result in the exposure of persons to noise levels in excess of the standards established in the local noise ordinances. This impact will occur at all sensitive receptors along the proposed and alternative pipeline routes. (Refer to Abatement Measures 1 through 15 in Section 14.)
- Construction of the project may generate excessive groundborne vibration or groundborne noise levels. This potentially significant impact will occur at all existing residential buildings within 79 feet of the construction equipment, and at all existing institutional buildings within 63 feet of the equipment. Further, building damage may occur if heavy construction equipment operates within about 15 feet of an existing residential building, within about 11 feet of an institutional building, or within about 8 feet of an industrial building. Therefore, this impact is also potentially significant. (Refer to Abatement Measure 16 in Section 14.)
- Project construction noise will produce a substantial temporary increase in ambient noise levels in the project vicinity above levels existing without the project. This impact will occur at all sensitive receptors along the proposed and alternative pipeline routes. (Refer to Abatement Measures 1 through 15 in Section 14.)

14 Abatement Measures

Because of the magnitude of the construction noise levels, it is not possible to comply with the thresholds of significance established for this project. However, the following measures will abate the noise (and vibration) impacts to the extent that is feasible:

1. Unless granted a variance or exemption by the City, construction activities shall not occur between the hours of 8:00 p.m. and 7:00 a.m. Monday through Friday, between the hours of 6:00 p.m. and 8:00 a.m. on Saturday, nor at any time on Sunday or a national holiday. This applies only when a construction work area is within 500 feet of a noise-sensitive land use.
2. In order to minimize the time during which any single noise-sensitive receptor is exposed to construction noise, construction shall be completed as rapidly as possible. A construction schedule shall be developed that minimizes potential cumulative construction noise impacts and accommodates particularly noise-sensitive periods for nearby land uses.
3. The quietest construction equipment available shall be used. Where possible, electric-powered equipment shall be used rather than diesel equipment and hydraulic-powered equipment shall be used rather than pneumatic power. If compressors powered by diesel or gasoline engines are used, they shall be enclosed or have baffles to help abate noise levels.
4. All construction equipment shall be properly maintained.

5. All equipment shall be equipped with suitable exhaust and air-intake silencers in proper working order.
6. Noisy equipment shall be operated only when necessary, and shall be switched off when not in use.
7. During all construction activities in residential neighborhoods, temporary barriers shall be employed where feasible around noisy equipment when it is located within 500 feet of a sensitive receptor. To maximize the effectiveness of the barriers they shall break the line-of site between the equipment and the noise-sensitive receptor(s) and shall be located as close as practicable to either the noise source or the receptor. Where the barrier does not enclose the equipment on multiple sides, the length of the barrier shall be substantially greater than its height to provide effective performance. The barriers shall be constructed of an acoustical blanket material that provides a minimum sound transmission class (STC) of 28.
8. Construction employees shall be trained in the proper operation and use of the equipment to minimize noise levels.
9. Construction supervisors shall be required to participate in training programs related to project-specific noise requirements, specifications, and/or equipment operations. The construction supervisor shall also receive on-site training related to the noise-specific issues and sensitive areas adjacent to the pipeline route.
10. Staging sites shall be located on properties restricted to industrial and commercial uses only.
11. Staging sites shall not be located within 500 feet of a sensitive receptor. Where this is not possible, the construction supervisor shall ensure that noise barriers are erected, or ensure that existing structures provide adequate noise barriers between the staging site and the sensitive receptor(s).
12. Stationary noise sources such as generators and compressors shall be positioned as far away as possible from noise sensitive areas.
13. To the extent practicable, construction equipment shall be stored in the construction zone while in use. This will eliminate noise associated with repeated transportation of the equipment to and from the site.
14. Public notice shall be given prior to construction identifying the location and dates of construction, and the name and phone number of the construction supervisor's contact person in case of complaints. One contact person shall be assigned to the pipeline project. The public notice shall encourage the residents to contact this person rather than the police in case of complaint. Residents shall also be kept informed of any changes to the schedule. The construction supervisor's designated contact person shall be on site throughout project construction with a mobile phone. If a complaint is received, the contact person shall take whatever reasonable steps are necessary to resolve the complaint. If possible, a member of the construction team shall also travel to the complainant's location to understand the nature of the disturbance.
15. Haul routes shall be on major arterial roads in industrial and commercial areas. Where haul routes must occur on major arterial roads in residential areas, such routes shall be subject to the review and approval of the local jurisdiction wherein the haul route will occur.

16. To reduce the likeliness of building damage occurring due to construction vibration, heavy equipment (backhoes, dozers, graders, loaders, etc.) shall not be operated within 15 feet of any existing building, within 11 feet of any institutional building, or within 8 feet of any industrial building. If the required distances cannot be maintained then the following measures shall be implemented:

    a. Qualified structural and geotechnical engineers shall review the peak particle velocities estimated in this report, and determine if there are any risks to the building, including possible risks from dynamic soil settlement induced by the vibration. If the structural or geotechnical engineers identify any potential risks, they shall take all necessary steps to protect the building including, but not limited to, photographing and/or videotaping the building in order to provide a record of the existing conditions before construction.

    b. If considered appropriate by a qualified structural engineer or geotechnical engineer, an engineer shall be on-site during the construction activities and perform such tests and observations as are necessary to ensure the structural stability of the building. This may include vibration measurements obtained inside or outside of the building.

15 Unmitigated Impacts

As indicated in Section 11 of this report, maximum construction noise levels may be as high as 102 dBA at sensitive locations along the pipeline routes. Since this exceeds the thresholds of significance established for this project, a significant impact has been assessed. While the abatement measures of Section 14 will reduce the construction levels as much as is feasible (about 10 dB), the resulting noise level will still exceed the daytime and nighttime thresholds of significance. Therefore, the impact will remain unmitigated.

As indicated in Section 11 of this report, construction activities will increase the ambient noise level by up to 29 dBA at sensitive locations along the pipeline routes. Since this exceeds the thresholds of significance established for this project, a significant impact has been assessed. While the abatement measures of Section 14 will minimize the increase in ambient levels as much as is feasible (about 10 dB), the resulting increase will still exceed the thresholds of significance. Therefore, the impact will remain unmitigated.

As indicated in Section 12 of this report, construction activities will generate perceptible ground vibration levels at sensitive locations along the pipeline routes. Since this exceeds the thresholds of significance established for this project, a significant impact has been assessed. While the impact cannot be mitigated, it is noted that the impact will be sporadic and temporary, will diminish over the course of construction, and will cease entirely at the completion of the project.

16 References

1. *Transit Noise and Vibration Impact Assessment*. U.S. Department of Transportation/Federal Transit Administration (FTA-VA-90-1003-06). May 2006.

2. *Transportation- and Construction-Induced Vibration Guidance Manual.* Jones & Stokes (J&S 02-039). Contract No. 43A0049 for California Department of Transportation, Noise, Vibration, and Hazardous Waste Management Office, Sacramento, CA. June 2004.
3. *FHWA Roadway Construction Noise Model (RCNM), Version 1.0*. Federal Highway Administration. February 2, 2006.
4. *Draft Project Description, LADWP Harbor Refineries Recycled Water Pipeline Project*. Michael Brandman Associates. September 2008.

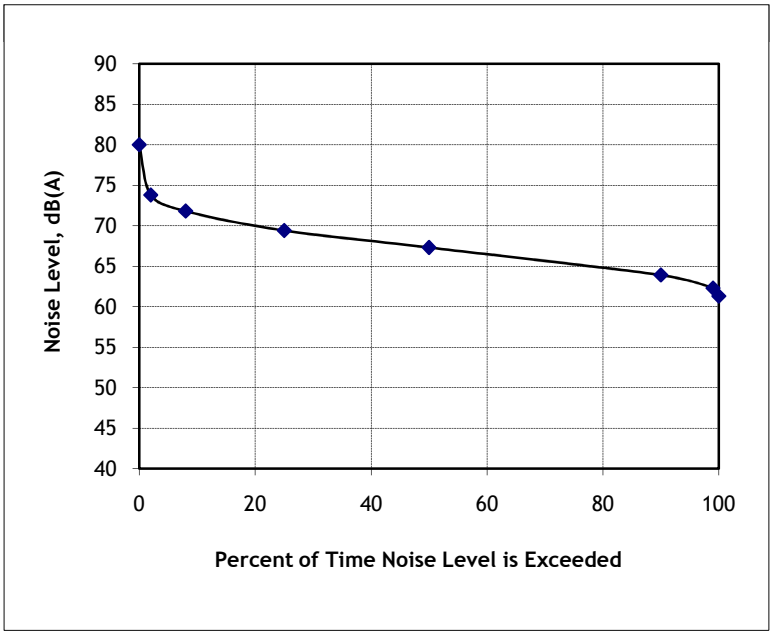
APPENDIX I

Noise and Vibration Measurements

Table I-1. Noise Survey

Project:	LADWP Water Pipeline
Position:	#1 - Adjacent to Doubletree Hotel, Carson Civic Plaza
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Carson Street
Distance:	23' to curb of Carson Street
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	9:24 AM to 9:44 AM	to	to
n*	**Ln**	**Ln**	**Ln**
2	73.8		
8	71.8		
25	69.4		
50	67.3		
90	63.9		
99	62.3		
Leq	68.6		
Lmax	80.0		
Lmin	61.3		

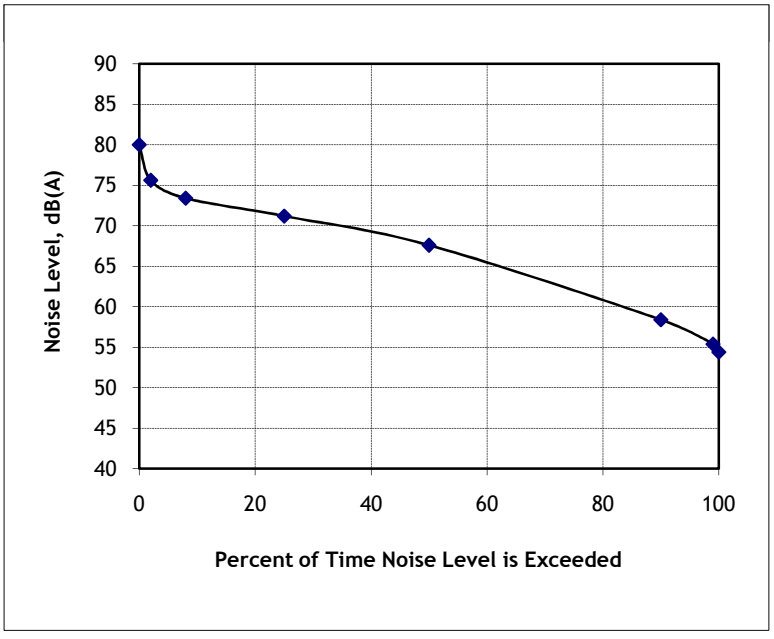


* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-2. Noise Survey

Project:	LADWP Water Pipeline
Position:	#2 - Adjacent to house at 21702 Acarus Avenue
Date:	March 26, 2008
Time:	Noted
Noise Source:	Traffic on Carson Street
Distance:	21' to curb of Carson Street
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	4:24 PM to 4:52 PM	to	to
n*	**Ln**	**Ln**	**Ln**
2	75.6		
8	73.4		
25	71.2		
50	67.6		
90	58.4		
99	55.4		
Leq	69.5		
Lmax	80.0		
Lmin	54.4		



* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-3. Measured Hourly Noise Levels and CNEL

Project: LADWP Water Pipeline

Location: #3 - Rear yard of 701 222nd Street

Date: March 26-27, 2009

Measurement Period	Hourly Noise Level, dB(A)		Measurement Period	Hourly Noise Level, dB(A)
12:00 am - 1:00 am	59.7		12:00 pm - 1:00 pm	67.0
1:00 am - 2:00 am	55.0		1:00 pm - 2:00 pm	65.1
2:00 am - 3:00 am	56.0		2:00 pm - 3:00 pm	65.7
3:00 am - 4:00 am	56.7		3:00 pm - 4:00 pm	65.1
4:00 am - 5:00 am	56.5		4:00 pm - 5:00 pm	66.0
5:00 am - 6:00 am	61.9		5:00 pm - 6:00 pm	65.0
6:00 am - 7:00 am	64.3		6:00 pm - 7:00 pm	63.7
7:00 am - 8:00 am	67.7		7:00 pm - 8:00 pm	63.6
8:00 am - 9:00 am	65.4		8:00 pm - 9:00 pm	65.5
9:00 am - 10:00 am	65.9		9:00 pm - 10:00 pm	61.8
10:00 am -11:00 am	65.5		10:00 pm - 11:00 pm	59.7
11:00 am - 12:00 pm	64.5		11:00 pm - 12:00 am	58.7
			CNEL	***68.0***

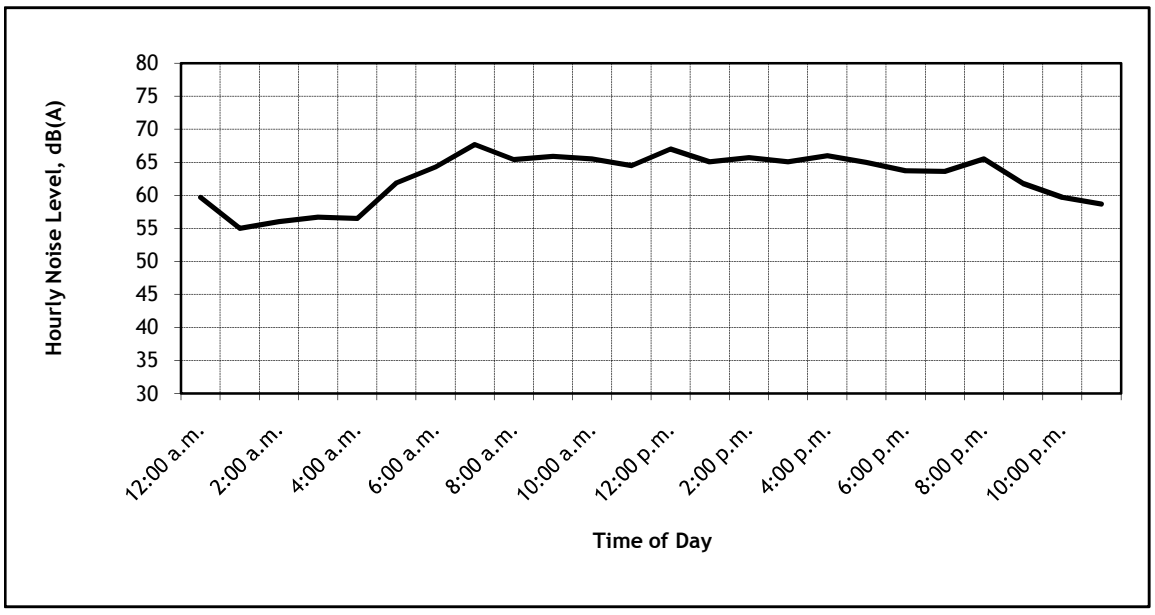
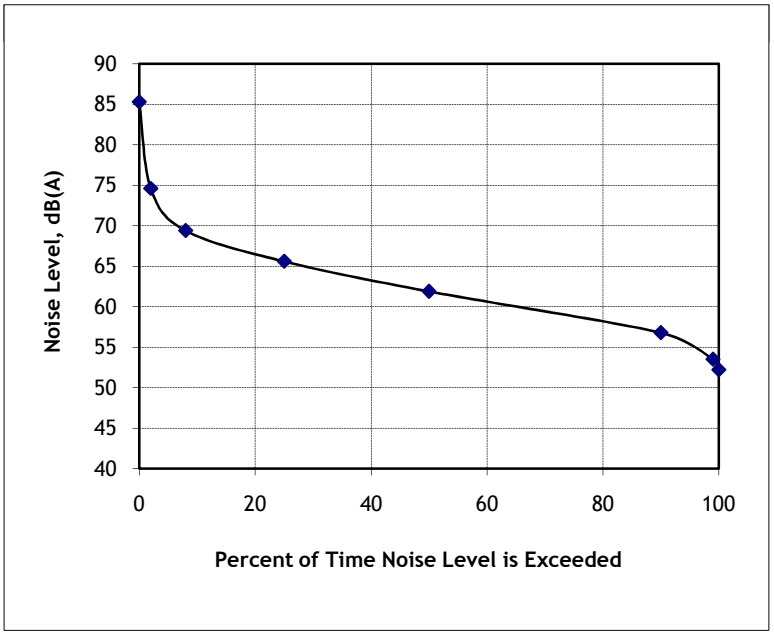


Table I-4. Noise Survey

Project:	LADWP Water Pipeline
Position:	#4 - Adjacent to house at 558 Lincoln Street
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Avalon Boulevard
Distance:	25' to curb of Carson Street
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	10:26 AM to 10:56 AM	to	to
n*	**Ln**	**Ln**	**Ln**
2	74.6		
8	69.4		
25	65.6		
50	61.9		
90	56.8		
99	53.5		
Leq	66.7		
Lmax	85.3		
Lmin	52.2		

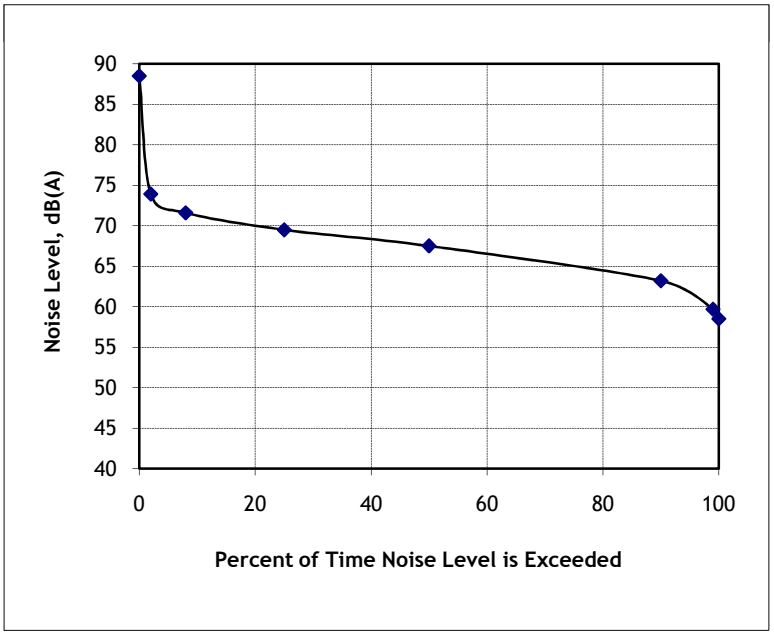


* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-5. Noise Survey

Project:	LADWP Water Pipeline
Position:	#5 - Adjacent to Crescent Inn Motel, 1104 Pacific Coast Highway
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Pacific Coast Highway
Distance:	15' to curb of Pacific Coast Highway
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	4:55 PM to 5:15 PM	to	to
n*	**Ln**	**Ln**	**Ln**
2	73.9		
8	71.6		
25	69.5		
50	67.5		
90	63.2		
99	59.7		
Leq	69.1		
Lmax	88.5		
Lmin	58.5		

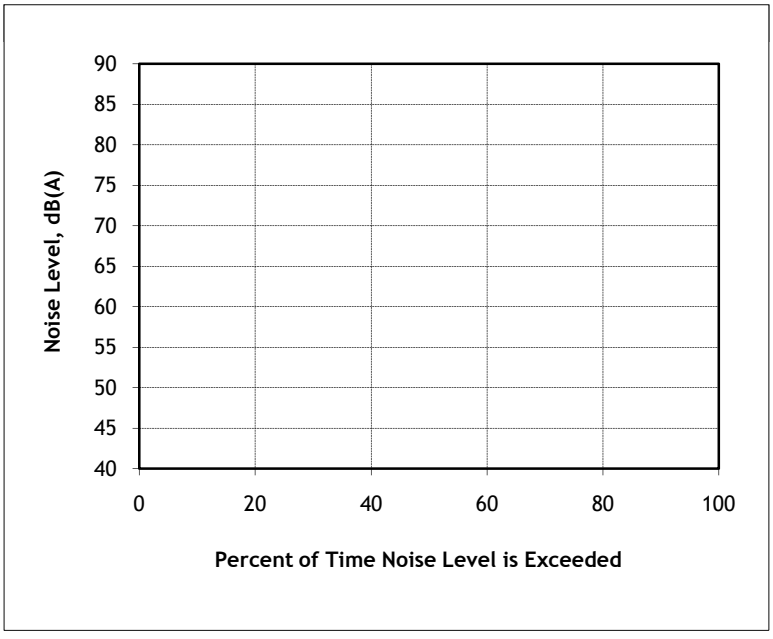


* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-6. Noise Survey

Project:	LADWP Water Pipeline
Position:	#6 - Adjacent to house at 1335 Papeete Street
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Figuroa Street and I-110
Distance:	17' to curb of Figuroa Street
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	2:33 PM to 2:53 PM	to	to
n*	**Ln**	**Ln**	**Ln**
2			
8			
25			
50			
90			
99			
Leq	69.9		
Lmax			
Lmin			



* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-7. Measured Hourly Noise Levels and CNEL

Project: LADWP Water Pipeline

Location: #7 - Rear yard of 1170 Casa Milagro

Date: March 26-27, 2009

Measurement Period	Hourly Noise Level, dB(A)		Measurement Period	Hourly Noise Level, dB(A)
12:00 am - 1:00 am	48.7		12:00 pm - 1:00 pm	54.4
1:00 am - 2:00 am	48.7		1:00 pm - 2:00 pm	54.4
2:00 am - 3:00 am	49.4		2:00 pm - 3:00 pm	56.3
3:00 am - 4:00 am	51.4		3:00 pm - 4:00 pm	56.1
4:00 am - 5:00 am	49.0		4:00 pm - 5:00 pm	57.0
5:00 am - 6:00 am	50.4		5:00 pm - 6:00 pm	59.6
6:00 am - 7:00 am	54.5		6:00 pm - 7:00 pm	58.1
7:00 am - 8:00 am	60.7		7:00 pm - 8:00 pm	55.5
8:00 am - 9:00 am	59.6		8:00 pm - 9:00 pm	53.9
9:00 am - 10:00 am	56.9		9:00 pm - 10:00 pm	59.8
10:00 am -11:00 am	54.1		10:00 pm - 11:00 pm	58.3
11:00 am - 12:00 pm	53.5		11:00 pm - 12:00 am	51.4
			CNEL	***60.7***

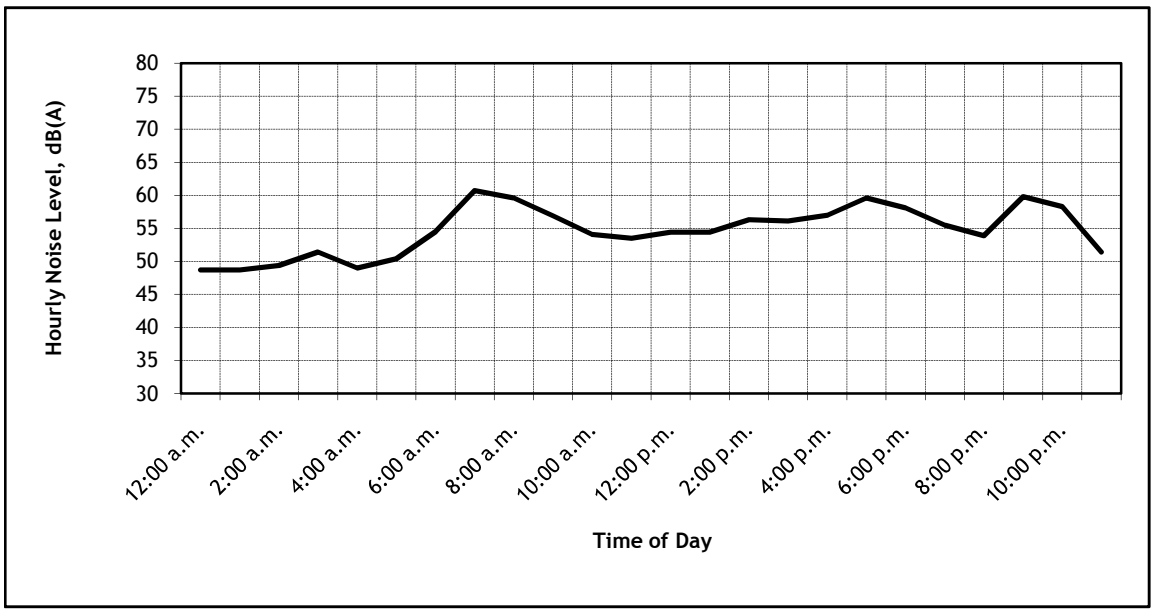
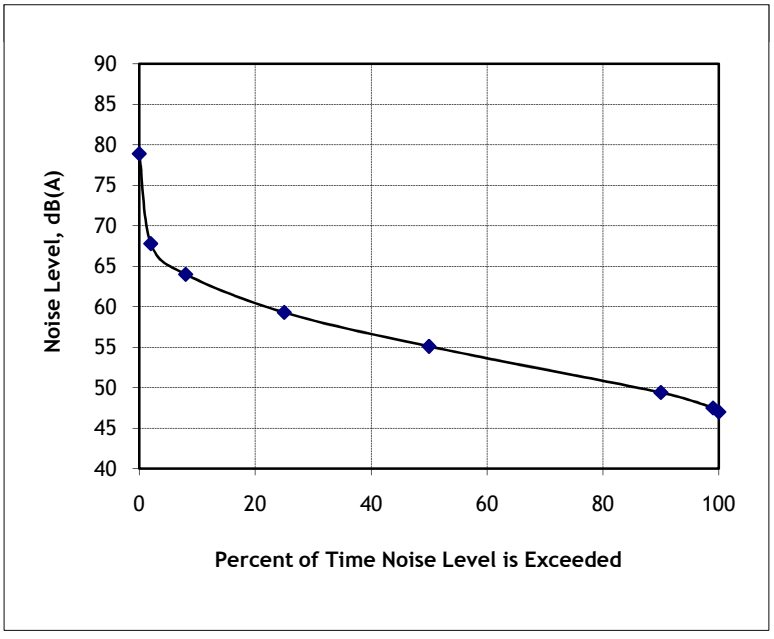


Table I-8. Noise Survey

Project:	LADWP Water Pipeline
Position:	#8 - Adjacent to house at 1333 Opp Street
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Mahar Street
Distance:	19' to curb of Mahar Avenue
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	1:20 PM to 1:43 PM	to	to
n*	**Ln**	**Ln**	**Ln**
2	67.8		
8	64.0		
25	59.3		
50	55.1		
90	49.4		
99	47.5		
Leq	59.7		
Lmax	78.9		
Lmin	47.0		



* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-9. Measured Hourly Noise Levels and CNEL

Project: LADWP Water Pipeline

Location: #9 - Rear yard of 23038 Bolsa Avenue

Date: March 26-27, 2009

Measurement Period	Hourly Noise Level, dB(A)		Measurement Period	Hourly Noise Level, dB(A)
12:00 am - 1:00 am	53.8		12:00 pm - 1:00 pm	58.5
1:00 am - 2:00 am	56.1		1:00 pm - 2:00 pm	60.2
2:00 am - 3:00 am	55.0		2:00 pm - 3:00 pm	58.8
3:00 am - 4:00 am	53.4		3:00 pm - 4:00 pm	59.3
4:00 am - 5:00 am	54.0		4:00 pm - 5:00 pm	66.8
5:00 am - 6:00 am	56.1		5:00 pm - 6:00 pm	59.8
6:00 am - 7:00 am	57.7		6:00 pm - 7:00 pm	65.0
7:00 am - 8:00 am	67.6		7:00 pm - 8:00 pm	57.7
8:00 am - 9:00 am	57.6		8:00 pm - 9:00 pm	58.9
9:00 am - 10:00 am	61.8		9:00 pm - 10:00 pm	56.0
10:00 am -11:00 am	61.3		10:00 pm - 11:00 pm	55.6
11:00 am - 12:00 pm	57.7		11:00 pm - 12:00 am	53.6
			CNEL	***63.8***

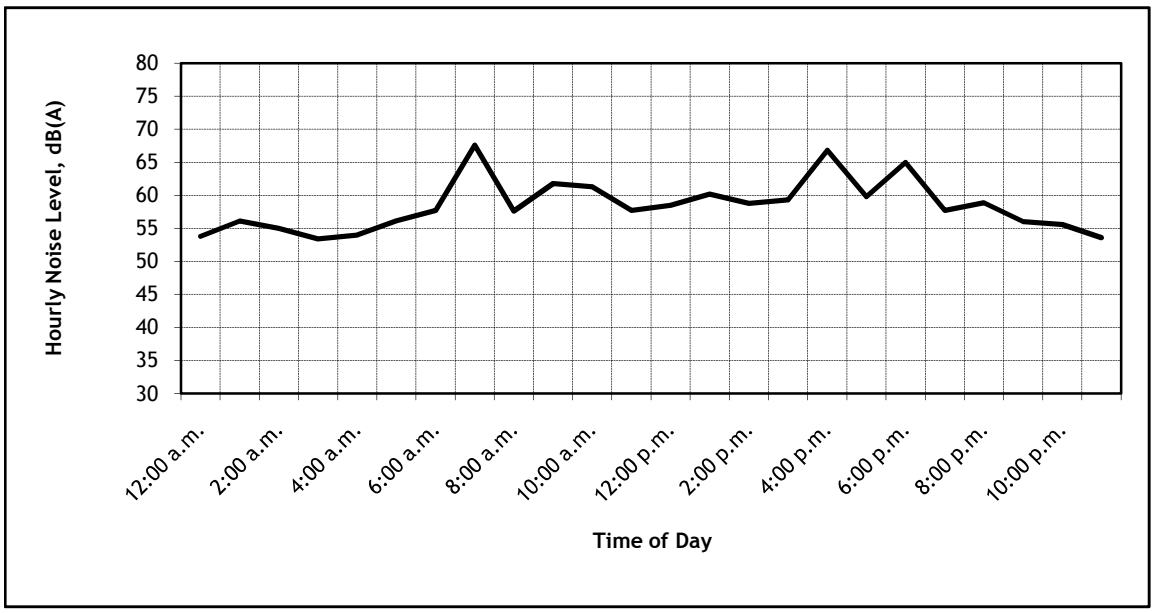
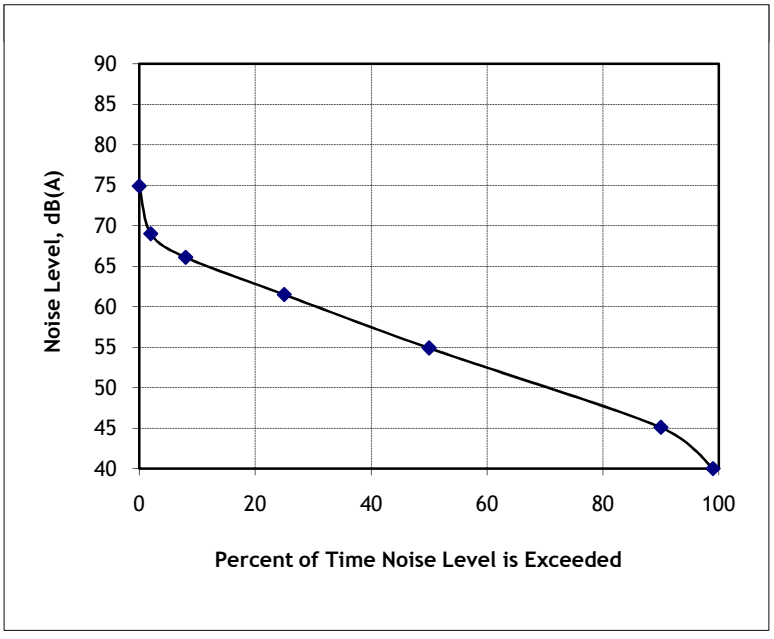


Table I-10. Noise Survey

Project:	LADWP Water Pipeline
Position:	#10 - Adjacent to house at 22910 Dolores Street
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Dolores Street
Distance:	34' to curb of Dolores Street
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	11:37 AM to 12:01 PM	to	to
n*	Ln	Ln	Ln
2	69.0		
8	66.1		
25	61.5		
50	54.9		
90	45.1		
99	40.0		
Leq	61.0		
Lmax	74.9		
Lmin	39.0		

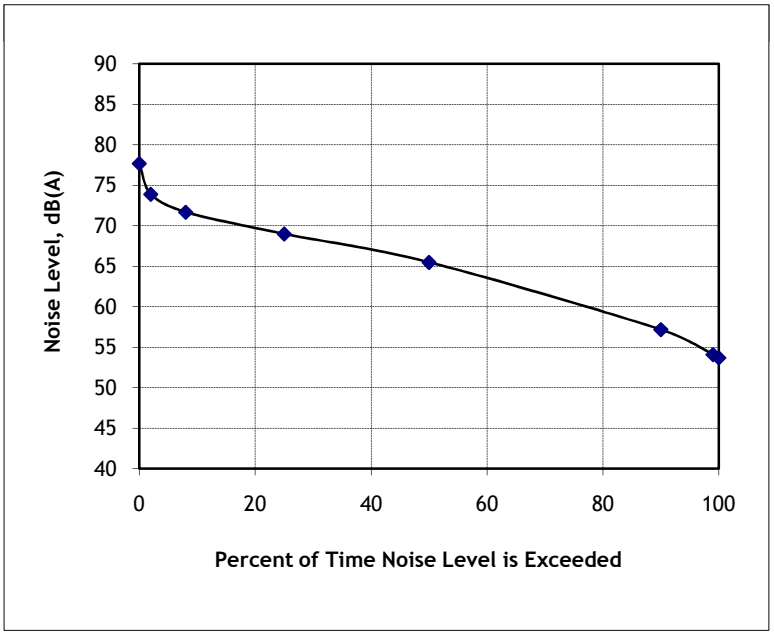


* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

Table I-11. Noise Survey

Project:	LADWP Water Pipeline
Position:	#11 - Adjacent to house at 104 235th Street
Date:	March 27, 2008
Time:	Noted
Noise Source:	Traffic on Main Street
Distance:	16' to curb of Main Street
SLM Height:	5'
LD 820 S/N:	1632
LD CAL200 Calibrator S/N:	2916
Operator:	T. Corbishley

	Measurement Period		
	6:17 PM to 6:39 PM	to	to
n*	**Ln**	**Ln**	**Ln**
2	73.9		
8	71.7		
25	69.0		
50	65.5		
90	57.2		
99	54.1		
Leq	67.5		
Lmax	77.7		
Lmin	53.7		



* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

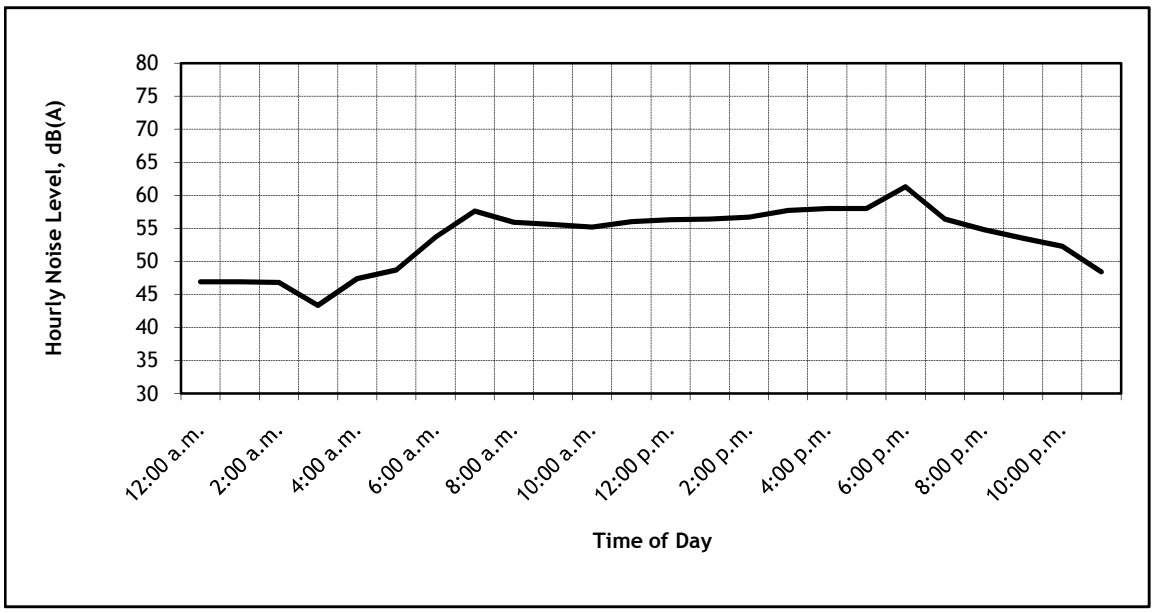
Table I-12. Measured Hourly Noise Levels and CNEL

Project: LADWP Water Pipeline

Location: #12 - Rear yard of 23705 Catskill Avenue

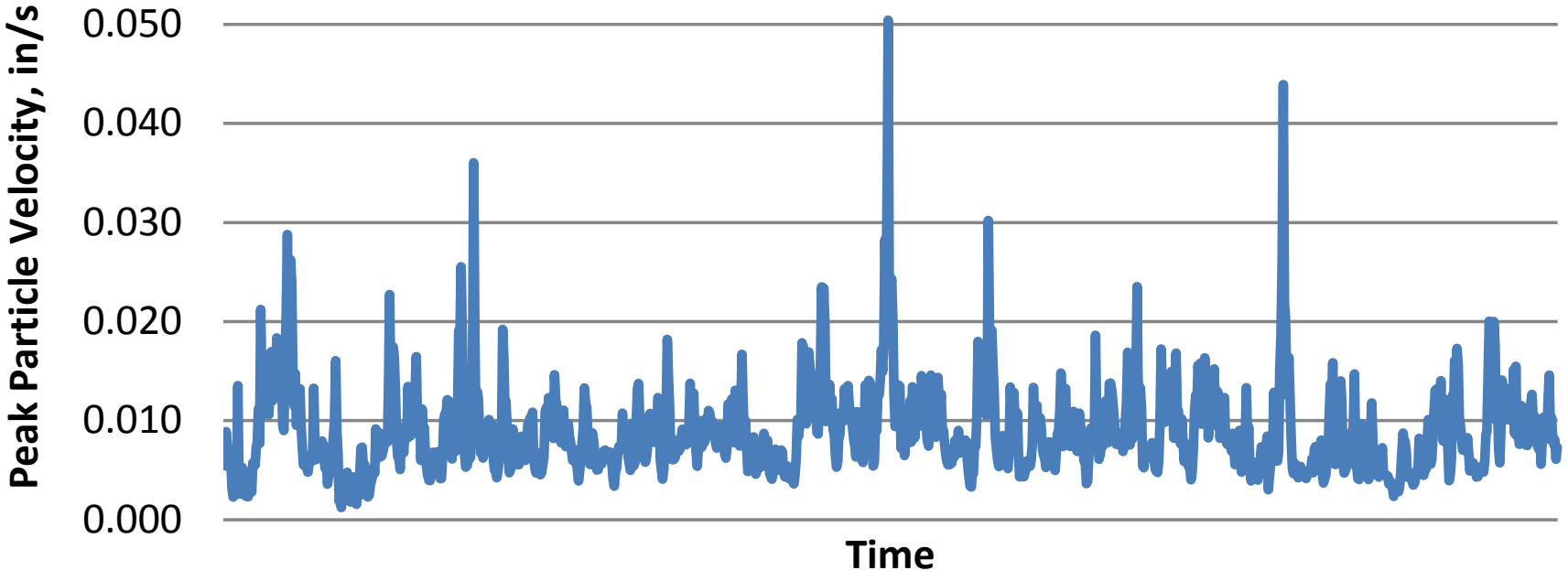
Date: March 26-27, 2009

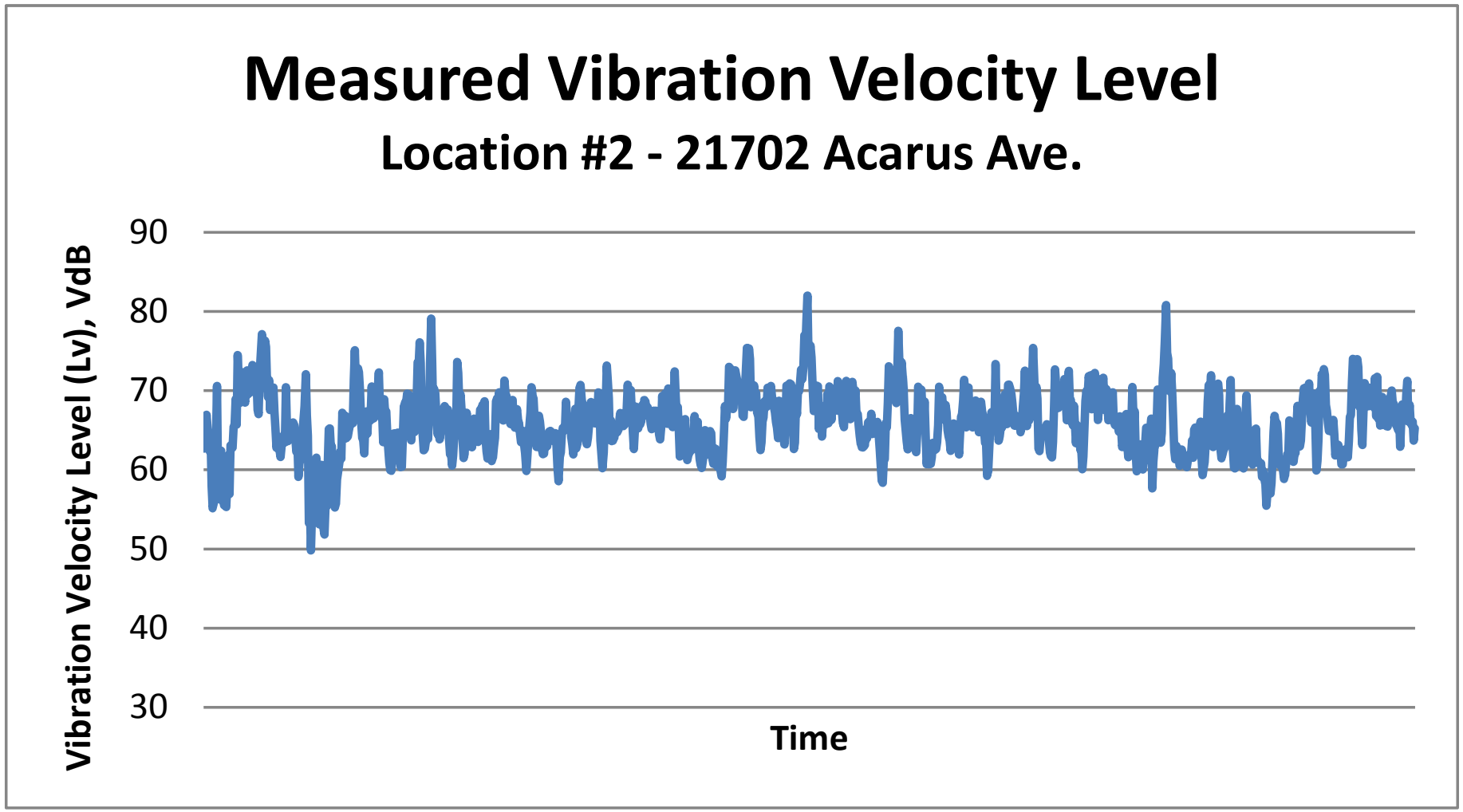
Measurement Period	Hourly Noise Level, dB(A)		Measurement Period	Hourly Noise Level, dB(A)
12:00 am - 1:00 am	46.9		12:00 pm - 1:00 pm	56.3
1:00 am - 2:00 am	46.9		1:00 pm - 2:00 pm	56.4
2:00 am - 3:00 am	46.8		2:00 pm - 3:00 pm	56.7
3:00 am - 4:00 am	43.3		3:00 pm - 4:00 pm	57.7
4:00 am - 5:00 am	47.4		4:00 pm - 5:00 pm	58.0
5:00 am - 6:00 am	48.7		5:00 pm - 6:00 pm	58.0
6:00 am - 7:00 am	53.7		6:00 pm - 7:00 pm	61.3
7:00 am - 8:00 am	57.6		7:00 pm - 8:00 pm	56.4
8:00 am - 9:00 am	55.9		8:00 pm - 9:00 pm	54.8
9:00 am - 10:00 am	55.6		9:00 pm - 10:00 pm	53.5
10:00 am -11:00 am	55.2		10:00 pm - 11:00 pm	52.3
11:00 am - 12:00 pm	56.0		11:00 pm - 12:00 am	48.4
			CNEL	***58.6***



Measured Peak Particle Velocity

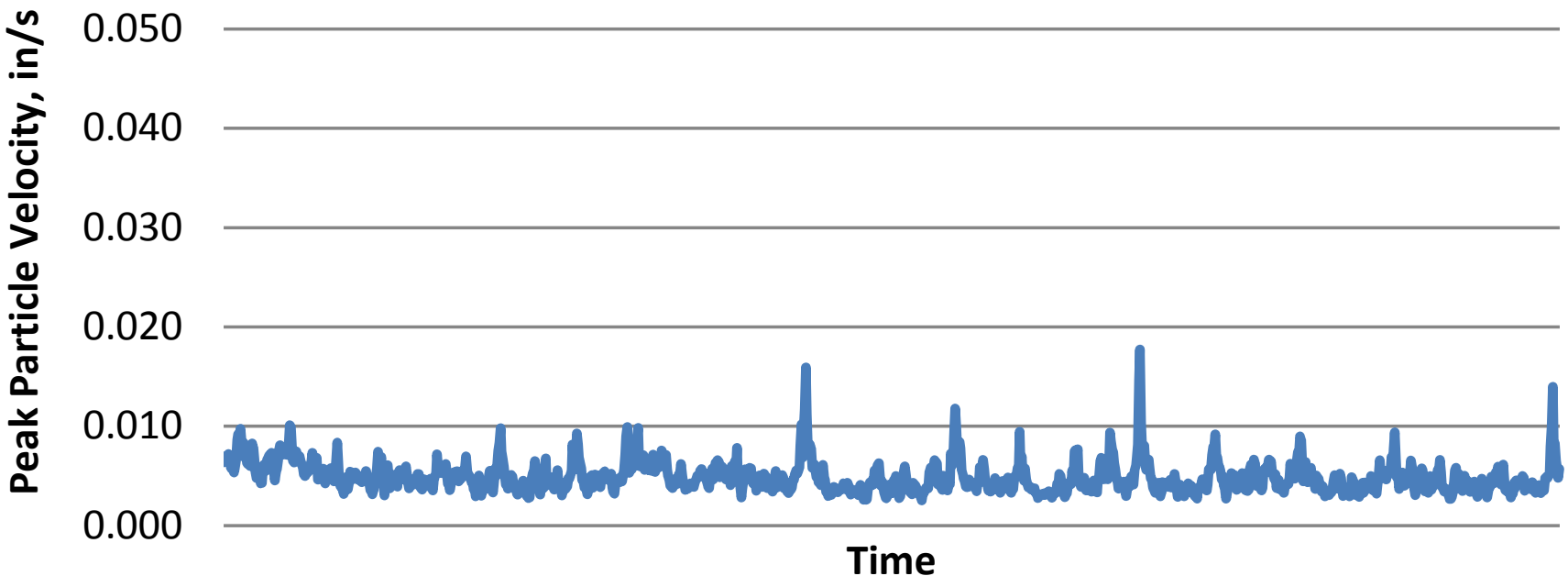
Location #2 - 21702 Acarus Ave.

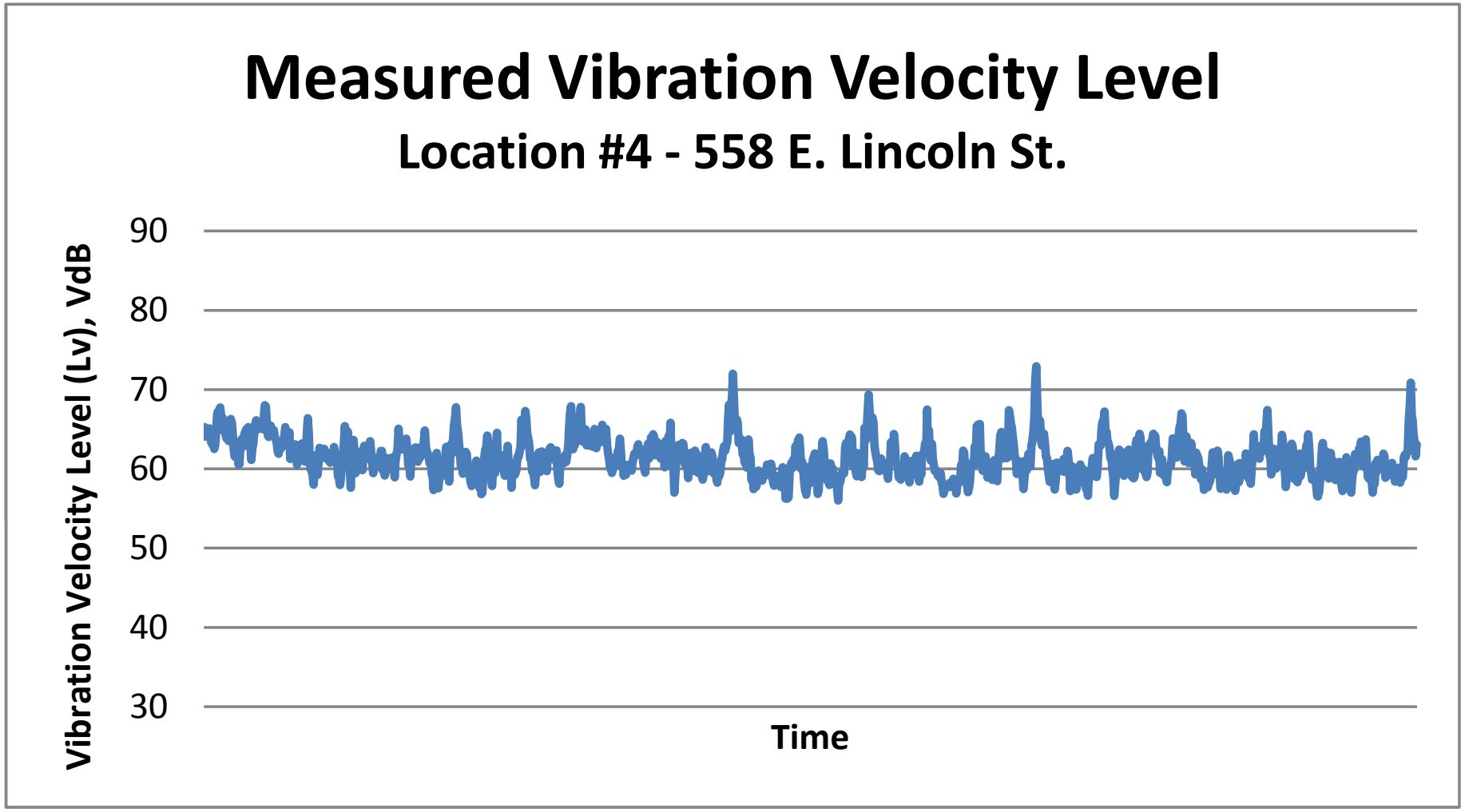



Measured Vibration Velocity Level
Location #2 - 21702 Acarus Ave.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

Measured Peak Particle Velocity

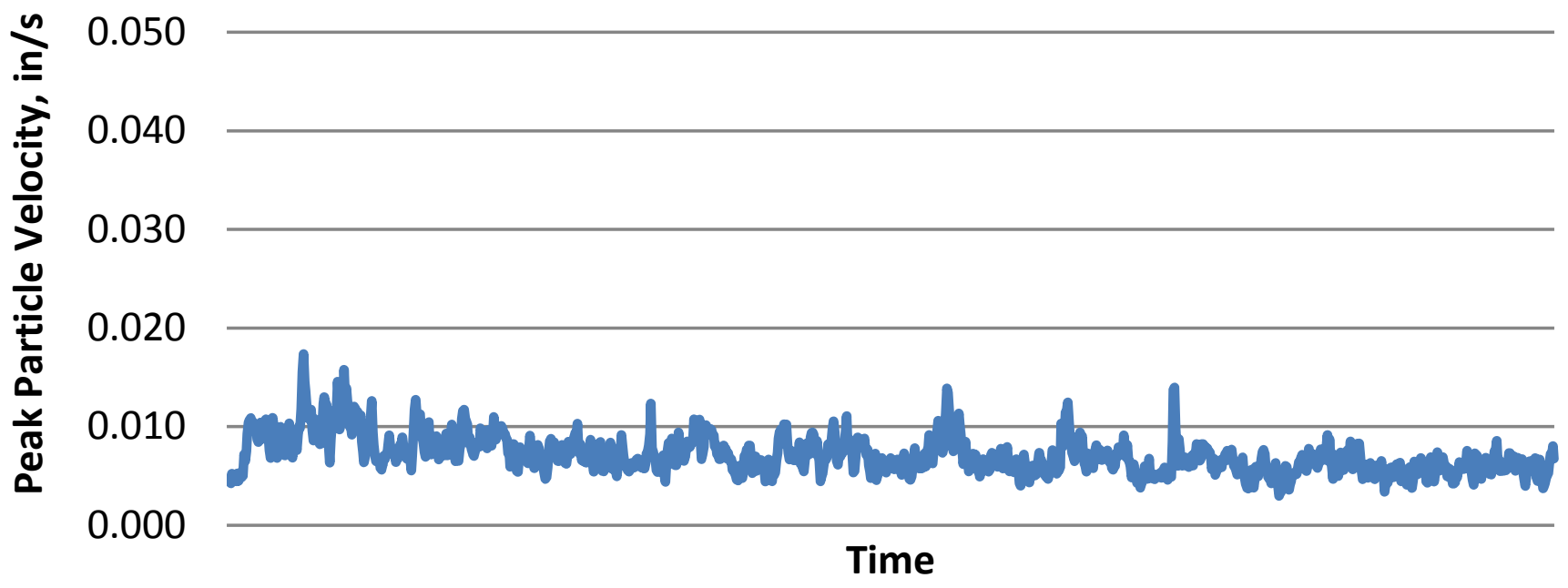
Location #4 - 558 E. Lincoln St.

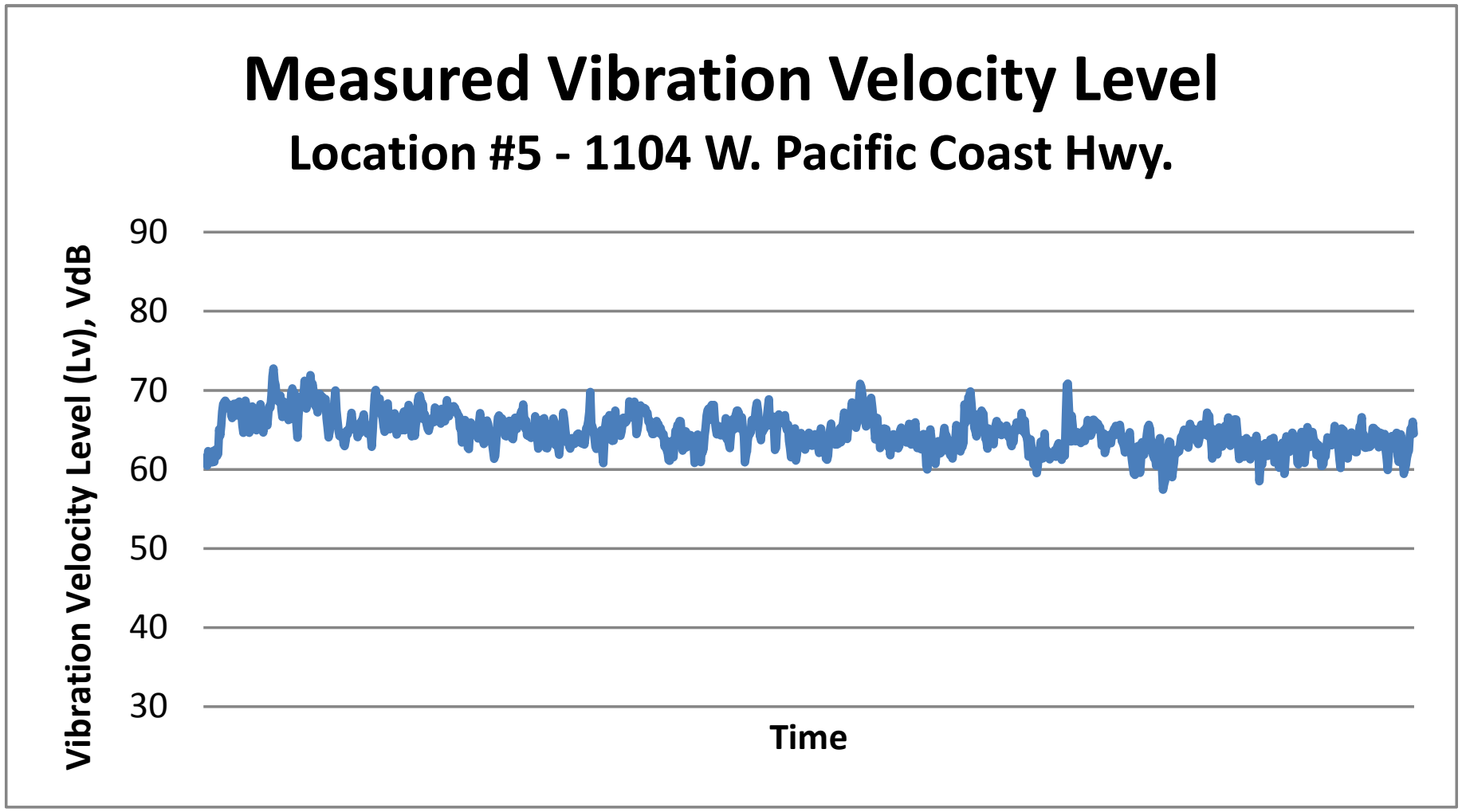



Measured Vibration Velocity Level
Location #4 - 558 E. Lincoln St.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

Measured Peak Particle Velocity

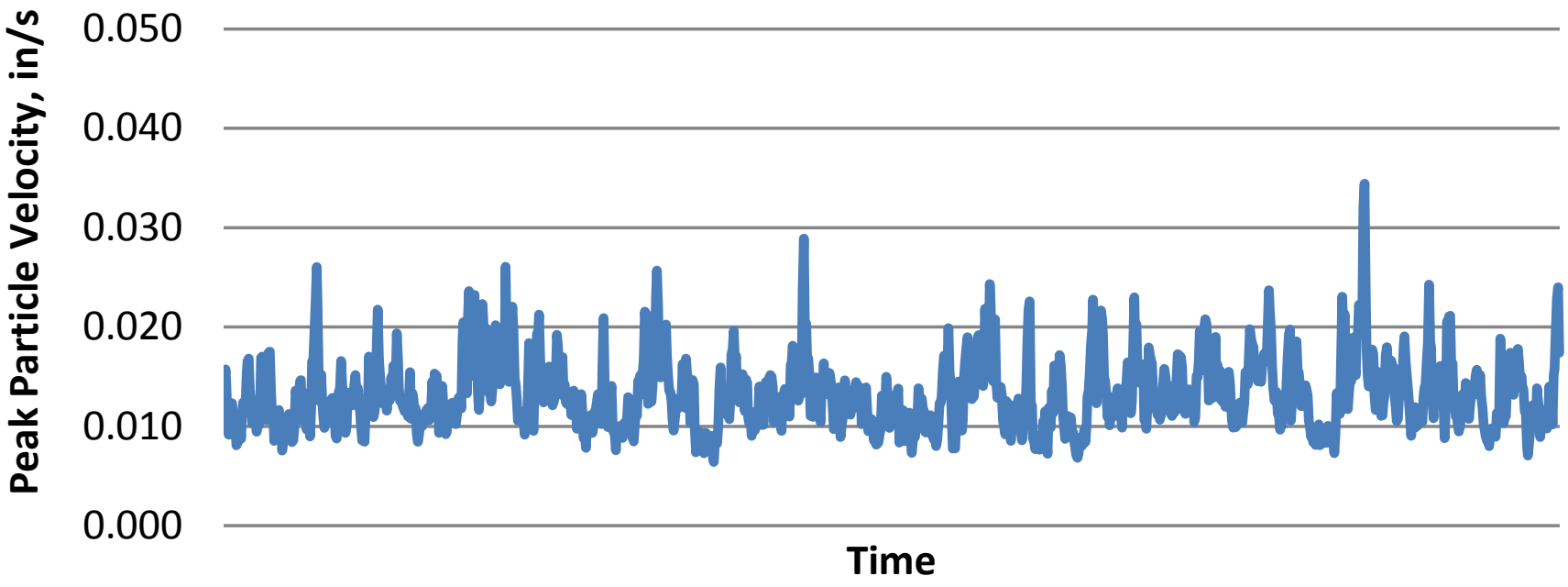
Location #5 - 1104 W. Pacific Coast Hwy.

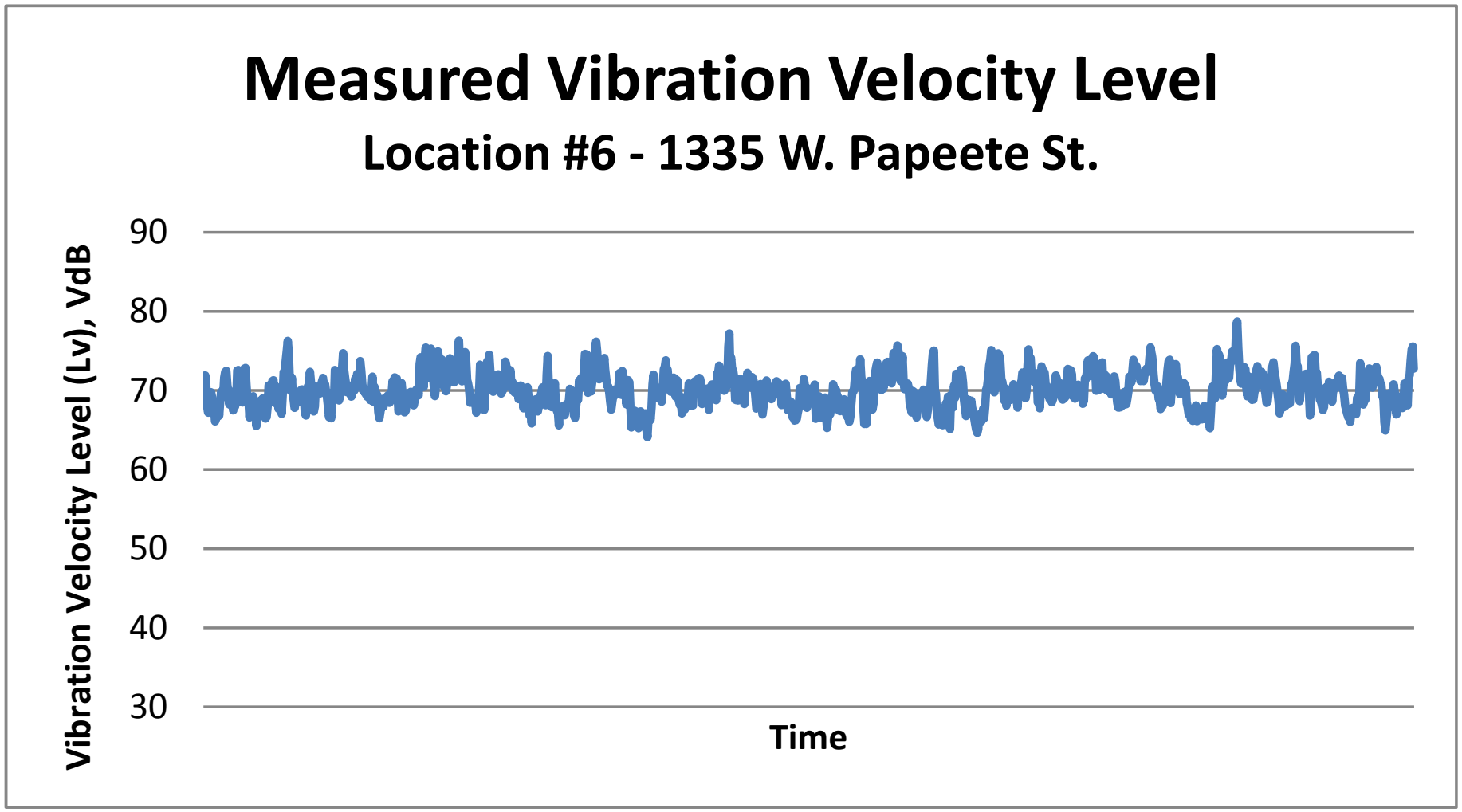



Measured Vibration Velocity Level
Location #5 - 1104 W. Pacific Coast Hwy.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

Measured Peak Particle Velocity

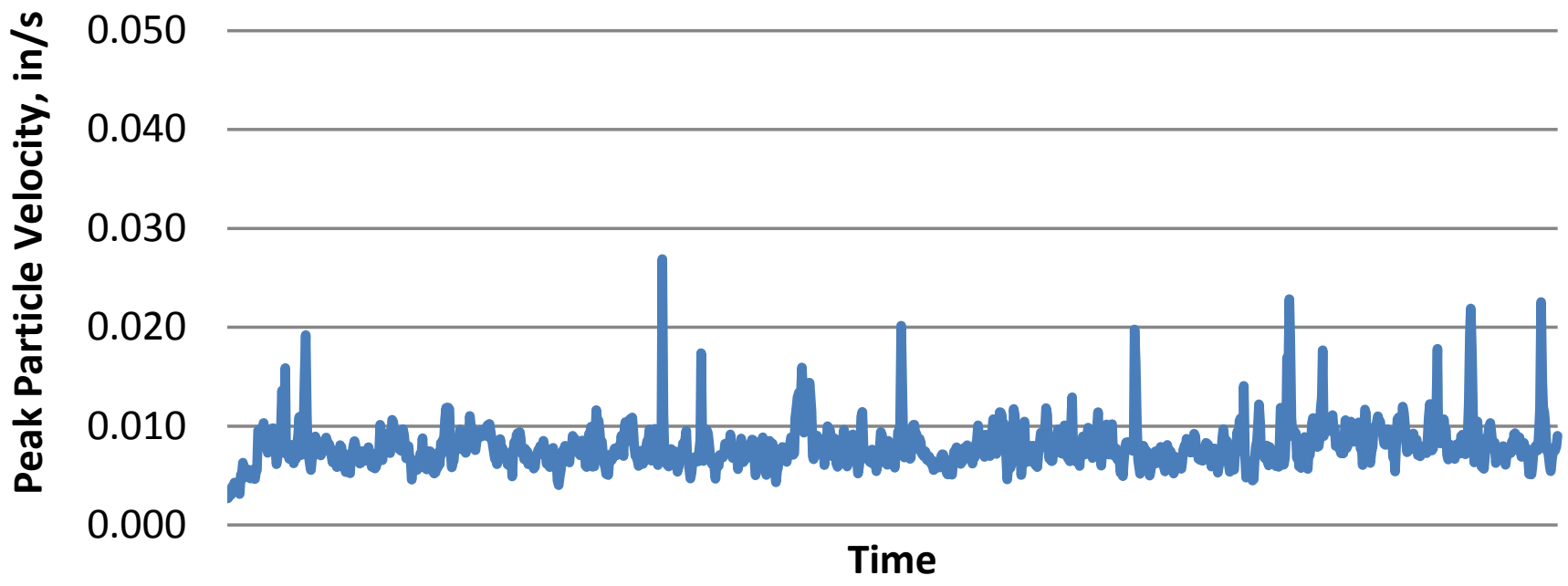
Location #6 - 1335 W. Papeete St.

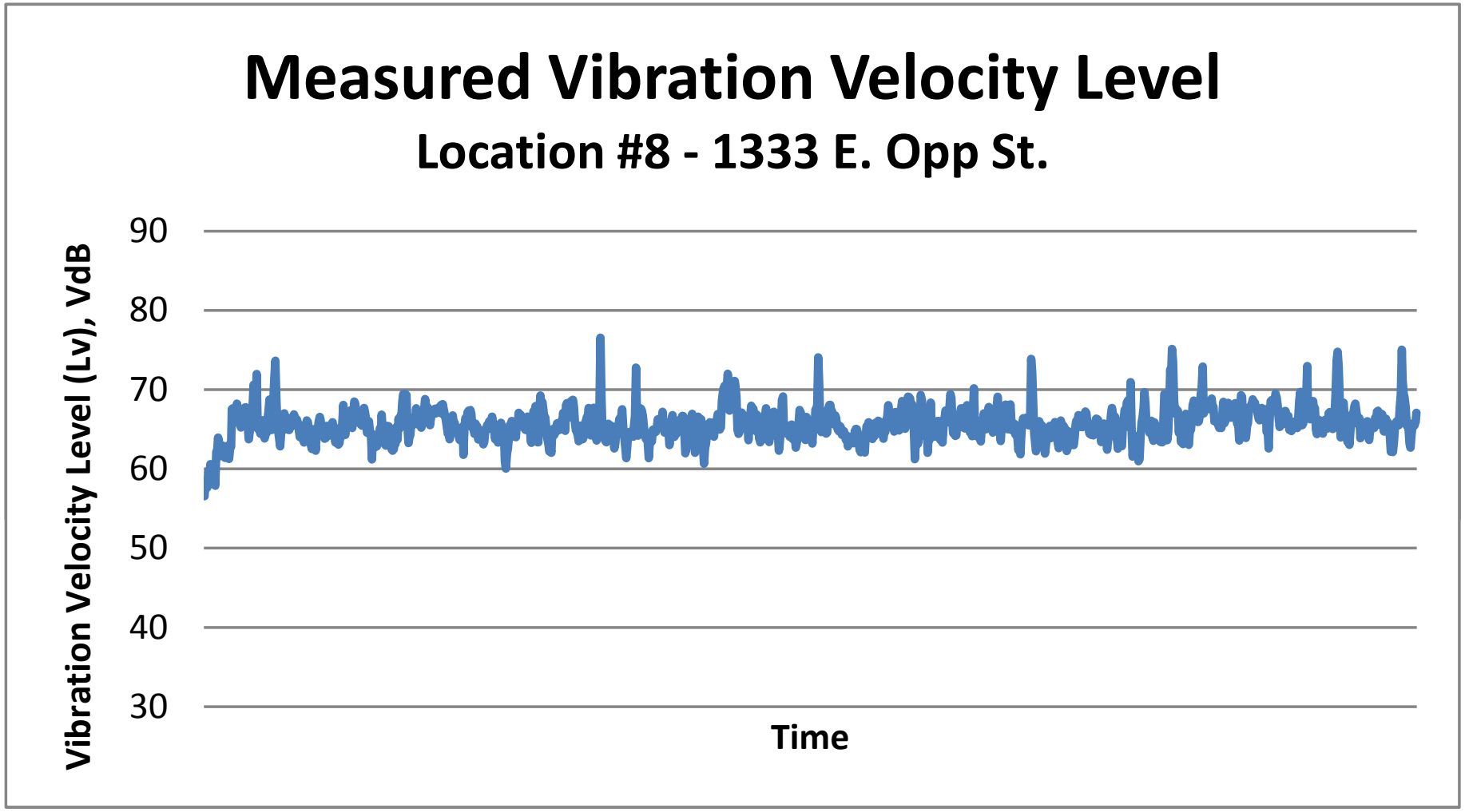



Measured Vibration Velocity Level
Location #6 - 1335 W. Papeete St.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

Measured Peak Particle Velocity

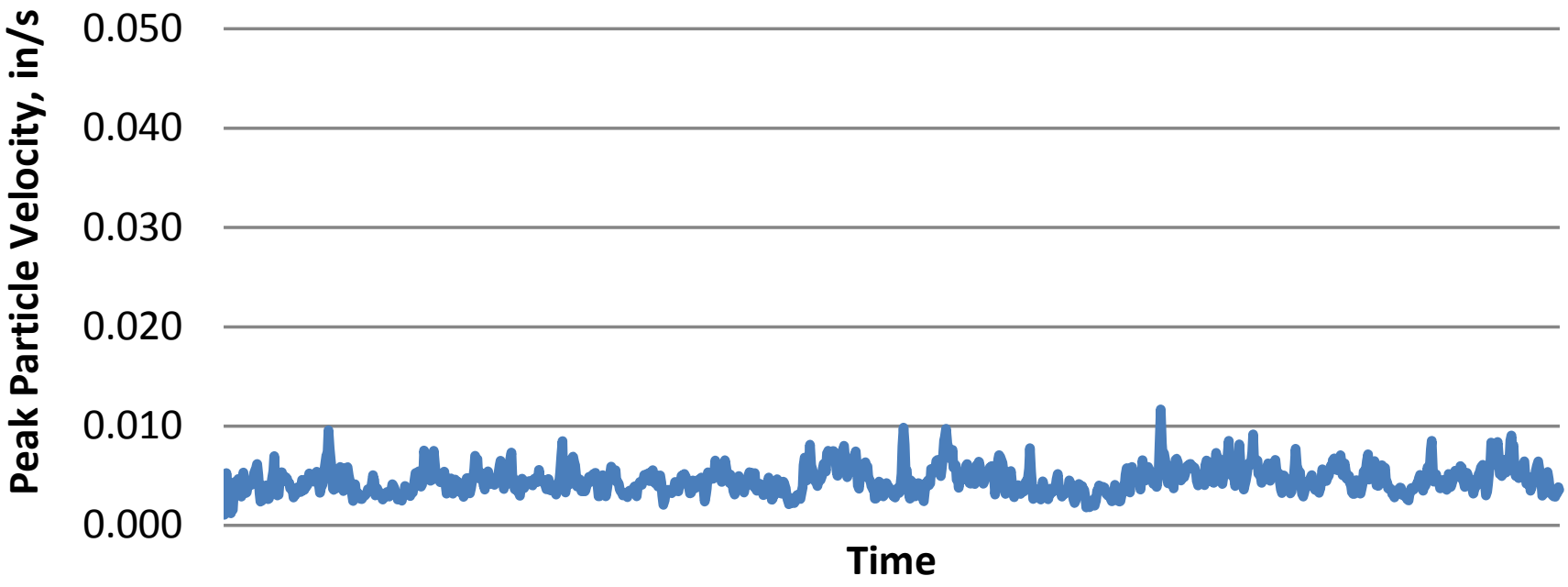
Location #8 - 1333 E. Opp St.

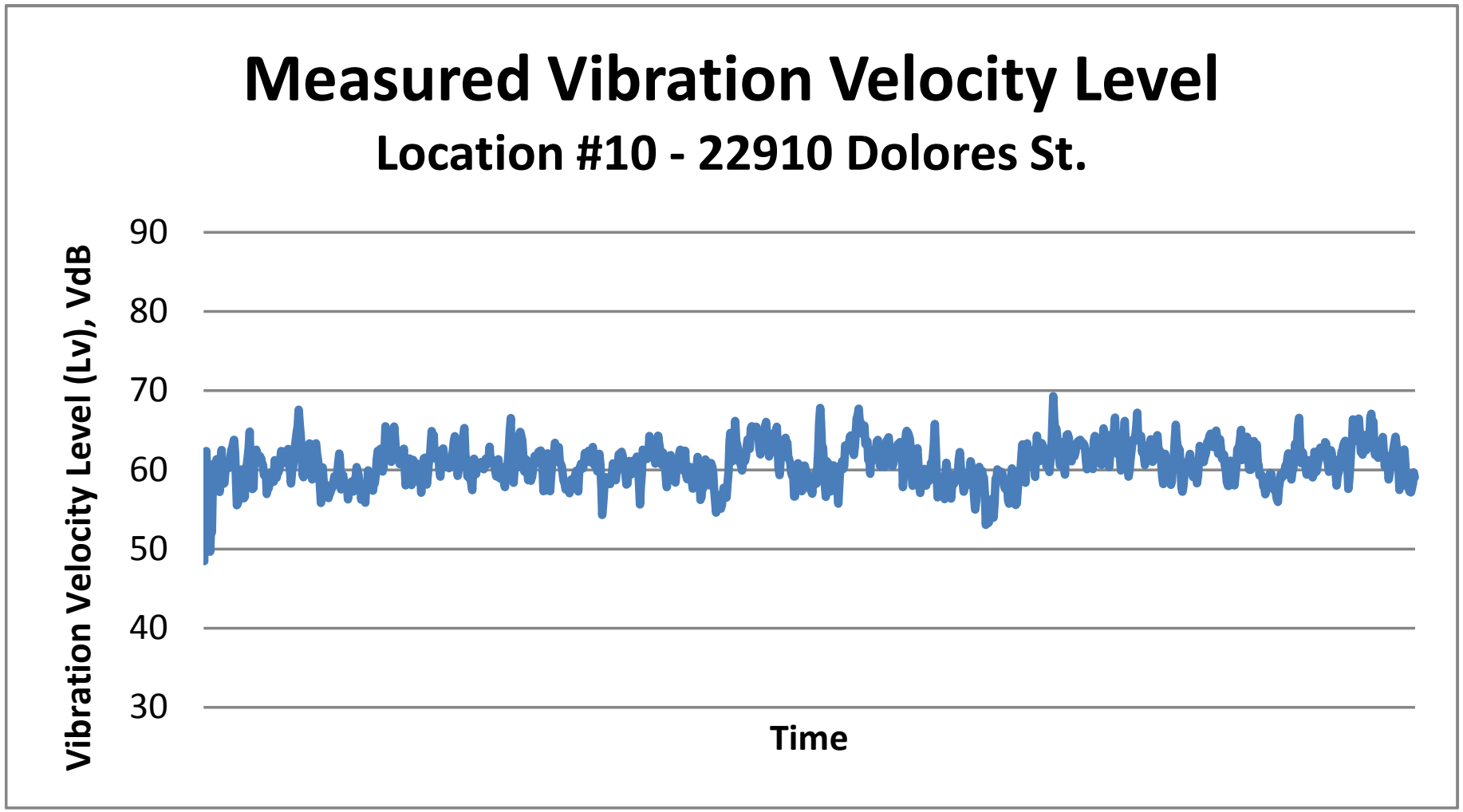



Measured Vibration Velocity Level
Location #8 - 1333 E. Opp St.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

Measured Peak Particle Velocity

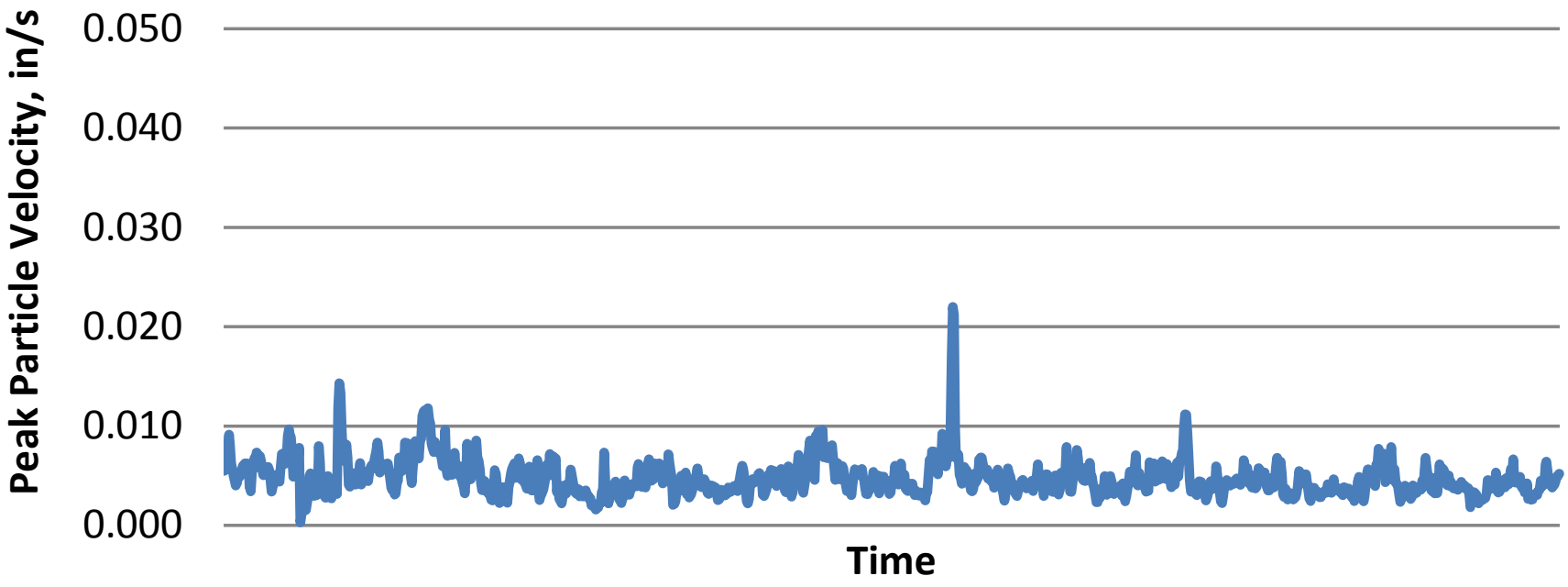
Location #10 - 22910 Dolores St.

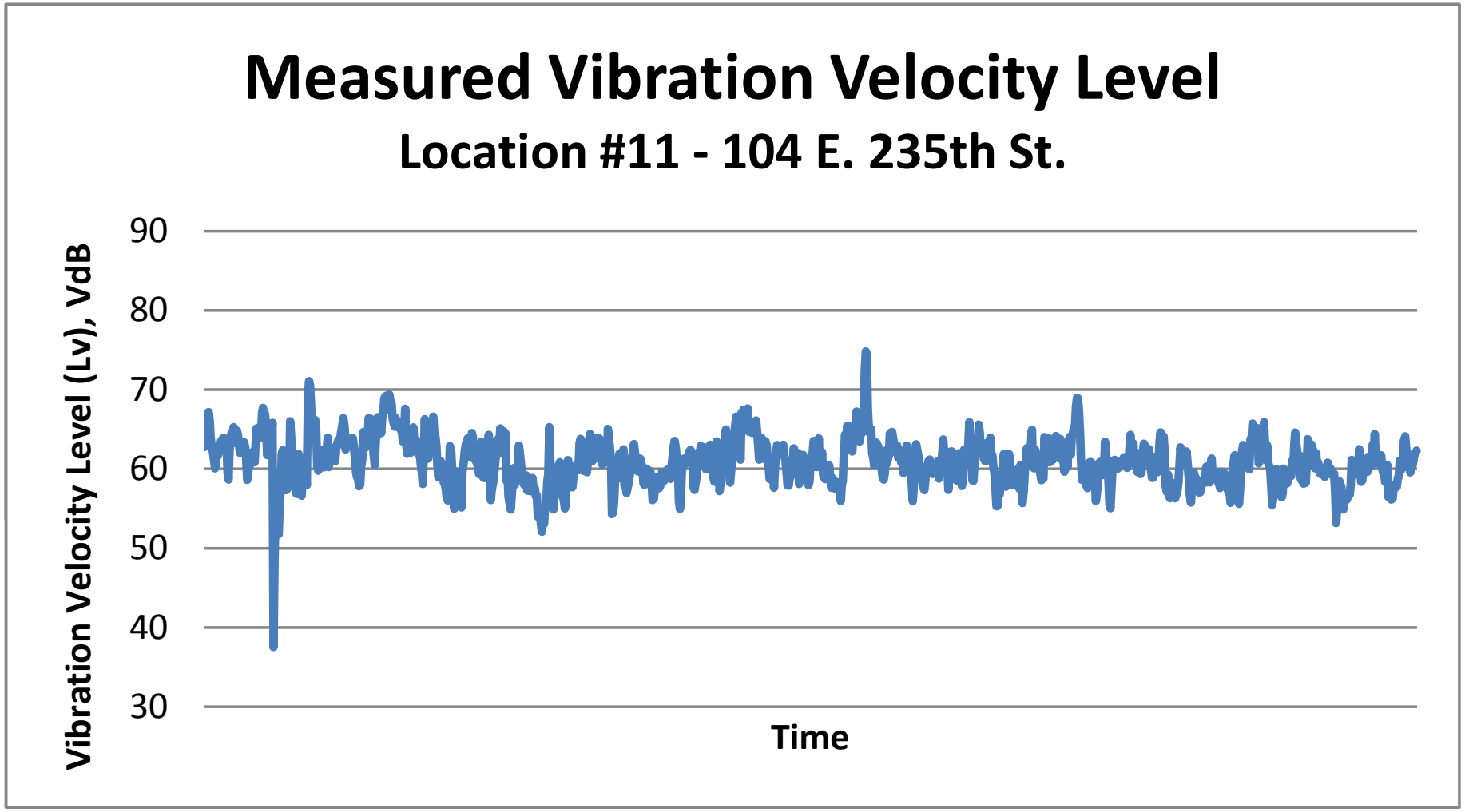



Measured Vibration Velocity Level
Location #10 - 22910 Dolores St.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

Measured Peak Particle Velocity

Location #11 - 104 E. 235th St.




Measured Vibration Velocity Level
Location #11 - 104 E. 235th St.
Vibration Velocity Level (Lv), VdB
90
80
70
60
50
40
30
Time

APPENDIX II

Construction Noise Model

Table II-1. Calculation of Corrected Equipment Sound Levels

Equipment	Lp @ 50', dBA	Usage Factor	Hours	Corrected Lp, dBA
Construction worker vehicles	75.0	0.4	8	71.0
End dump trucks	76.5	0.4	8	72.5
Concrete saws	89.6	0.2	8	82.6
Jackhammers	88.9	0.2	8	81.9
Loader	79.1	0.4	8	75.1
Fork lift	76.0	0.2	8	68.0
5-cyd dump trucks	76.5	0.4	6	71.3
Backhoe	77.6	0.4	6	72.4
Excavator	80.7	0.4	6	75.5
15-Ton Crane	80.6	0.2	8	72.6
Water truck	76.5	0.4	8	72.5
Compactor	83.2	0.2	4	73.2
Hydraulic jack	82.0	0.3	6	74.7
Auger machine	84.4	0.2	6	76.2
Welding truck with generator	80.6	0.4	4	73.6
40 kW generator	80.6	0.5	6	76.3
Drill/bore rig	84.4	0.2	8	77.4
Mud rig	80.9	0.5	8	77.9
Paver	77.2	0.5	2	68.2

Table II-2. Calculation of Average Noise Level at a Distance of 20 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	20	100	20	200	20	300	20	400	20	500	20
Const. worker veh.	62.5	71.0	65.6	68.7	42.5	72.4	138.9	62.1	238.3	57.5	338.1	54.4	438.0	52.2
Const. worker veh.	187.5	71.0	188.6	59.5	89.8	65.9	23.6	77.5	114.3	63.8	213.4	58.4	313.1	55.1
Const. worker veh.	312.5	71.0	313.1	55.1	213.4	58.4	114.3	63.8	23.6	77.5	89.8	65.9	188.6	59.5
Const. worker veh.	437.5	71.0	438.0	52.2	338.1	54.4	238.3	57.5	138.9	62.1	42.5	72.4	65.6	68.7
Const. worker veh.	562.5	71.0	562.9	50.0	462.9	51.7	363.1	53.8	263.3	56.6	163.7	60.7	65.6	68.7
Const. worker veh.	687.5	71.0	687.8	48.3	587.8	49.6	487.9	51.2	388.0	53.2	288.2	55.8	188.6	59.5
Const. worker veh.	812.5	71.0	812.7	46.8	712.8	47.9	612.8	49.3	512.9	50.8	413.0	52.7	313.1	55.1
Const. worker veh.	937.5	71.0	937.7	45.6	837.7	46.5	737.8	47.6	637.8	48.9	537.9	50.4	438.0	52.2
End dump trucks	83.3	72.5	85.7	67.8	26.0	78.2	118.4	65.0	217.6	59.7	317.3	56.5	417.1	54.1
End dump trucks	250.0	72.5	250.8	58.5	151.3	62.9	53.9	71.9	53.9	71.9	151.3	62.9	250.8	58.5
End dump trucks	416.7	72.5	417.1	54.1	317.3	56.5	217.6	59.7	118.4	65.0	26.0	78.2	85.7	67.8
End dump trucks	583.3	72.5	583.7	51.2	483.7	52.8	383.9	54.8	284.0	57.4	184.4	61.2	85.7	67.8
End dump trucks	750.0	72.5	750.3	49.0	650.3	50.2	550.4	51.7	450.4	53.4	350.6	55.6	250.8	58.5
End dump trucks	916.7	72.5	916.9	47.3	816.9	48.3	716.9	49.4	617.0	50.7	517.1	52.2	417.1	54.1
Concrete saws	166.7	82.6	167.9	72.1	69.6	79.7	38.9	84.8	134.8	74.0	234.2	69.2	333.9	66.1
Concrete saws	500.0	82.6	500.4	62.6	400.5	64.5	300.7	67.0	201.0	70.5	102.0	76.4	20.0	90.6
Concrete saws	833.3	82.6	833.6	58.2	733.6	59.3	633.6	60.6	533.7	62.0	433.8	63.8	333.9	66.1
Jackhammers	166.7	81.9	167.9	71.4	69.6	79.0	38.9	84.1	134.8	73.3	234.2	68.5	333.9	65.4
Jackhammers	500.0	81.9	500.4	61.9	400.5	63.8	300.7	66.3	201.0	69.8	102.0	75.7	20.0	89.9
Jackhammers	833.3	81.9	833.6	57.5	733.6	58.6	633.6	59.9	533.7	61.3	433.8	63.1	333.9	65.4
Loader	125.0	75.1	126.6	67.1	32.0	79.0	77.6	71.3	176.1	64.2	275.7	60.3	375.5	57.6
Loader	375.0	75.1	375.5	57.6	275.7	60.3	176.1	64.2	77.6	71.3	32.0	79.0	126.6	67.1
Loader	625.0	75.1	625.3	53.2	525.4	54.7	425.5	56.5	325.6	58.8	225.9	62.0	126.6	67.1
Loader	875.0	75.1	875.2	50.3	775.3	51.3	675.3	52.5	575.3	53.9	475.4	55.6	375.5	57.6
Fork lift	250.0	68.0	250.8	54.0	151.3	58.4	53.9	67.4	53.9	67.4	151.3	58.4	250.8	54.0
Fork lift	750.0	68.0	750.3	44.5	650.3	45.8	550.4	47.2	450.4	48.9	350.6	51.1	250.8	54.0
5-cyd dump trucks	125.0	71.3	126.6	63.2	32.0	75.1	77.6	67.5	176.1	60.3	275.7	56.4	375.5	53.8
5-cyd dump trucks	375.0	71.3	375.5	53.8	275.7	56.4	176.1	60.3	77.6	67.5	32.0	75.1	126.6	63.2
5-cyd dump trucks	625.0	71.3	625.3	49.3	525.4	50.8	425.5	52.7	325.6	55.0	225.9	58.2	126.6	63.2
5-cyd dump trucks	875.0	71.3	875.2	46.4	775.3	47.5	675.3	48.7	575.3	50.1	475.4	51.7	375.5	53.8
Backhoe	125.0	72.4	126.6	64.3	32.0	76.2	77.6	68.6	176.1	61.4	275.7	57.5	375.5	54.9
Backhoe	375.0	72.4	375.5	54.9	275.7	57.5	176.1	61.4	77.6	68.6	32.0	76.2	126.6	64.3
Backhoe	625.0	72.4	625.3	50.4	525.4	51.9	425.5	53.8	325.6	56.1	225.9	59.3	126.6	64.3
Backhoe	875.0	72.4	875.2	47.5	775.3	48.6	675.3	49.8	575.3	51.2	475.4	52.8	375.5	54.9
Excavator	125.0	75.5	126.6	67.4	32.0	79.3	77.6	71.7	176.1	64.5	275.7	60.6	375.5	58.0
Excavator	375.0	75.5	375.5	58.0	275.7	60.6	176.1	64.5	77.6	71.7	32.0	79.3	126.6	67.4
Excavator	625.0	75.5	625.3	53.5	525.4	55.0	425.5	56.9	325.6	59.2	225.9	62.4	126.6	67.4
Excavator	875.0	75.5	875.2	50.6	775.3	51.7	675.3	52.9	575.3	54.3	475.4	55.9	375.5	58.0
15-Ton Crane	125.0	72.6	126.6	64.6	32.0	76.5	77.6	68.8	176.1	61.7	275.7	57.8	375.5	55.1
15-Ton Crane	375.0	72.6	375.5	55.1	275.7	57.8	176.1	61.7	77.6	68.8	32.0	76.5	126.6	64.6
15-Ton Crane	625.0	72.6	625.3	50.7	525.4	52.2	425.5	54.0	325.6	56.4	225.9	59.5	126.6	64.6
15-Ton Crane	875.0	72.6	875.2	47.8	775.3	48.8	675.3	50.0	575.3	51.4	475.4	53.1	375.5	55.1
Water truck	250.0	72.5	250.8	58.5	151.3	62.9	53.9	71.9	53.9	71.9	151.3	62.9	250.8	58.5

Table II-2, cont. Calculation of Average Noise Level at a Distance of 20 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	20	100	20	200	20	300	20	400	20	500	20
Water truck	750.0	72.5	750.3	49.0	650.3	50.2	550.4	51.7	450.4	53.4	350.6	55.6	250.8	58.5
Compactor	125.0	73.2	126.6	65.1	32.0	77.1	77.6	69.4	176.1	62.3	275.7	58.4	375.5	55.7
Compactor	375.0	73.2	375.5	55.7	275.7	58.4	176.1	62.3	77.6	69.4	32.0	77.1	126.6	65.1
Compactor	625.0	73.2	625.3	51.3	525.4	52.8	425.5	54.6	325.6	56.9	225.9	60.1	126.6	65.1
Compactor	875.0	73.2	875.2	48.3	775.3	49.4	675.3	50.6	575.3	52.0	475.4	53.6	375.5	55.7
Hydraulic jack	166.7	74.7	167.9	64.2	69.6	71.9	38.9	76.9	134.8	66.1	234.2	61.3	333.9	58.2
Hydraulic jack	500.0	74.7	500.4	54.7	400.5	56.7	300.7	59.1	201.0	62.6	102.0	68.5	20.0	82.7
Hydraulic jack	833.3	74.7	833.6	50.3	733.6	51.4	633.6	52.7	533.7	54.2	433.8	56.0	333.9	58.2
Auger machine	166.7	76.2	167.9	65.6	69.6	73.3	38.9	78.3	134.8	67.5	234.2	62.7	333.9	59.7
Auger machine	500.0	76.2	500.4	56.2	400.5	58.1	300.7	60.6	201.0	64.1	102.0	70.0	20.0	84.1
Auger machine	833.3	76.2	833.6	51.7	733.6	52.8	633.6	54.1	533.7	55.6	433.8	57.4	333.9	59.7
Welding truck w/gen	166.7	73.6	167.9	63.1	69.6	70.7	38.9	75.8	134.8	65.0	234.2	60.2	333.9	57.1
Welding truck w/gen	500.0	73.6	500.4	53.6	400.5	55.5	300.7	58.0	201.0	61.5	102.0	67.4	20.0	81.6
Welding truck w/gen	833.3	73.6	833.6	49.2	733.6	50.3	633.6	51.6	533.7	53.0	433.8	54.8	333.9	57.1
40 kW generator	166.7	76.3	167.9	65.8	69.6	73.5	38.9	78.5	134.8	67.7	234.2	62.9	333.9	59.8
40 kW generator	500.0	76.3	500.4	56.3	400.5	58.3	300.7	60.8	201.0	64.3	102.0	70.1	20.0	84.3
40 kW generator	833.3	76.3	833.6	51.9	733.6	53.0	633.6	54.3	533.7	55.8	433.8	57.6	333.9	59.8
Drill/bore rig	500.0	77.4	500.4	57.4	400.5	59.3	300.7	61.8	201.0	65.3	102.0	71.2	20.0	85.4
Mud rig	500.0	77.9	500.4	57.9	400.5	59.8	300.7	62.3	201.0	65.8	102.0	71.7	20.0	85.8
Paver	250.0	68.2	250.8	54.2	151.3	58.6	53.9	67.5	53.9	67.5	151.3	58.6	250.8	54.2
Paver	750.0	68.2	750.3	44.6	650.3	45.9	550.4	47.3	450.4	49.1	350.6	51.3	250.8	54.2
Open trench excavation				79.3		88.2		89.4		84.4		87.8		95.3
Pipe jacking				79.5		88.3		89.6		84.5		87.8		95.5
Directional drilling				79.5		88.3		89.7		84.5		87.8		95.6

Table II-3. Calculation of Average Noise Level at a Distance of 50 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	50	100	50	200	50	300	50	400	50	500	50
Const. worker veh.	62.5	71.0	80.0	66.9	62.5	69.1	146.3	61.7	242.7	57.3	341.2	54.3	440.3	52.1
Const. worker veh.	187.5	71.0	194.1	59.2	100.8	64.9	51.5	70.8	123.1	63.2	218.3	58.2	316.5	55.0
Const. worker veh.	312.5	71.0	316.5	55.0	218.3	58.2	123.1	63.2	51.5	70.8	100.8	64.9	194.1	59.2
Const. worker veh.	437.5	71.0	440.3	52.1	341.2	54.3	242.7	57.3	146.3	61.7	62.5	69.1	80.0	66.9
Const. worker veh.	562.5	71.0	564.7	50.0	465.2	51.6	365.9	53.7	267.2	56.5	170.0	60.4	80.0	66.9
Const. worker veh.	687.5	71.0	689.3	48.2	589.6	49.6	490.1	51.2	390.7	53.2	291.8	55.7	194.1	59.2
Const. worker veh.	812.5	71.0	814.0	46.8	714.3	47.9	614.5	49.2	514.9	50.8	415.5	52.6	316.5	55.0
Const. worker veh.	937.5	71.0	938.8	45.5	839.0	46.5	739.2	47.6	639.5	48.9	539.8	50.4	440.3	52.1
End dump trucks	83.3	72.5	97.2	66.7	52.7	72.1	126.9	64.4	222.4	59.6	320.6	56.4	419.7	54.0
End dump trucks	250.0	72.5	255.0	58.4	158.1	62.5	70.7	69.5	70.7	69.5	158.1	62.5	255.0	58.4
End dump trucks	416.7	72.5	419.7	54.0	320.6	56.4	222.4	59.6	126.9	64.4	52.7	72.1	97.2	66.7
End dump trucks	583.3	72.5	585.5	51.1	485.9	52.8	386.6	54.8	287.7	57.3	190.0	60.9	97.2	66.7
End dump trucks	750.0	72.5	751.7	49.0	651.9	50.2	552.3	51.7	452.8	53.4	353.6	55.5	255.0	58.4
End dump trucks	916.7	72.5	918.0	47.2	818.2	48.2	718.4	49.4	618.7	50.7	519.1	52.2	419.7	54.0
Concrete saws	166.7	82.6	174.0	71.8	83.3	78.2	60.1	81.0	142.4	73.5	238.6	69.0	337.1	66.0
Concrete saws	500.0	82.6	502.5	62.6	403.1	64.5	304.1	66.9	206.2	70.3	111.8	75.6	50.0	82.6
Concrete saws	833.3	82.6	834.8	58.2	735.0	59.3	635.3	60.5	535.7	62.0	436.2	63.8	337.1	66.0
Jackhammers	166.7	81.9	174.0	71.1	83.3	77.5	60.1	80.3	142.4	72.8	238.6	68.3	337.1	65.3
Jackhammers	500.0	81.9	502.5	61.9	403.1	63.8	304.1	66.2	206.2	69.6	111.8	74.9	50.0	81.9
Jackhammers	833.3	81.9	834.8	57.5	735.0	58.6	635.3	59.8	535.7	61.3	436.2	63.1	337.1	65.3
Loader	125.0	75.1	134.6	66.5	55.9	74.2	90.1	70.0	182.0	63.9	279.5	60.2	378.3	57.5
Loader	375.0	75.1	378.3	57.5	279.5	60.2	182.0	63.9	90.1	70.0	55.9	74.2	134.6	66.5
Loader	625.0	75.1	627.0	53.2	527.4	54.7	427.9	56.5	328.8	58.8	230.5	61.8	134.6	66.5
Loader	875.0	75.1	876.4	50.2	776.6	51.3	676.8	52.5	577.2	53.9	477.6	55.5	378.3	57.5
Fork lift	250.0	68.0	255.0	53.9	158.1	58.0	70.7	65.0	70.7	65.0	158.1	58.0	255.0	53.9
Fork lift	750.0	68.0	751.7	44.5	651.9	45.7	552.3	47.2	452.8	48.9	353.6	51.1	255.0	53.9
5-cyd dump trucks	125.0	71.3	134.6	62.7	55.9	70.3	90.1	66.2	182.0	60.0	279.5	56.3	378.3	53.7
5-cyd dump trucks	375.0	71.3	378.3	53.7	279.5	56.3	182.0	60.0	90.1	66.2	55.9	70.3	134.6	62.7
5-cyd dump trucks	625.0	71.3	627.0	49.3	527.4	50.8	427.9	52.6	328.8	54.9	230.5	58.0	134.6	62.7
5-cyd dump trucks	875.0	71.3	876.4	46.4	776.6	47.4	676.8	48.6	577.2	50.0	477.6	51.7	378.3	53.7
Backhoe	125.0	72.4	134.6	63.8	55.9	71.4	90.1	67.3	182.0	61.1	279.5	57.4	378.3	54.8
Backhoe	375.0	72.4	378.3	54.8	279.5	57.4	182.0	61.1	90.1	67.3	55.9	71.4	134.6	63.8
Backhoe	625.0	72.4	627.0	50.4	527.4	51.9	427.9	53.7	328.8	56.0	230.5	59.1	134.6	63.8
Backhoe	875.0	72.4	876.4	47.5	776.6	48.5	676.8	49.7	577.2	51.1	477.6	52.8	378.3	54.8
Excavator	125.0	75.5	134.6	66.9	55.9	74.5	90.1	70.4	182.0	64.2	279.5	60.5	378.3	57.9
Excavator	375.0	75.5	378.3	57.9	279.5	60.5	182.0	64.2	90.1	70.4	55.9	74.5	134.6	66.9
Excavator	625.0	75.5	627.0	53.5	527.4	55.0	427.9	56.8	328.8	59.1	230.5	62.2	134.6	66.9
Excavator	875.0	75.5	876.4	50.6	776.6	51.6	676.8	52.8	577.2	54.2	477.6	55.9	378.3	57.9
15-Ton Crane	125.0	72.6	134.6	64.0	55.9	71.7	90.1	67.5	182.0	61.4	279.5	57.7	378.3	55.1
15-Ton Crane	375.0	72.6	378.3	55.1	279.5	57.7	182.0	61.4	90.1	67.5	55.9	71.7	134.6	64.0
15-Ton Crane	625.0	72.6	627.0	50.7	527.4	52.2	427.9	54.0	328.8	56.3	230.5	59.4	134.6	64.0
15-Ton Crane	875.0	72.6	876.4	47.8	776.6	48.8	676.8	50.0	577.2	51.4	477.6	53.0	378.3	55.1
Water truck	250.0	72.5	255.0	58.4	158.1	62.5	70.7	69.5	70.7	69.5	158.1	62.5	255.0	58.4

Table II-3, cont. Calculation of Average Noise Level at a Distance of 50 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	50	100	50	200	50	300	50	400	50	500	50
Water truck	750.0	72.5	751.7	49.0	651.9	50.2	552.3	51.7	452.8	53.4	353.6	55.5	255.0	58.4
Compactor	125.0	73.2	134.6	64.6	55.9	72.2	90.1	68.1	182.0	62.0	279.5	58.3	378.3	55.6
Compactor	375.0	73.2	378.3	55.6	279.5	58.3	182.0	62.0	90.1	68.1	55.9	72.2	134.6	64.6
Compactor	625.0	73.2	627.0	51.2	527.4	52.7	427.9	54.6	328.8	56.8	230.5	59.9	134.6	64.6
Compactor	875.0	73.2	876.4	48.3	776.6	49.4	676.8	50.6	577.2	52.0	477.6	53.6	378.3	55.6
Hydraulic jack	166.7	74.7	174.0	63.9	83.3	70.3	60.1	73.1	142.4	65.6	238.6	61.2	337.1	58.2
Hydraulic jack	500.0	74.7	502.5	54.7	403.1	56.6	304.1	59.0	206.2	62.4	111.8	67.7	50.0	74.7
Hydraulic jack	833.3	74.7	834.8	50.3	735.0	51.4	635.3	52.6	535.7	54.1	436.2	55.9	337.1	58.2
Auger machine	166.7	76.2	174.0	65.3	83.3	71.7	60.1	74.6	142.4	67.1	238.6	62.6	337.1	59.6
Auger machine	500.0	76.2	502.5	56.1	403.1	58.0	304.1	60.5	206.2	63.9	111.8	69.2	50.0	76.2
Auger machine	833.3	76.2	834.8	51.7	735.0	52.8	635.3	54.1	535.7	55.6	436.2	57.3	337.1	59.6
Welding truck w/gen	166.7	73.6	174.0	62.8	83.3	69.2	60.1	72.0	142.4	64.5	238.6	60.0	337.1	57.0
Welding truck w/gen	500.0	73.6	502.5	53.6	403.1	55.5	304.1	57.9	206.2	61.3	111.8	66.6	50.0	73.6
Welding truck w/gen	833.3	73.6	834.8	49.2	735.0	50.3	635.3	51.5	535.7	53.0	436.2	54.8	337.1	57.0
40 kW generator	166.7	76.3	174.0	65.5	83.3	71.9	60.1	74.7	142.4	67.2	238.6	62.8	337.1	59.8
40 kW generator	500.0	76.3	502.5	56.3	403.1	58.2	304.1	60.7	206.2	64.0	111.8	69.4	50.0	76.3
40 kW generator	833.3	76.3	834.8	51.9	735.0	53.0	635.3	54.3	535.7	55.7	436.2	57.5	337.1	59.8
Drill/bore rig	500.0	77.4	502.5	57.4	403.1	59.3	304.1	61.7	206.2	65.1	111.8	70.4	50.0	77.4
Mud rig	500.0	77.9	502.5	57.8	403.1	59.8	304.1	62.2	206.2	65.6	111.8	70.9	50.0	77.9
Paver	250.0	68.2	255.0	54.0	158.1	58.2	70.7	65.2	70.7	65.2	158.1	58.2	255.0	54.0
Paver	750.0	68.2	751.7	44.6	651.9	45.9	552.3	47.3	452.8	49.0	353.6	51.2	255.0	54.0
Open trench excavation				78.8		84.9		86.0		82.7		84.6		87.8
Pipe jacking				79.0		85.0		86.2		82.8		84.7		88.0
Directional drilling				79.1		85.1		86.3		82.9		84.7		88.1

Table II-4. Calculation of Average Noise Level at a Distance of 100 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	100	100	100	200	100	300	100	400	100	500	100
Const. worker veh.	62.5	71.0	117.9	63.6	106.8	64.4	170.0	60.4	257.7	56.8	352.0	54.1	448.8	52.0
Const. worker veh.	187.5	71.0	212.5	58.5	132.9	62.5	100.8	64.9	150.5	61.4	234.9	57.6	328.1	54.7
Const. worker veh.	312.5	71.0	328.1	54.7	234.9	57.6	150.5	61.4	100.8	64.9	132.9	62.5	212.5	58.5
Const. worker veh.	437.5	71.0	448.8	52.0	352.0	54.1	257.7	56.8	170.0	60.4	106.8	64.4	117.9	63.6
Const. worker veh.	562.5	71.0	571.3	49.9	473.2	51.5	376.0	53.5	280.9	56.0	190.8	59.4	117.9	63.6
Const. worker veh.	687.5	71.0	694.7	48.2	595.9	49.5	497.7	51.1	400.2	53.0	304.4	55.3	212.5	58.5
Const. worker veh.	812.5	71.0	818.6	46.7	719.5	47.9	620.6	49.1	522.2	50.6	424.4	52.4	328.1	54.7
Const. worker veh.	937.5	71.0	942.8	45.5	843.4	46.5	744.2	47.6	645.3	48.8	546.7	50.2	448.8	52.0
End dump trucks	83.3	72.5	130.2	64.2	101.4	66.4	153.7	62.8	238.6	58.9	332.1	56.1	428.5	53.9
End dump trucks	250.0	72.5	269.3	57.9	180.3	61.4	111.8	65.5	111.8	65.5	180.3	61.4	269.3	57.9
End dump trucks	416.7	72.5	428.5	53.9	332.1	56.1	238.6	58.9	153.7	62.8	101.4	66.4	130.2	64.2
End dump trucks	583.3	72.5	591.8	51.1	493.6	52.6	396.2	54.5	300.5	56.9	208.8	60.1	130.2	64.2
End dump trucks	750.0	72.5	756.6	48.9	657.6	50.1	559.0	51.6	461.0	53.2	364.0	55.3	269.3	57.9
End dump trucks	916.7	72.5	922.1	47.2	822.8	48.2	723.6	49.3	624.7	50.6	526.3	52.1	428.5	53.9
Concrete saws	166.7	82.6	194.4	70.8	120.2	75.0	105.4	76.1	166.7	72.2	253.9	68.5	348.0	65.8
Concrete saws	500.0	82.6	509.9	62.4	412.3	64.3	316.2	66.6	223.6	69.6	141.4	73.6	100.0	76.6
Concrete saws	833.3	82.6	839.3	58.1	740.1	59.2	641.2	60.5	542.6	61.9	444.7	63.6	348.0	65.8
Jackhammers	166.7	81.9	194.4	70.1	120.2	74.3	105.4	75.4	166.7	71.5	253.9	67.8	348.0	65.1
Jackhammers	500.0	81.9	509.9	61.7	412.3	63.6	316.2	65.9	223.6	68.9	141.4	72.9	100.0	75.9
Jackhammers	833.3	81.9	839.3	57.4	740.1	58.5	641.2	59.8	542.6	61.2	444.7	62.9	348.0	65.1
Loader	125.0	75.1	160.1	65.0	103.1	68.8	125.0	67.2	201.6	63.0	292.6	59.8	388.1	57.3
Loader	375.0	75.1	388.1	57.3	292.6	59.8	201.6	63.0	125.0	67.2	103.1	68.8	160.1	65.0
Loader	625.0	75.1	632.9	53.1	534.4	54.5	436.6	56.3	340.0	58.5	246.2	61.3	160.1	65.0
Loader	875.0	75.1	880.7	50.2	781.4	51.2	682.4	52.4	583.6	53.8	485.4	55.4	388.1	57.3
Fork lift	250.0	68.0	269.3	53.4	180.3	56.9	111.8	61.1	111.8	61.1	180.3	56.9	269.3	53.4
Fork lift	750.0	68.0	756.6	44.4	657.6	45.7	559.0	47.1	461.0	48.7	364.0	50.8	269.3	53.4
5-cyd dump trucks	125.0	71.3	160.1	61.2	103.1	65.0	125.0	63.3	201.6	59.2	292.6	55.9	388.1	53.5
5-cyd dump trucks	375.0	71.3	388.1	53.5	292.6	55.9	201.6	59.2	125.0	63.3	103.1	65.0	160.1	61.2
5-cyd dump trucks	625.0	71.3	632.9	49.2	534.4	50.7	436.6	52.4	340.0	54.6	246.2	57.4	160.1	61.2
5-cyd dump trucks	875.0	71.3	880.7	46.4	781.4	47.4	682.4	48.6	583.6	49.9	485.4	51.5	388.1	53.5
Backhoe	125.0	72.4	160.1	62.3	103.1	66.1	125.0	64.4	201.6	60.3	292.6	57.0	388.1	54.6
Backhoe	375.0	72.4	388.1	54.6	292.6	57.0	201.6	60.3	125.0	64.4	103.1	66.1	160.1	62.3
Backhoe	625.0	72.4	632.9	50.3	534.4	51.8	436.6	53.5	340.0	55.7	246.2	58.5	160.1	62.3
Backhoe	875.0	72.4	880.7	47.5	781.4	48.5	682.4	49.7	583.6	51.0	485.4	52.6	388.1	54.6
Excavator	125.0	75.5	160.1	65.4	103.1	69.2	125.0	67.5	201.6	63.4	292.6	60.1	388.1	57.7
Excavator	375.0	75.5	388.1	57.7	292.6	60.1	201.6	63.4	125.0	67.5	103.1	69.2	160.1	65.4
Excavator	625.0	75.5	632.9	53.4	534.4	54.9	436.6	56.6	340.0	58.8	246.2	61.6	160.1	65.4
Excavator	875.0	75.5	880.7	50.6	781.4	51.6	682.4	52.8	583.6	54.1	485.4	55.7	388.1	57.7
15-Ton Crane	125.0	72.6	160.1	62.5	103.1	66.4	125.0	64.7	201.6	60.5	292.6	57.3	388.1	54.8
15-Ton Crane	375.0	72.6	388.1	54.8	292.6	57.3	201.6	60.5	125.0	64.7	103.1	66.4	160.1	62.5
15-Ton Crane	625.0	72.6	632.9	50.6	534.4	52.1	436.6	53.8	340.0	56.0	246.2	58.8	160.1	62.5
15-Ton Crane	875.0	72.6	880.7	47.7	781.4	48.8	682.4	49.9	583.6	51.3	485.4	52.9	388.1	54.8
Water truck	250.0	72.5	269.3	57.9	180.3	61.4	111.8	65.5	111.8	65.5	180.3	61.4	269.3	57.9

Table II-4, cont. Calculation of Average Noise Level at a Distance of 100 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	100	100	100	200	100	300	100	400	100	500	100
Water truck	750.0	72.5	756.6	48.9	657.6	50.1	559.0	51.6	461.0	53.2	364.0	55.3	269.3	57.9
Compactor	125.0	73.2	160.1	63.1	103.1	66.9	125.0	65.2	201.6	61.1	292.6	57.9	388.1	55.4
Compactor	375.0	73.2	388.1	55.4	292.6	57.9	201.6	61.1	125.0	65.2	103.1	66.9	160.1	63.1
Compactor	625.0	73.2	632.9	51.2	534.4	52.6	436.6	54.4	340.0	56.5	246.2	59.4	160.1	63.1
Compactor	875.0	73.2	880.7	48.3	781.4	49.3	682.4	50.5	583.6	51.9	485.4	53.5	388.1	55.4
Hydraulic jack	166.7	74.7	194.4	62.9	120.2	67.1	105.4	68.3	166.7	64.3	253.9	60.6	348.0	57.9
Hydraulic jack	500.0	74.7	509.9	54.6	412.3	56.4	316.2	58.7	223.6	61.7	141.4	65.7	100.0	68.7
Hydraulic jack	833.3	74.7	839.3	50.2	740.1	51.3	641.2	52.6	542.6	54.0	444.7	55.7	348.0	57.9
Auger machine	166.7	76.2	194.4	64.4	120.2	68.5	105.4	69.7	166.7	65.7	253.9	62.0	348.0	59.3
Auger machine	500.0	76.2	509.9	56.0	412.3	57.8	316.2	60.1	223.6	63.2	141.4	67.1	100.0	70.1
Auger machine	833.3	76.2	839.3	51.7	740.1	52.8	641.2	54.0	542.6	55.5	444.7	57.2	348.0	59.3
Welding truck w/gen	166.7	73.6	194.4	61.8	120.2	66.0	105.4	67.1	166.7	63.2	253.9	59.5	348.0	56.8
Welding truck w/gen	500.0	73.6	509.9	53.4	412.3	55.3	316.2	57.6	223.6	60.6	141.4	64.6	100.0	67.6
Welding truck w/gen	833.3	73.6	839.3	49.1	740.1	50.2	641.2	51.5	542.6	52.9	444.7	54.6	348.0	56.8
40 kW generator	166.7	76.3	194.4	64.5	120.2	68.7	105.4	69.9	166.7	65.9	253.9	62.2	348.0	59.5
40 kW generator	500.0	76.3	509.9	56.2	412.3	58.0	316.2	60.3	223.6	63.3	141.4	67.3	100.0	70.3
40 kW generator	833.3	76.3	839.3	51.8	740.1	52.9	641.2	54.2	542.6	55.6	444.7	57.4	348.0	59.5
Drill/bore rig	500.0	77.4	509.9	57.2	412.3	59.1	316.2	61.4	223.6	64.4	141.4	68.4	100.0	71.4
Mud rig	500.0	77.9	509.9	57.7	412.3	59.6	316.2	61.9	223.6	64.9	141.4	68.9	100.0	71.9
Paver	250.0	68.2	269.3	53.5	180.3	57.0	111.8	61.2	111.8	61.2	180.3	57.0	269.3	53.5
Paver	750.0	68.2	756.6	44.6	657.6	45.8	559.0	47.2	461.0	48.9	364.0	50.9	269.3	53.5
excavation				77.7		81.2		82.0		80.8		81.7		82.9
Pipe jacking				77.9		81.4		82.2		81.0		81.8		83.1
Directional drilling				77.9		81.5		82.3		81.0		81.9		83.1

Table II-5. Calculation of Average Noise Level at a Distance of 150 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	150	100	150	200	150	300	150	400	150	500	150
Const. worker veh.	62.5	71.0	162.5	60.8	154.6	61.2	203.5	58.8	280.9	56.0	369.3	53.7	462.5	51.7
Const. worker veh.	187.5	71.0	240.1	57.4	173.7	60.2	150.5	61.4	187.5	59.5	260.1	56.7	346.6	54.2
Const. worker veh.	312.5	71.0	346.6	54.2	260.1	56.7	187.5	59.5	150.5	61.4	173.7	60.2	240.1	57.4
Const. worker veh.	437.5	71.0	462.5	51.7	369.3	53.7	280.9	56.0	203.5	58.8	154.6	61.2	162.5	60.8
Const. worker veh.	562.5	71.0	582.2	49.7	486.2	51.3	392.3	53.1	302.3	55.4	221.1	58.1	162.5	60.8
Const. worker veh.	687.5	71.0	703.7	48.1	606.3	49.3	510.1	50.8	415.5	52.6	324.3	54.8	240.1	57.4
Const. worker veh.	812.5	71.0	826.2	46.7	728.1	47.8	630.6	49.0	534.0	50.4	438.9	52.2	346.6	54.2
Const. worker veh.	937.5	71.0	949.4	45.5	850.8	46.4	752.6	47.5	654.9	48.7	558.0	50.1	462.5	51.7
End dump trucks	83.3	72.5	171.6	61.8	150.9	62.9	190.0	60.9	263.5	58.1	350.4	55.6	442.8	53.6
End dump trucks	250.0	72.5	291.5	57.2	212.1	60.0	158.1	62.5	158.1	62.5	212.1	60.0	291.5	57.2
End dump trucks	416.7	72.5	442.8	53.6	350.4	55.6	263.5	58.1	190.0	60.9	150.9	62.9	171.6	61.8
End dump trucks	583.3	72.5	602.3	50.9	506.1	52.4	411.6	54.2	320.6	56.4	236.9	59.0	171.6	61.8
End dump trucks	750.0	72.5	764.9	48.8	667.1	50.0	570.1	51.4	474.3	53.0	380.8	54.9	291.5	57.2
End dump trucks	916.7	72.5	928.9	47.1	830.3	48.1	732.2	49.2	634.6	50.4	538.0	51.9	442.8	53.6
Concrete saws	166.7	82.6	224.2	69.6	164.1	72.3	153.7	72.9	200.7	70.5	277.4	67.7	365.5	65.3
Concrete saws	500.0	82.6	522.0	62.2	427.2	64.0	335.4	66.1	250.0	68.6	180.3	71.5	150.0	73.1
Concrete saws	833.3	82.6	846.7	58.0	748.5	59.1	650.9	60.3	554.0	61.7	458.6	63.4	365.5	65.3
Jackhammers	166.7	81.9	224.2	68.9	164.1	71.6	153.7	72.2	200.7	69.8	277.4	67.0	365.5	64.6
Jackhammers	500.0	81.9	522.0	61.5	427.2	63.3	335.4	65.4	250.0	67.9	180.3	70.8	150.0	72.4
Jackhammers	833.3	81.9	846.7	57.3	748.5	58.4	650.9	59.6	554.0	61.0	458.6	62.7	365.5	64.6
Loader	125.0	75.1	195.3	63.3	152.1	65.5	167.7	64.6	230.5	61.8	313.2	59.2	403.9	57.0
Loader	375.0	75.1	403.9	57.0	313.2	59.2	230.5	61.8	167.7	64.6	152.1	65.5	195.3	63.3
Loader	625.0	75.1	642.7	52.9	546.0	54.4	450.7	56.0	357.9	58.0	270.4	60.5	195.3	63.3
Loader	875.0	75.1	887.8	50.1	789.4	51.2	691.5	52.3	594.2	53.6	498.1	55.2	403.9	57.0
Fork lift	250.0	68.0	291.5	52.7	212.1	55.5	158.1	58.0	158.1	58.0	212.1	55.5	291.5	52.7
Fork lift	750.0	68.0	764.9	44.3	667.1	45.5	570.1	46.9	474.3	48.5	380.8	50.4	291.5	52.7
5-cyd dump trucks	125.0	71.3	195.3	59.4	152.1	61.6	167.7	60.8	230.5	58.0	313.2	55.3	403.9	53.1
5-cyd dump trucks	375.0	71.3	403.9	53.1	313.2	55.3	230.5	58.0	167.7	60.8	152.1	61.6	195.3	59.4
5-cyd dump trucks	625.0	71.3	642.7	49.1	546.0	50.5	450.7	52.2	357.9	54.2	270.4	56.6	195.3	59.4
5-cyd dump trucks	875.0	71.3	887.8	46.3	789.4	47.3	691.5	48.5	594.2	49.8	498.1	51.3	403.9	53.1
Backhoe	125.0	72.4	195.3	60.5	152.1	62.7	167.7	61.9	230.5	59.1	313.2	56.4	403.9	54.2
Backhoe	375.0	72.4	403.9	54.2	313.2	56.4	230.5	59.1	167.7	61.9	152.1	62.7	195.3	60.5
Backhoe	625.0	72.4	642.7	50.2	546.0	51.6	450.7	53.3	357.9	55.3	270.4	57.7	195.3	60.5
Backhoe	875.0	72.4	887.8	47.4	789.4	48.4	691.5	49.6	594.2	50.9	498.1	52.4	403.9	54.2
Excavator	125.0	75.5	195.3	63.6	152.1	65.8	167.7	65.0	230.5	62.2	313.2	59.5	403.9	57.3
Excavator	375.0	75.5	403.9	57.3	313.2	59.5	230.5	62.2	167.7	65.0	152.1	65.8	195.3	63.6
Excavator	625.0	75.5	642.7	53.3	546.0	54.7	450.7	56.4	357.9	58.4	270.4	60.8	195.3	63.6
Excavator	875.0	75.5	887.8	50.5	789.4	51.5	691.5	52.7	594.2	54.0	498.1	55.5	403.9	57.3
15-Ton Crane	125.0	72.6	195.3	60.8	152.1	63.0	167.7	62.1	230.5	59.4	313.2	56.7	403.9	54.5
15-Ton Crane	375.0	72.6	403.9	54.5	313.2	56.7	230.5	59.4	167.7	62.1	152.1	63.0	195.3	60.8
15-Ton Crane	625.0	72.6	642.7	50.5	546.0	51.9	450.7	53.5	357.9	55.5	270.4	58.0	195.3	60.8
15-Ton Crane	875.0	72.6	887.8	47.7	789.4	48.7	691.5	49.8	594.2	51.1	498.1	52.7	403.9	54.5
Water truck	250.0	72.5	291.5	57.2	212.1	60.0	158.1	62.5	158.1	62.5	212.1	60.0	291.5	57.2

Table II-5, cont. Calculation of Average Noise Level at a Distance of 150 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	150	100	150	200	150	300	150	400	150	500	150
Water truck	750.0	72.5	764.9	48.8	667.1	50.0	570.1	51.4	474.3	53.0	380.8	54.9	291.5	57.2
Compactor	125.0	73.2	195.3	61.4	152.1	63.5	167.7	62.7	230.5	59.9	313.2	57.3	403.9	55.1
Compactor	375.0	73.2	403.9	55.1	313.2	57.3	230.5	59.9	167.7	62.7	152.1	63.5	195.3	61.4
Compactor	625.0	73.2	642.7	51.0	546.0	52.4	450.7	54.1	357.9	56.1	270.4	58.5	195.3	61.4
Compactor	875.0	73.2	887.8	48.2	789.4	49.2	691.5	50.4	594.2	51.7	498.1	53.2	403.9	55.1
Hydraulic jack	166.7	74.7	224.2	61.7	164.1	64.4	153.7	65.0	200.7	62.7	277.4	59.8	365.5	57.5
Hydraulic jack	500.0	74.7	522.0	54.4	427.2	56.1	335.4	58.2	250.0	60.8	180.3	63.6	150.0	65.2
Hydraulic jack	833.3	74.7	846.7	50.2	748.5	51.2	650.9	52.4	554.0	53.8	458.6	55.5	365.5	57.5
Auger machine	166.7	76.2	224.2	63.1	164.1	65.8	153.7	66.4	200.7	64.1	277.4	61.3	365.5	58.9
Auger machine	500.0	76.2	522.0	55.8	427.2	57.5	335.4	59.6	250.0	62.2	180.3	65.0	150.0	66.6
Auger machine	833.3	76.2	846.7	51.6	748.5	52.7	650.9	53.9	554.0	55.3	458.6	56.9	365.5	58.9
Welding truck w/gen	166.7	73.6	224.2	60.6	164.1	63.3	153.7	63.9	200.7	61.5	277.4	58.7	365.5	56.3
Welding truck w/gen	500.0	73.6	522.0	53.2	427.2	55.0	335.4	57.1	250.0	59.6	180.3	62.5	150.0	64.1
Welding truck w/gen	833.3	73.6	846.7	49.0	748.5	50.1	650.9	51.3	554.0	52.7	458.6	54.4	365.5	56.3
40 kW generator	166.7	76.3	224.2	63.3	164.1	66.0	153.7	66.6	200.7	64.3	277.4	61.5	365.5	59.1
40 kW generator	500.0	76.3	522.0	56.0	427.2	57.7	335.4	59.8	250.0	62.4	180.3	65.2	150.0	66.8
40 kW generator	833.3	76.3	846.7	51.8	748.5	52.8	650.9	54.1	554.0	55.4	458.6	57.1	365.5	59.1
Drill/bore rig	500.0	77.4	522.0	57.0	427.2	58.8	335.4	60.9	250.0	63.4	180.3	66.3	150.0	67.9
Mud rig	500.0	77.9	522.0	57.5	427.2	59.3	335.4	61.4	250.0	63.9	180.3	66.8	150.0	68.3
Paver	250.0	68.2	291.5	52.9	212.1	55.6	158.1	58.2	158.1	58.2	212.1	55.6	291.5	52.9
Paver	750.0	68.2	764.9	44.5	667.1	45.7	570.1	47.0	474.3	48.6	380.8	50.5	291.5	52.9
excavation				76.5		78.8		79.5		79.2		79.7		80.2
Pipe jacking				76.7		79.0		79.7		79.4		79.9		80.4
Directional drilling				76.7		79.0		79.8		79.4		79.9		80.5

Table II-6. Calculation of Average Noise Level at a Distance of 200 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	200	100	200	200	200	300	200	400	200	500	200
Const. worker veh.	62.5	71.0	209.5	58.6	203.5	58.8	242.7	57.3	310.5	55.2	392.3	53.1	481.0	51.4
Const. worker veh.	187.5	71.0	274.1	56.2	218.3	58.2	200.4	59.0	229.5	57.8	291.8	55.7	371.0	53.6
Const. worker veh.	312.5	71.0	371.0	53.6	291.8	55.7	229.5	57.8	200.4	59.0	218.3	58.2	274.1	56.2
Const. worker veh.	437.5	71.0	481.0	51.4	392.3	53.1	310.5	55.2	242.7	57.3	203.5	58.8	209.5	58.6
Const. worker veh.	562.5	71.0	597.0	49.5	503.9	51.0	414.0	52.7	330.0	54.6	257.7	56.8	209.5	58.6
Const. worker veh.	687.5	71.0	716.0	47.9	620.6	49.1	526.9	50.6	436.1	52.2	350.2	54.1	274.1	56.2
Const. worker veh.	812.5	71.0	836.8	46.5	740.0	47.6	644.3	48.8	550.1	50.2	458.4	51.8	371.0	53.6
Const. worker veh.	937.5	71.0	958.6	45.4	861.0	46.3	764.1	47.3	668.1	48.5	573.5	49.8	481.0	51.4
End dump trucks	83.3	72.5	216.7	59.8	200.7	60.4	231.5	59.2	294.9	57.1	374.5	55.0	462.2	53.2
End dump trucks	250.0	72.5	320.2	56.4	250.0	58.5	206.2	60.2	206.2	60.2	250.0	58.5	320.2	56.4
End dump trucks	416.7	72.5	462.2	53.2	374.5	55.0	294.9	57.1	231.5	59.2	200.7	60.4	216.7	59.8
End dump trucks	583.3	72.5	616.7	50.7	523.1	52.1	432.4	53.8	346.8	55.7	271.3	57.8	216.7	59.8
End dump trucks	750.0	72.5	776.2	48.7	680.1	49.8	585.2	51.2	492.4	52.7	403.1	54.4	320.2	56.4
End dump trucks	916.7	72.5	938.2	47.1	840.8	48.0	744.1	49.1	648.3	50.3	554.0	51.6	462.2	53.2
Concrete saws	166.7	82.6	260.3	68.3	210.8	70.1	202.8	70.5	240.4	69.0	307.3	66.8	388.7	64.8
Concrete saws	500.0	82.6	538.5	62.0	447.2	63.6	360.6	65.5	282.8	67.6	223.6	69.6	200.0	70.6
Concrete saws	833.3	82.6	857.0	57.9	760.1	59.0	664.2	60.1	569.6	61.5	477.3	63.0	388.7	64.8
Jackhammers	166.7	81.9	260.3	67.6	210.8	69.4	202.8	69.8	240.4	68.3	307.3	66.1	388.7	64.1
Jackhammers	500.0	81.9	538.5	61.3	447.2	62.9	360.6	64.8	282.8	66.9	223.6	68.9	200.0	69.9
Jackhammers	833.3	81.9	857.0	57.2	760.1	58.3	664.2	59.4	569.6	60.8	477.3	62.3	388.7	64.1
Loader	125.0	75.1	235.8	61.6	201.6	63.0	213.6	62.5	265.8	60.6	340.0	58.5	425.0	56.5
Loader	375.0	75.1	425.0	56.5	340.0	58.5	265.8	60.6	213.6	62.5	201.6	63.0	235.8	61.6
Loader	625.0	75.1	656.2	52.8	561.8	54.1	469.7	55.7	381.6	57.5	301.0	59.5	235.8	61.6
Loader	875.0	75.1	897.6	50.0	800.4	51.0	704.0	52.1	608.8	53.4	515.4	54.9	425.0	56.5
Fork lift	250.0	68.0	320.2	51.9	250.0	54.1	206.2	55.7	206.2	55.7	250.0	54.1	320.2	51.9
Fork lift	750.0	68.0	776.2	44.2	680.1	45.4	585.2	46.7	492.4	48.2	403.1	49.9	320.2	51.9
5-cyd dump trucks	125.0	71.3	235.8	57.8	201.6	59.2	213.6	58.7	265.8	56.8	340.0	54.6	425.0	52.7
5-cyd dump trucks	375.0	71.3	425.0	52.7	340.0	54.6	265.8	56.8	213.6	58.7	201.6	59.2	235.8	57.8
5-cyd dump trucks	625.0	71.3	656.2	48.9	561.8	50.3	469.7	51.8	381.6	53.6	301.0	55.7	235.8	57.8
5-cyd dump trucks	875.0	71.3	897.6	46.2	800.4	47.2	704.0	48.3	608.8	49.6	515.4	51.0	425.0	52.7
Backhoe	125.0	72.4	235.8	58.9	201.6	60.3	213.6	59.8	265.8	57.9	340.0	55.7	425.0	53.8
Backhoe	375.0	72.4	425.0	53.8	340.0	55.7	265.8	57.9	213.6	59.8	201.6	60.3	235.8	58.9
Backhoe	625.0	72.4	656.2	50.0	561.8	51.4	469.7	52.9	381.6	54.7	301.0	56.8	235.8	58.9
Backhoe	875.0	72.4	897.6	47.3	800.4	48.3	704.0	49.4	608.8	50.7	515.4	52.1	425.0	53.8
Excavator	125.0	75.5	235.8	62.0	201.6	63.4	213.6	62.9	265.8	61.0	340.0	58.8	425.0	56.9
Excavator	375.0	75.5	425.0	56.9	340.0	58.8	265.8	61.0	213.6	62.9	201.6	63.4	235.8	62.0
Excavator	625.0	75.5	656.2	53.1	561.8	54.5	469.7	56.0	381.6	57.8	301.0	59.9	235.8	62.0
Excavator	875.0	75.5	897.6	50.4	800.4	51.4	704.0	52.5	608.8	53.8	515.4	55.2	425.0	56.9
15-Ton Crane	125.0	72.6	235.8	59.2	201.6	60.5	213.6	60.0	265.8	58.1	340.0	56.0	425.0	54.1
15-Ton Crane	375.0	72.6	425.0	54.1	340.0	56.0	265.8	58.1	213.6	60.0	201.6	60.5	235.8	59.2
15-Ton Crane	625.0	72.6	656.2	50.3	561.8	51.6	469.7	53.2	381.6	55.0	301.0	57.0	235.8	59.2
15-Ton Crane	875.0	72.6	897.6	47.6	800.4	48.6	704.0	49.7	608.8	50.9	515.4	52.4	425.0	54.1
Water truck	250.0	72.5	320.2	56.4	250.0	58.5	206.2	60.2	206.2	60.2	250.0	58.5	320.2	56.4

Table II-6, cont. Calculation of Average Noise Level at a Distance of 200 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	200	100	200	200	200	300	200	400	200	500	200
Water truck	750.0	72.5	776.2	48.7	680.1	49.8	585.2	51.2	492.4	52.7	403.1	54.4	320.2	56.4
Compactor	125.0	73.2	235.8	59.7	201.6	61.1	213.6	60.6	265.8	58.7	340.0	56.5	425.0	54.6
Compactor	375.0	73.2	425.0	54.6	340.0	56.5	265.8	58.7	213.6	60.6	201.6	61.1	235.8	59.7
Compactor	625.0	73.2	656.2	50.8	561.8	52.2	469.7	53.7	381.6	55.5	301.0	57.6	235.8	59.7
Compactor	875.0	73.2	897.6	48.1	800.4	49.1	704.0	50.2	608.8	51.5	515.4	52.9	425.0	54.6
Hydraulic jack	166.7	74.7	260.3	60.4	210.8	62.2	202.8	62.6	240.4	61.1	307.3	59.0	388.7	56.9
Hydraulic jack	500.0	74.7	538.5	54.1	447.2	55.7	360.6	57.6	282.8	59.7	223.6	61.7	200.0	62.7
Hydraulic jack	833.3	74.7	857.0	50.0	760.1	51.1	664.2	52.3	569.6	53.6	477.3	55.1	388.7	56.9
Auger machine	166.7	76.2	260.3	61.8	210.8	63.7	202.8	64.0	240.4	62.5	307.3	60.4	388.7	58.3
Auger machine	500.0	76.2	538.5	55.5	447.2	57.1	360.6	59.0	282.8	61.1	223.6	63.2	200.0	64.1
Auger machine	833.3	76.2	857.0	51.5	760.1	52.5	664.2	53.7	569.6	55.0	477.3	56.6	388.7	58.3
Welding truck w/gen	166.7	73.6	260.3	59.3	210.8	61.1	202.8	61.5	240.4	60.0	307.3	57.8	388.7	55.8
Welding truck w/gen	500.0	73.6	538.5	53.0	447.2	54.6	360.6	56.5	282.8	58.6	223.6	60.6	200.0	61.6
Welding truck w/gen	833.3	73.6	857.0	48.9	760.1	50.0	664.2	51.1	569.6	52.5	477.3	54.0	388.7	55.8
40 kW generator	166.7	76.3	260.3	62.0	210.8	63.8	202.8	64.2	240.4	62.7	307.3	60.6	388.7	58.5
40 kW generator	500.0	76.3	538.5	55.7	447.2	57.3	360.6	59.2	282.8	61.3	223.6	63.3	200.0	64.3
40 kW generator	833.3	76.3	857.0	51.7	760.1	52.7	664.2	53.9	569.6	55.2	477.3	56.7	388.7	58.5
Drill/bore rig	500.0	77.4	538.5	56.8	447.2	58.4	360.6	60.3	282.8	62.4	223.6	64.4	200.0	65.4
Mud rig	500.0	77.9	538.5	57.2	447.2	58.9	360.6	60.7	282.8	62.8	223.6	64.9	200.0	65.8
Paver	250.0	68.2	320.2	52.0	250.0	54.2	206.2	55.9	206.2	55.9	250.0	54.2	320.2	52.0
Paver	750.0	68.2	776.2	44.3	680.1	45.5	585.2	46.8	492.4	48.3	403.1	50.0	320.2	52.0
excavation				75.4		77.0		77.7		77.8		78.2		78.4
Pipe jacking				75.6		77.2		77.9		78.0		78.3		78.6
Directional drilling				75.6		77.3		78.0		78.1		78.4		78.7

Table II-7. Calculation of Maximum Noise Level at a Distance of 20 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	20	100	20	200	20	300	20	400	20	500	20
Const. worker veh.	62.5	75.0	65.6	72.6	42.5	76.4	138.9	66.1	238.3	61.4	338.1	58.4	438.0	56.2
Const. worker veh.	187.5	75.0	188.6	63.5	89.8	69.9	23.6	81.5	114.3	67.8	213.4	62.4	313.1	59.1
Const. worker veh.	312.5	75.0	313.1	59.1	213.4	62.4	114.3	67.8	23.6	81.5	89.8	69.9	188.6	63.5
Const. worker veh.	437.5	75.0	438.0	56.2	338.1	58.4	238.3	61.4	138.9	66.1	42.5	76.4	65.6	72.6
Const. worker veh.	562.5	75.0	562.9	54.0	462.9	55.7	363.1	57.8	263.3	60.6	163.7	64.7	65.6	72.6
Const. worker veh.	687.5	75.0	687.8	52.2	587.8	53.6	487.9	55.2	388.0	57.2	288.2	59.8	188.6	63.5
Const. worker veh.	812.5	75.0	812.7	50.8	712.8	51.9	612.8	53.2	512.9	54.8	413.0	56.7	313.1	59.1
Const. worker veh.	937.5	75.0	937.7	49.5	837.7	50.5	737.8	51.6	637.8	52.9	537.9	54.4	438.0	56.2
End dump trucks	83.3	76.5	85.7	71.8	26.0	82.2	118.4	69.0	217.6	63.7	317.3	60.5	417.1	58.1
End dump trucks	250.0	76.5	250.8	62.5	151.3	66.9	53.9	75.9	53.9	75.9	151.3	66.9	250.8	62.5
End dump trucks	416.7	76.5	417.1	58.1	317.3	60.5	217.6	63.7	118.4	69.0	26.0	82.2	85.7	71.8
End dump trucks	583.3	76.5	583.7	55.2	483.7	56.8	383.9	58.8	284.0	61.4	184.4	65.2	85.7	71.8
End dump trucks	750.0	76.5	750.3	53.0	650.3	54.2	550.4	55.7	450.4	57.4	350.6	59.6	250.8	62.5
End dump trucks	916.7	76.5	916.9	51.2	816.9	52.2	716.9	53.4	617.0	54.7	517.1	56.2	417.1	58.1
Concrete saws	166.7	89.6	167.9	79.1	69.6	86.7	38.9	91.8	134.8	81.0	234.2	76.2	333.9	73.1
Concrete saws	500.0	89.6	500.4	69.6	400.5	71.5	300.7	74.0	201.0	77.5	102.0	83.4	20.0	97.6
Concrete saws	833.3	89.6	833.6	65.2	733.6	66.3	633.6	67.5	533.7	69.0	433.8	70.8	333.9	73.1
Jackhammers	166.7	88.9	167.9	78.4	69.6	86.0	38.9	91.1	134.8	80.3	234.2	75.5	333.9	72.4
Jackhammers	500.0	88.9	500.4	68.9	400.5	70.8	300.7	73.3	201.0	76.8	102.0	82.7	20.0	96.9
Jackhammers	833.3	88.9	833.6	64.5	733.6	65.6	633.6	66.8	533.7	68.3	433.8	70.1	333.9	72.4
Loader	125.0	79.1	126.6	71.0	32.0	83.0	77.6	75.3	176.1	68.2	275.7	64.3	375.5	61.6
Loader	375.0	79.1	375.5	61.6	275.7	64.3	176.1	68.2	77.6	75.3	32.0	83.0	126.6	71.0
Loader	625.0	79.1	625.3	57.2	525.4	58.7	425.5	60.5	325.6	62.8	225.9	66.0	126.6	71.0
Loader	875.0	79.1	875.2	54.2	775.3	55.3	675.3	56.5	575.3	57.9	475.4	59.5	375.5	61.6
Fork lift	250.0	76.0	250.8	62.0	151.3	66.4	53.9	75.4	53.9	75.4	151.3	66.4	250.8	62.0
Fork lift	750.0	76.0	750.3	52.5	650.3	53.7	550.4	55.2	450.4	56.9	350.6	59.1	250.8	62.0
5-cyd dump trucks	125.0	76.5	126.6	68.4	32.0	80.4	77.6	72.7	176.1	65.6	275.7	61.7	375.5	59.0
5-cyd dump trucks	375.0	76.5	375.5	59.0	275.7	61.7	176.1	65.6	77.6	72.7	32.0	80.4	126.6	68.4
5-cyd dump trucks	625.0	76.5	625.3	54.6	525.4	56.1	425.5	57.9	325.6	60.2	225.9	63.4	126.6	68.4
5-cyd dump trucks	875.0	76.5	875.2	51.6	775.3	52.7	675.3	53.9	575.3	55.3	475.4	56.9	375.5	59.0
Backhoe	125.0	77.6	126.6	69.5	32.0	81.5	77.6	73.8	176.1	66.7	275.7	62.8	375.5	60.1
Backhoe	375.0	77.6	375.5	60.1	275.7	62.8	176.1	66.7	77.6	73.8	32.0	81.5	126.6	69.5
Backhoe	625.0	77.6	625.3	55.7	525.4	57.2	425.5	59.0	325.6	61.3	225.9	64.5	126.6	69.5
Backhoe	875.0	77.6	875.2	52.7	775.3	53.8	675.3	55.0	575.3	56.4	475.4	58.0	375.5	60.1
Excavator	125.0	80.7	126.6	72.6	32.0	84.6	77.6	76.9	176.1	69.8	275.7	65.9	375.5	63.2
Excavator	375.0	80.7	375.5	63.2	275.7	65.9	176.1	69.8	77.6	76.9	32.0	84.6	126.6	72.6
Excavator	625.0	80.7	625.3	58.8	525.4	60.3	425.5	62.1	325.6	64.4	225.9	67.6	126.6	72.6
Excavator	875.0	80.7	875.2	55.8	775.3	56.9	675.3	58.1	575.3	59.5	475.4	61.1	375.5	63.2
15-Ton Crane	125.0	80.6	126.6	72.5	32.0	84.5	77.6	76.8	176.1	69.7	275.7	65.8	375.5	63.1
15-Ton Crane	375.0	80.6	375.5	63.1	275.7	65.8	176.1	69.7	77.6	76.8	32.0	84.5	126.6	72.5
15-Ton Crane	625.0	80.6	625.3	58.7	525.4	60.2	425.5	62.0	325.6	64.3	225.9	67.5	126.6	72.5
15-Ton Crane	875.0	80.6	875.2	55.7	775.3	56.8	675.3	58.0	575.3	59.4	475.4	61.0	375.5	63.1
Water truck	250.0	76.5	250.8	62.5	151.3	66.9	53.9	75.9	53.9	75.9	151.3	66.9	250.8	62.5

Table II-7, cont. Calculation of Maximum Noise Level at a Distance of 20 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	20	100	20	200	20	300	20	400	20	500	20
Water truck	750.0	76.5	750.3	53.0	650.3	54.2	550.4	55.7	450.4	57.4	350.6	59.6	250.8	62.5
Compactor	125.0	83.2	126.6	75.1	32.0	87.1	77.6	79.4	176.1	72.3	275.7	68.4	375.5	65.7
Compactor	375.0	83.2	375.5	65.7	275.7	68.4	176.1	72.3	77.6	79.4	32.0	87.1	126.6	75.1
Compactor	625.0	83.2	625.3	61.3	525.4	62.8	425.5	64.6	325.6	66.9	225.9	70.1	126.6	75.1
Compactor	875.0	83.2	875.2	58.3	775.3	59.4	675.3	60.6	575.3	62.0	475.4	63.6	375.5	65.7
Hydraulic jack	166.7	82.0	167.9	71.5	69.6	79.1	38.9	84.2	134.8	73.4	234.2	68.6	333.9	65.5
Hydraulic jack	500.0	82.0	500.4	62.0	400.5	63.9	300.7	66.4	201.0	69.9	102.0	75.8	20.0	90.0
Hydraulic jack	833.3	82.0	833.6	57.6	733.6	58.7	633.6	59.9	533.7	61.4	433.8	63.2	333.9	65.5
Auger machine	166.7	84.4	167.9	73.9	69.6	81.5	38.9	86.6	134.8	75.8	234.2	71.0	333.9	67.9
Auger machine	500.0	84.4	500.4	64.4	400.5	66.3	300.7	68.8	201.0	72.3	102.0	78.2	20.0	92.4
Auger machine	833.3	84.4	833.6	60.0	733.6	61.1	633.6	62.3	533.7	63.8	433.8	65.6	333.9	67.9
Welding truck w/gen	166.7	80.6	167.9	70.1	69.6	77.7	38.9	82.8	134.8	72.0	234.2	67.2	333.9	64.1
Welding truck w/gen	500.0	80.6	500.4	60.6	400.5	62.5	300.7	65.0	201.0	68.5	102.0	74.4	20.0	88.6
Welding truck w/gen	833.3	80.6	833.6	56.2	733.6	57.3	633.6	58.5	533.7	60.0	433.8	61.8	333.9	64.1
40 kW generator	166.7	80.6	167.9	70.1	69.6	77.7	38.9	82.8	134.8	72.0	234.2	67.2	333.9	64.1
40 kW generator	500.0	80.6	500.4	60.6	400.5	62.5	300.7	65.0	201.0	68.5	102.0	74.4	20.0	88.6
40 kW generator	833.3	80.6	833.6	56.2	733.6	57.3	633.6	58.5	533.7	60.0	433.8	61.8	333.9	64.1
Drill/bore rig	500.0	84.4	500.4	64.4	400.5	66.3	300.7	68.8	201.0	72.3	102.0	78.2	20.0	92.4
Mud rig	500.0	80.9	500.4	60.9	400.5	62.8	300.7	65.3	201.0	68.8	102.0	74.7	20.0	88.9
Paver	250.0	77.2	250.8	63.2	151.3	67.6	53.9	76.6	53.9	76.6	151.3	67.6	250.8	63.2
Paver	750.0	77.2	750.3	53.7	650.3	54.9	550.4	56.4	450.4	58.1	350.6	60.3	250.8	63.2
Open trench excavation				85.6		94.5		95.9		90.3		94.0		101.7
Pipe jacking				85.8		94.6		96.2		90.5		94.1		102.0
Directional drilling				85.9		94.7		96.4		90.6		94.1		102.2

Table II-8. Calculation of Maximum Noise Level at a Distance of 50 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	50	100	50	200	50	300	50	400	50	500	50
Const. worker veh.	62.5	75.0	80.0	70.9	62.5	73.1	146.3	65.7	242.7	61.3	341.2	58.3	440.3	56.1
Const. worker veh.	187.5	75.0	194.1	63.2	100.8	68.9	51.5	74.7	123.1	67.2	218.3	62.2	316.5	59.0
Const. worker veh.	312.5	75.0	316.5	59.0	218.3	62.2	123.1	67.2	51.5	74.7	100.8	68.9	194.1	63.2
Const. worker veh.	437.5	75.0	440.3	56.1	341.2	58.3	242.7	61.3	146.3	65.7	62.5	73.1	80.0	70.9
Const. worker veh.	562.5	75.0	564.7	53.9	465.2	55.6	365.9	57.7	267.2	60.4	170.0	64.4	80.0	70.9
Const. worker veh.	687.5	75.0	689.3	52.2	589.6	53.6	490.1	55.2	390.7	57.1	291.8	59.7	194.1	63.2
Const. worker veh.	812.5	75.0	814.0	50.8	714.3	51.9	614.5	53.2	514.9	54.7	415.5	56.6	316.5	59.0
Const. worker veh.	937.5	75.0	938.8	49.5	839.0	50.5	739.2	51.6	639.5	52.9	539.8	54.3	440.3	56.1
End dump trucks	83.3	76.5	97.2	70.7	52.7	76.0	126.9	68.4	222.4	63.5	320.6	60.4	419.7	58.0
End dump trucks	250.0	76.5	255.0	62.4	158.1	66.5	70.7	73.5	70.7	73.5	158.1	66.5	255.0	62.4
End dump trucks	416.7	76.5	419.7	58.0	320.6	60.4	222.4	63.5	126.9	68.4	52.7	76.0	97.2	70.7
End dump trucks	583.3	76.5	585.5	55.1	485.9	56.7	386.6	58.7	287.7	61.3	190.0	64.9	97.2	70.7
End dump trucks	750.0	76.5	751.7	53.0	651.9	54.2	552.3	55.6	452.8	57.4	353.6	59.5	255.0	62.4
End dump trucks	916.7	76.5	918.0	51.2	818.2	52.2	718.4	53.4	618.7	54.6	519.1	56.2	419.7	58.0
Concrete saws	166.7	89.6	174.0	78.8	83.3	85.2	60.1	88.0	142.4	80.5	238.6	76.0	337.1	73.0
Concrete saws	500.0	89.6	502.5	69.6	403.1	71.5	304.1	73.9	206.2	77.3	111.8	82.6	50.0	89.6
Concrete saws	833.3	89.6	834.8	65.1	735.0	66.3	635.3	67.5	535.7	69.0	436.2	70.8	337.1	73.0
Jackhammers	166.7	88.9	174.0	78.1	83.3	84.5	60.1	87.3	142.4	79.8	238.6	75.3	337.1	72.3
Jackhammers	500.0	88.9	502.5	68.9	403.1	70.8	304.1	73.2	206.2	76.6	111.8	81.9	50.0	88.9
Jackhammers	833.3	88.9	834.8	64.4	735.0	65.6	635.3	66.8	535.7	68.3	436.2	70.1	337.1	72.3
Loader	125.0	79.1	134.6	70.5	55.9	78.1	90.1	74.0	182.0	67.9	279.5	64.2	378.3	61.5
Loader	375.0	79.1	378.3	61.5	279.5	64.2	182.0	67.9	90.1	74.0	55.9	78.1	134.6	70.5
Loader	625.0	79.1	627.0	57.1	527.4	58.6	427.9	60.5	328.8	62.7	230.5	65.8	134.6	70.5
Loader	875.0	79.1	876.4	54.2	776.6	55.3	676.8	56.5	577.2	57.9	477.6	59.5	378.3	61.5
Fork lift	250.0	76.0	255.0	61.9	158.1	66.0	70.7	73.0	70.7	73.0	158.1	66.0	255.0	61.9
Fork lift	750.0	76.0	751.7	52.5	651.9	53.7	552.3	55.1	452.8	56.9	353.6	59.0	255.0	61.9
5-cyd dump trucks	125.0	76.5	134.6	67.9	55.9	75.5	90.1	71.4	182.0	65.3	279.5	61.6	378.3	58.9
5-cyd dump trucks	375.0	76.5	378.3	58.9	279.5	61.6	182.0	65.3	90.1	71.4	55.9	75.5	134.6	67.9
5-cyd dump trucks	625.0	76.5	627.0	54.5	527.4	56.0	427.9	57.9	328.8	60.1	230.5	63.2	134.6	67.9
5-cyd dump trucks	875.0	76.5	876.4	51.6	776.6	52.7	676.8	53.9	577.2	55.3	477.6	56.9	378.3	58.9
Backhoe	125.0	77.6	134.6	69.0	55.9	76.6	90.1	72.5	182.0	66.4	279.5	62.7	378.3	60.0
Backhoe	375.0	77.6	378.3	60.0	279.5	62.7	182.0	66.4	90.1	72.5	55.9	76.6	134.6	69.0
Backhoe	625.0	77.6	627.0	55.6	527.4	57.1	427.9	59.0	328.8	61.2	230.5	64.3	134.6	69.0
Backhoe	875.0	77.6	876.4	52.7	776.6	53.8	676.8	55.0	577.2	56.4	477.6	58.0	378.3	60.0
Excavator	125.0	80.7	134.6	72.1	55.9	79.7	90.1	75.6	182.0	69.5	279.5	65.8	378.3	63.1
Excavator	375.0	80.7	378.3	63.1	279.5	65.8	182.0	69.5	90.1	75.6	55.9	79.7	134.6	72.1
Excavator	625.0	80.7	627.0	58.7	527.4	60.2	427.9	62.1	328.8	64.3	230.5	67.4	134.6	72.1
Excavator	875.0	80.7	876.4	55.8	776.6	56.9	676.8	58.1	577.2	59.5	477.6	61.1	378.3	63.1
15-Ton Crane	125.0	80.6	134.6	72.0	55.9	79.6	90.1	75.5	182.0	69.4	279.5	65.7	378.3	63.0
15-Ton Crane	375.0	80.6	378.3	63.0	279.5	65.7	182.0	69.4	90.1	75.5	55.9	79.6	134.6	72.0
15-Ton Crane	625.0	80.6	627.0	58.6	527.4	60.1	427.9	62.0	328.8	64.2	230.5	67.3	134.6	72.0
15-Ton Crane	875.0	80.6	876.4	55.7	776.6	56.8	676.8	58.0	577.2	59.4	477.6	61.0	378.3	63.0
Water truck	250.0	76.5	255.0	62.4	158.1	66.5	70.7	73.5	70.7	73.5	158.1	66.5	255.0	62.4

Table II-8, cont. Calculation of Maximum Noise Level at a Distance of 50 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	50	100	50	200	50	300	50	400	50	500	50
Water truck	750.0	76.5	751.7	53.0	651.9	54.2	552.3	55.6	452.8	57.4	353.6	59.5	255.0	62.4
Compactor	125.0	83.2	134.6	74.6	55.9	82.2	90.1	78.1	182.0	72.0	279.5	68.3	378.3	65.6
Compactor	375.0	83.2	378.3	65.6	279.5	68.3	182.0	72.0	90.1	78.1	55.9	82.2	134.6	74.6
Compactor	625.0	83.2	627.0	61.2	527.4	62.7	427.9	64.6	328.8	66.8	230.5	69.9	134.6	74.6
Compactor	875.0	83.2	876.4	58.3	776.6	59.4	676.8	60.6	577.2	62.0	477.6	63.6	378.3	65.6
Hydraulic jack	166.7	82.0	174.0	71.2	83.3	77.6	60.1	80.4	142.4	72.9	238.6	68.4	337.1	65.4
Hydraulic jack	500.0	82.0	502.5	62.0	403.1	63.9	304.1	66.3	206.2	69.7	111.8	75.0	50.0	82.0
Hydraulic jack	833.3	82.0	834.8	57.5	735.0	58.7	635.3	59.9	535.7	61.4	436.2	63.2	337.1	65.4
Auger machine	166.7	84.4	174.0	73.6	83.3	80.0	60.1	82.8	142.4	75.3	238.6	70.8	337.1	67.8
Auger machine	500.0	84.4	502.5	64.4	403.1	66.3	304.1	68.7	206.2	72.1	111.8	77.4	50.0	84.4
Auger machine	833.3	84.4	834.8	59.9	735.0	61.1	635.3	62.3	535.7	63.8	436.2	65.6	337.1	67.8
Welding truck w/gen	166.7	80.6	174.0	69.8	83.3	76.2	60.1	79.0	142.4	71.5	238.6	67.0	337.1	64.0
Welding truck w/gen	500.0	80.6	502.5	60.6	403.1	62.5	304.1	64.9	206.2	68.3	111.8	73.6	50.0	80.6
Welding truck w/gen	833.3	80.6	834.8	56.1	735.0	57.3	635.3	58.5	535.7	60.0	436.2	61.8	337.1	64.0
40 kW generator	166.7	80.6	174.0	69.8	83.3	76.2	60.1	79.0	142.4	71.5	238.6	67.0	337.1	64.0
40 kW generator	500.0	80.6	502.5	60.6	403.1	62.5	304.1	64.9	206.2	68.3	111.8	73.6	50.0	80.6
40 kW generator	833.3	80.6	834.8	56.1	735.0	57.3	635.3	58.5	535.7	60.0	436.2	61.8	337.1	64.0
Drill/bore rig	500.0	84.4	502.5	64.4	403.1	66.3	304.1	68.7	206.2	72.1	111.8	77.4	50.0	84.4
Mud rig	500.0	80.9	502.5	60.9	403.1	62.8	304.1	65.2	206.2	68.6	111.8	73.9	50.0	80.9
Paver	250.0	77.2	255.0	63.1	158.1	67.2	70.7	74.2	70.7	74.2	158.1	67.2	255.0	63.1
Paver	750.0	77.2	751.7	53.7	651.9	54.9	552.3	56.3	452.8	58.1	353.6	60.2	255.0	63.1
Open trench excavation				85.2		91.3		92.5		89.0		90.9		94.3
Pipe jacking				85.4		91.5		92.8		89.2		91.0		94.5
Directional drilling				85.5		91.6		93.0		89.3		91.1		94.7

Table II-9. Calculation of Maximum Noise Level at a Distance of 100 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	100	100	100	200	100	300	100	400	100	500	100
Const. worker veh.	62.5	75.0	117.9	67.5	106.8	68.4	170.0	64.4	257.7	60.8	352.0	58.0	448.8	55.9
Const. worker veh.	187.5	75.0	212.5	62.4	132.9	66.5	100.8	68.9	150.5	65.4	234.9	61.6	328.1	58.7
Const. worker veh.	312.5	75.0	328.1	58.7	234.9	61.6	150.5	65.4	100.8	68.9	132.9	66.5	212.5	62.4
Const. worker veh.	437.5	75.0	448.8	55.9	352.0	58.0	257.7	60.8	170.0	64.4	106.8	68.4	117.9	67.5
Const. worker veh.	562.5	75.0	571.3	53.8	473.2	55.5	376.0	57.5	280.9	60.0	190.8	63.4	117.9	67.5
Const. worker veh.	687.5	75.0	694.7	52.1	595.9	53.5	497.7	55.0	400.2	56.9	304.4	59.3	212.5	62.4
Const. worker veh.	812.5	75.0	818.6	50.7	719.5	51.8	620.6	53.1	522.2	54.6	424.4	56.4	328.1	58.7
Const. worker veh.	937.5	75.0	942.8	49.5	843.4	50.5	744.2	51.5	645.3	52.8	546.7	54.2	448.8	55.9
End dump trucks	83.3	76.5	130.2	68.2	101.4	70.4	153.7	66.7	238.6	62.9	332.1	60.1	428.5	57.8
End dump trucks	250.0	76.5	269.3	61.9	180.3	65.4	111.8	69.5	111.8	69.5	180.3	65.4	269.3	61.9
End dump trucks	416.7	76.5	428.5	57.8	332.1	60.1	238.6	62.9	153.7	66.7	101.4	70.4	130.2	68.2
End dump trucks	583.3	76.5	591.8	55.0	493.6	56.6	396.2	58.5	300.5	60.9	208.8	64.1	130.2	68.2
End dump trucks	750.0	76.5	756.6	52.9	657.6	54.1	559.0	55.5	461.0	57.2	364.0	59.3	269.3	61.9
End dump trucks	916.7	76.5	922.1	51.2	822.8	52.2	723.6	53.3	624.7	54.6	526.3	56.1	428.5	57.8
Concrete saws	166.7	89.6	194.4	77.8	120.2	82.0	105.4	83.1	166.7	79.1	253.9	75.5	348.0	72.7
Concrete saws	500.0	89.6	509.9	69.4	412.3	71.3	316.2	73.6	223.6	76.6	141.4	80.6	100.0	83.6
Concrete saws	833.3	89.6	839.3	65.1	740.1	66.2	641.2	67.4	542.6	68.9	444.7	70.6	348.0	72.7
Jackhammers	166.7	88.9	194.4	77.1	120.2	81.3	105.4	82.4	166.7	78.4	253.9	74.8	348.0	72.0
Jackhammers	500.0	88.9	509.9	68.7	412.3	70.6	316.2	72.9	223.6	75.9	141.4	79.9	100.0	82.9
Jackhammers	833.3	88.9	839.3	64.4	740.1	65.5	641.2	66.7	542.6	68.2	444.7	69.9	348.0	72.0
Loader	125.0	79.1	160.1	69.0	103.1	72.8	125.0	71.1	201.6	67.0	292.6	63.8	388.1	61.3
Loader	375.0	79.1	388.1	61.3	292.6	63.8	201.6	67.0	125.0	71.1	103.1	72.8	160.1	69.0
Loader	625.0	79.1	632.9	57.1	534.4	58.5	436.6	60.3	340.0	62.4	246.2	65.3	160.1	69.0
Loader	875.0	79.1	880.7	54.2	781.4	55.2	682.4	56.4	583.6	57.8	485.4	59.4	388.1	61.3
Fork lift	250.0	76.0	269.3	61.4	180.3	64.9	111.8	69.0	111.8	69.0	180.3	64.9	269.3	61.4
Fork lift	750.0	76.0	756.6	52.4	657.6	53.6	559.0	55.0	461.0	56.7	364.0	58.8	269.3	61.4
5-cyd dump trucks	125.0	76.5	160.1	66.4	103.1	70.2	125.0	68.5	201.6	64.4	292.6	61.2	388.1	58.7
5-cyd dump trucks	375.0	76.5	388.1	58.7	292.6	61.2	201.6	64.4	125.0	68.5	103.1	70.2	160.1	66.4
5-cyd dump trucks	625.0	76.5	632.9	54.5	534.4	55.9	436.6	57.7	340.0	59.8	246.2	62.7	160.1	66.4
5-cyd dump trucks	875.0	76.5	880.7	51.6	781.4	52.6	682.4	53.8	583.6	55.2	485.4	56.8	388.1	58.7
Backhoe	125.0	77.6	160.1	67.5	103.1	71.3	125.0	69.6	201.6	65.5	292.6	62.3	388.1	59.8
Backhoe	375.0	77.6	388.1	59.8	292.6	62.3	201.6	65.5	125.0	69.6	103.1	71.3	160.1	67.5
Backhoe	625.0	77.6	632.9	55.6	534.4	57.0	436.6	58.8	340.0	60.9	246.2	63.8	160.1	67.5
Backhoe	875.0	77.6	880.7	52.7	781.4	53.7	682.4	54.9	583.6	56.3	485.4	57.9	388.1	59.8
Excavator	125.0	80.7	160.1	70.6	103.1	74.4	125.0	72.7	201.6	68.6	292.6	65.4	388.1	62.9
Excavator	375.0	80.7	388.1	62.9	292.6	65.4	201.6	68.6	125.0	72.7	103.1	74.4	160.1	70.6
Excavator	625.0	80.7	632.9	58.7	534.4	60.1	436.6	61.9	340.0	64.0	246.2	66.9	160.1	70.6
Excavator	875.0	80.7	880.7	55.8	781.4	56.8	682.4	58.0	583.6	59.4	485.4	61.0	388.1	62.9
15-Ton Crane	125.0	80.6	160.1	70.5	103.1	74.3	125.0	72.6	201.6	68.5	292.6	65.3	388.1	62.8
15-Ton Crane	375.0	80.6	388.1	62.8	292.6	65.3	201.6	68.5	125.0	72.6	103.1	74.3	160.1	70.5
15-Ton Crane	625.0	80.6	632.9	58.6	534.4	60.0	436.6	61.8	340.0	63.9	246.2	66.8	160.1	70.5
15-Ton Crane	875.0	80.6	880.7	55.7	781.4	56.7	682.4	57.9	583.6	59.3	485.4	60.9	388.1	62.8
Water truck	250.0	76.5	269.3	61.9	180.3	65.4	111.8	69.5	111.8	69.5	180.3	65.4	269.3	61.9

Table II-9, cont. Calculation of Maximum Noise Level at a Distance of 100 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	100	100	100	200	100	300	100	400	100	500	100
Water truck	750.0	76.5	756.6	52.9	657.6	54.1	559.0	55.5	461.0	57.2	364.0	59.3	269.3	61.9
Compactor	125.0	83.2	160.1	73.1	103.1	76.9	125.0	75.2	201.6	71.1	292.6	67.9	388.1	65.4
Compactor	375.0	83.2	388.1	65.4	292.6	67.9	201.6	71.1	125.0	75.2	103.1	76.9	160.1	73.1
Compactor	625.0	83.2	632.9	61.2	534.4	62.6	436.6	64.4	340.0	66.5	246.2	69.4	160.1	73.1
Compactor	875.0	83.2	880.7	58.3	781.4	59.3	682.4	60.5	583.6	61.9	485.4	63.5	388.1	65.4
Hydraulic jack	166.7	82.0	194.4	70.2	120.2	74.4	105.4	75.5	166.7	71.5	253.9	67.9	348.0	65.1
Hydraulic jack	500.0	82.0	509.9	61.8	412.3	63.7	316.2	66.0	223.6	69.0	141.4	73.0	100.0	76.0
Hydraulic jack	833.3	82.0	839.3	57.5	740.1	58.6	641.2	59.8	542.6	61.3	444.7	63.0	348.0	65.1
Auger machine	166.7	84.4	194.4	72.6	120.2	76.8	105.4	77.9	166.7	73.9	253.9	70.3	348.0	67.5
Auger machine	500.0	84.4	509.9	64.2	412.3	66.1	316.2	68.4	223.6	71.4	141.4	75.4	100.0	78.4
Auger machine	833.3	84.4	839.3	59.9	740.1	61.0	641.2	62.2	542.6	63.7	444.7	65.4	348.0	67.5
Welding truck w/gen	166.7	80.6	194.4	68.8	120.2	73.0	105.4	74.1	166.7	70.1	253.9	66.5	348.0	63.7
Welding truck w/gen	500.0	80.6	509.9	60.4	412.3	62.3	316.2	64.6	223.6	67.6	141.4	71.6	100.0	74.6
Welding truck w/gen	833.3	80.6	839.3	56.1	740.1	57.2	641.2	58.4	542.6	59.9	444.7	61.6	348.0	63.7
40 kW generator	166.7	80.6	194.4	68.8	120.2	73.0	105.4	74.1	166.7	70.1	253.9	66.5	348.0	63.7
40 kW generator	500.0	80.6	509.9	60.4	412.3	62.3	316.2	64.6	223.6	67.6	141.4	71.6	100.0	74.6
40 kW generator	833.3	80.6	839.3	56.1	740.1	57.2	641.2	58.4	542.6	59.9	444.7	61.6	348.0	63.7
Drill/bore rig	500.0	84.4	509.9	64.2	412.3	66.1	316.2	68.4	223.6	71.4	141.4	75.4	100.0	78.4
Mud rig	500.0	80.9	509.9	60.7	412.3	62.6	316.2	64.9	223.6	67.9	141.4	71.9	100.0	74.9
Paver	250.0	77.2	269.3	62.6	180.3	66.1	111.8	70.2	111.8	70.2	180.3	66.1	269.3	62.6
Paver	750.0	77.2	756.6	53.6	657.6	54.8	559.0	56.2	461.0	57.9	364.0	60.0	269.3	62.6
Open trench excavation				84.1		87.7		88.5		87.2		88.0		89.3
Pipe jacking				84.3		87.9		88.8		87.4		88.2		89.5
Directional drilling				84.5		88.1		88.9		87.5		88.3		89.7

Table II-10. Calculation of Maximum Noise Level at a Distance of 150 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	150	100	150	200	150	300	150	400	150	500	150
Const. worker veh.	62.5	75.0	162.5	64.8	154.6	65.2	203.5	62.8	280.9	60.0	369.3	57.6	462.5	55.7
Const. worker veh.	187.5	75.0	240.1	61.4	173.7	64.2	150.5	65.4	187.5	63.5	260.1	60.7	346.6	58.2
Const. worker veh.	312.5	75.0	346.6	58.2	260.1	60.7	187.5	63.5	150.5	65.4	173.7	64.2	240.1	61.4
Const. worker veh.	437.5	75.0	462.5	55.7	369.3	57.6	280.9	60.0	203.5	62.8	154.6	65.2	162.5	64.8
Const. worker veh.	562.5	75.0	582.2	53.7	486.2	55.2	392.3	57.1	302.3	59.4	221.1	62.1	162.5	64.8
Const. worker veh.	687.5	75.0	703.7	52.0	606.3	53.3	510.1	54.8	415.5	56.6	324.3	58.8	240.1	61.4
Const. worker veh.	812.5	75.0	826.2	50.6	728.1	51.7	630.6	53.0	534.0	54.4	438.9	56.1	346.6	58.2
Const. worker veh.	937.5	75.0	949.4	49.4	850.8	50.4	752.6	51.4	654.9	52.7	558.0	54.0	462.5	55.7
End dump trucks	83.3	76.5	171.6	65.8	150.9	66.9	190.0	64.9	263.5	62.1	350.4	59.6	442.8	57.6
End dump trucks	250.0	76.5	291.5	61.2	212.1	63.9	158.1	66.5	158.1	66.5	212.1	63.9	291.5	61.2
End dump trucks	416.7	76.5	442.8	57.6	350.4	59.6	263.5	62.1	190.0	64.9	150.9	66.9	171.6	65.8
End dump trucks	583.3	76.5	602.3	54.9	506.1	56.4	411.6	58.2	320.6	60.4	236.9	63.0	171.6	65.8
End dump trucks	750.0	76.5	764.9	52.8	667.1	54.0	570.1	55.4	474.3	57.0	380.8	58.9	291.5	61.2
End dump trucks	916.7	76.5	928.9	51.1	830.3	52.1	732.2	53.2	634.6	54.4	538.0	55.9	442.8	57.6
Concrete saws	166.7	89.6	224.2	76.6	164.1	79.3	153.7	79.8	200.7	77.5	277.4	74.7	365.5	72.3
Concrete saws	500.0	89.6	522.0	69.2	427.2	71.0	335.4	73.1	250.0	75.6	180.3	78.5	150.0	80.1
Concrete saws	833.3	89.6	846.7	65.0	748.5	66.1	650.9	67.3	554.0	68.7	458.6	70.4	365.5	72.3
Jackhammers	166.7	88.9	224.2	75.9	164.1	78.6	153.7	79.1	200.7	76.8	277.4	74.0	365.5	71.6
Jackhammers	500.0	88.9	522.0	68.5	427.2	70.3	335.4	72.4	250.0	74.9	180.3	77.8	150.0	79.4
Jackhammers	833.3	88.9	846.7	64.3	748.5	65.4	650.9	66.6	554.0	68.0	458.6	69.7	365.5	71.6
Loader	125.0	79.1	195.3	67.3	152.1	69.4	167.7	68.6	230.5	65.8	313.2	63.2	403.9	61.0
Loader	375.0	79.1	403.9	61.0	313.2	63.2	230.5	65.8	167.7	68.6	152.1	69.4	195.3	67.3
Loader	625.0	79.1	642.7	56.9	546.0	58.3	450.7	60.0	357.9	62.0	270.4	64.4	195.3	67.3
Loader	875.0	79.1	887.8	54.1	789.4	55.1	691.5	56.3	594.2	57.6	498.1	59.1	403.9	61.0
Fork lift	250.0	76.0	291.5	60.7	212.1	63.4	158.1	66.0	158.1	66.0	212.1	63.4	291.5	60.7
Fork lift	750.0	76.0	764.9	52.3	667.1	53.5	570.1	54.9	474.3	56.5	380.8	58.4	291.5	60.7
5-cyd dump trucks	125.0	76.5	195.3	64.7	152.1	66.8	167.7	66.0	230.5	63.2	313.2	60.6	403.9	58.4
5-cyd dump trucks	375.0	76.5	403.9	58.4	313.2	60.6	230.5	63.2	167.7	66.0	152.1	66.8	195.3	64.7
5-cyd dump trucks	625.0	76.5	642.7	54.3	546.0	55.7	450.7	57.4	357.9	59.4	270.4	61.8	195.3	64.7
5-cyd dump trucks	875.0	76.5	887.8	51.5	789.4	52.5	691.5	53.7	594.2	55.0	498.1	56.5	403.9	58.4
Backhoe	125.0	77.6	195.3	65.8	152.1	67.9	167.7	67.1	230.5	64.3	313.2	61.7	403.9	59.5
Backhoe	375.0	77.6	403.9	59.5	313.2	61.7	230.5	64.3	167.7	67.1	152.1	67.9	195.3	65.8
Backhoe	625.0	77.6	642.7	55.4	546.0	56.8	450.7	58.5	357.9	60.5	270.4	62.9	195.3	65.8
Backhoe	875.0	77.6	887.8	52.6	789.4	53.6	691.5	54.8	594.2	56.1	498.1	57.6	403.9	59.5
Excavator	125.0	80.7	195.3	68.9	152.1	71.0	167.7	70.2	230.5	67.4	313.2	64.8	403.9	62.6
Excavator	375.0	80.7	403.9	62.6	313.2	64.8	230.5	67.4	167.7	70.2	152.1	71.0	195.3	68.9
Excavator	625.0	80.7	642.7	58.5	546.0	59.9	450.7	61.6	357.9	63.6	270.4	66.0	195.3	68.9
Excavator	875.0	80.7	887.8	55.7	789.4	56.7	691.5	57.9	594.2	59.2	498.1	60.7	403.9	62.6
15-Ton Crane	125.0	80.6	195.3	68.8	152.1	70.9	167.7	70.1	230.5	67.3	313.2	64.7	403.9	62.5
15-Ton Crane	375.0	80.6	403.9	62.5	313.2	64.7	230.5	67.3	167.7	70.1	152.1	70.9	195.3	68.8
15-Ton Crane	625.0	80.6	642.7	58.4	546.0	59.8	450.7	61.5	357.9	63.5	270.4	65.9	195.3	68.8
15-Ton Crane	875.0	80.6	887.8	55.6	789.4	56.6	691.5	57.8	594.2	59.1	498.1	60.6	403.9	62.5
Water truck	250.0	76.5	291.5	61.2	212.1	63.9	158.1	66.5	158.1	66.5	212.1	63.9	291.5	61.2

Table II-10, cont. Calculation of Maximum Noise Level at a Distance of 150 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	150	100	150	200	150	300	150	400	150	500	150
Water truck	750.0	76.5	764.9	52.8	667.1	54.0	570.1	55.4	474.3	57.0	380.8	58.9	291.5	61.2
Compactor	125.0	83.2	195.3	71.4	152.1	73.5	167.7	72.7	230.5	69.9	313.2	67.3	403.9	65.1
Compactor	375.0	83.2	403.9	65.1	313.2	67.3	230.5	69.9	167.7	72.7	152.1	73.5	195.3	71.4
Compactor	625.0	83.2	642.7	61.0	546.0	62.4	450.7	64.1	357.9	66.1	270.4	68.5	195.3	71.4
Compactor	875.0	83.2	887.8	58.2	789.4	59.2	691.5	60.4	594.2	61.7	498.1	63.2	403.9	65.1
Hydraulic jack	166.7	82.0	224.2	69.0	164.1	71.7	153.7	72.2	200.7	69.9	277.4	67.1	365.5	64.7
Hydraulic jack	500.0	82.0	522.0	61.6	427.2	63.4	335.4	65.5	250.0	68.0	180.3	70.9	150.0	72.5
Hydraulic jack	833.3	82.0	846.7	57.4	748.5	58.5	650.9	59.7	554.0	61.1	458.6	62.8	365.5	64.7
Auger machine	166.7	84.4	224.2	71.4	164.1	74.1	153.7	74.6	200.7	72.3	277.4	69.5	365.5	67.1
Auger machine	500.0	84.4	522.0	64.0	427.2	65.8	335.4	67.9	250.0	70.4	180.3	73.3	150.0	74.9
Auger machine	833.3	84.4	846.7	59.8	748.5	60.9	650.9	62.1	554.0	63.5	458.6	65.2	365.5	67.1
Welding truck w/gen	166.7	80.6	224.2	67.6	164.1	70.3	153.7	70.8	200.7	68.5	277.4	65.7	365.5	63.3
Welding truck w/gen	500.0	80.6	522.0	60.2	427.2	62.0	335.4	64.1	250.0	66.6	180.3	69.5	150.0	71.1
Welding truck w/gen	833.3	80.6	846.7	56.0	748.5	57.1	650.9	58.3	554.0	59.7	458.6	61.4	365.5	63.3
40 kW generator	166.7	80.6	224.2	67.6	164.1	70.3	153.7	70.8	200.7	68.5	277.4	65.7	365.5	63.3
40 kW generator	500.0	80.6	522.0	60.2	427.2	62.0	335.4	64.1	250.0	66.6	180.3	69.5	150.0	71.1
40 kW generator	833.3	80.6	846.7	56.0	748.5	57.1	650.9	58.3	554.0	59.7	458.6	61.4	365.5	63.3
Drill/bore rig	500.0	84.4	522.0	64.0	427.2	65.8	335.4	67.9	250.0	70.4	180.3	73.3	150.0	74.9
Mud rig	500.0	80.9	522.0	60.5	427.2	62.3	335.4	64.4	250.0	66.9	180.3	69.8	150.0	71.4
Paver	250.0	77.2	291.5	61.9	212.1	64.6	158.1	67.2	158.1	67.2	212.1	64.6	291.5	61.9
Paver	750.0	77.2	764.9	53.5	667.1	54.7	570.1	56.1	474.3	57.7	380.8	59.6	291.5	61.9
Open trench excavation				82.9		85.3		86.0		85.6		86.1		86.6
Pipe jacking				83.1		85.5		86.2		85.8		86.3		86.8
Directional drilling				83.3		85.6		86.4		86.0		86.4		87.0

Table II-11. Calculation of Maximum Noise Level at a Distance of 200 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	200	100	200	200	200	300	200	400	200	500	200
Const. worker veh.	62.5	75.0	209.5	62.6	203.5	62.8	242.7	61.3	310.5	59.1	392.3	57.1	481.0	55.3
Const. worker veh.	187.5	75.0	274.1	60.2	218.3	62.2	200.4	62.9	229.5	61.8	291.8	59.7	371.0	57.6
Const. worker veh.	312.5	75.0	371.0	57.6	291.8	59.7	229.5	61.8	200.4	62.9	218.3	62.2	274.1	60.2
Const. worker veh.	437.5	75.0	481.0	55.3	392.3	57.1	310.5	59.1	242.7	61.3	203.5	62.8	209.5	62.6
Const. worker veh.	562.5	75.0	597.0	53.5	503.9	54.9	414.0	56.6	330.0	58.6	257.7	60.8	209.5	62.6
Const. worker veh.	687.5	75.0	716.0	51.9	620.6	53.1	526.9	54.5	436.1	56.2	350.2	58.1	274.1	60.2
Const. worker veh.	812.5	75.0	836.8	50.5	740.0	51.6	644.3	52.8	550.1	54.2	458.4	55.8	371.0	57.6
Const. worker veh.	937.5	75.0	958.6	49.3	861.0	50.3	764.1	51.3	668.1	52.5	573.5	53.8	481.0	55.3
End dump trucks	83.3	76.5	216.7	63.8	200.7	64.4	231.5	63.2	294.9	61.1	374.5	59.0	462.2	57.2
End dump trucks	250.0	76.5	320.2	60.4	250.0	62.5	206.2	64.2	206.2	64.2	250.0	62.5	320.2	60.4
End dump trucks	416.7	76.5	462.2	57.2	374.5	59.0	294.9	61.1	231.5	63.2	200.7	64.4	216.7	63.8
End dump trucks	583.3	76.5	616.7	54.7	523.1	56.1	432.4	57.8	346.8	59.7	271.3	61.8	216.7	63.8
End dump trucks	750.0	76.5	776.2	52.7	680.1	53.8	585.2	55.1	492.4	56.6	403.1	58.4	320.2	60.4
End dump trucks	916.7	76.5	938.2	51.0	840.8	52.0	744.1	53.0	648.3	54.2	554.0	55.6	462.2	57.2
Concrete saws	166.7	89.6	260.3	75.3	210.8	77.1	202.8	77.4	240.4	76.0	307.3	73.8	388.7	71.8
Concrete saws	500.0	89.6	538.5	69.0	447.2	70.6	360.6	72.4	282.8	74.5	223.6	76.6	200.0	77.6
Concrete saws	833.3	89.6	857.0	64.9	760.1	66.0	664.2	67.1	569.6	68.5	477.3	70.0	388.7	71.8
Jackhammers	166.7	88.9	260.3	74.6	210.8	76.4	202.8	76.7	240.4	75.3	307.3	73.1	388.7	71.1
Jackhammers	500.0	88.9	538.5	68.3	447.2	69.9	360.6	71.7	282.8	73.8	223.6	75.9	200.0	76.9
Jackhammers	833.3	88.9	857.0	64.2	760.1	65.3	664.2	66.4	569.6	67.8	477.3	69.3	388.7	71.1
Loader	125.0	79.1	235.8	65.6	201.6	67.0	213.6	66.5	265.8	64.6	340.0	62.4	425.0	60.5
Loader	375.0	79.1	425.0	60.5	340.0	62.4	265.8	64.6	213.6	66.5	201.6	67.0	235.8	65.6
Loader	625.0	79.1	656.2	56.7	561.8	58.1	469.7	59.6	381.6	61.4	301.0	63.5	235.8	65.6
Loader	875.0	79.1	897.6	54.0	800.4	55.0	704.0	56.1	608.8	57.4	515.4	58.8	425.0	60.5
Fork lift	250.0	76.0	320.2	59.9	250.0	62.0	206.2	63.7	206.2	63.7	250.0	62.0	320.2	59.9
Fork lift	750.0	76.0	776.2	52.2	680.1	53.3	585.2	54.6	492.4	56.1	403.1	57.9	320.2	59.9
5-cyd dump trucks	125.0	76.5	235.8	63.0	201.6	64.4	213.6	63.9	265.8	62.0	340.0	59.8	425.0	57.9
5-cyd dump trucks	375.0	76.5	425.0	57.9	340.0	59.8	265.8	62.0	213.6	63.9	201.6	64.4	235.8	63.0
5-cyd dump trucks	625.0	76.5	656.2	54.1	561.8	55.5	469.7	57.0	381.6	58.8	301.0	60.9	235.8	63.0
5-cyd dump trucks	875.0	76.5	897.6	51.4	800.4	52.4	704.0	53.5	608.8	54.8	515.4	56.2	425.0	57.9
Backhoe	125.0	77.6	235.8	64.1	201.6	65.5	213.6	65.0	265.8	63.1	340.0	60.9	425.0	59.0
Backhoe	375.0	77.6	425.0	59.0	340.0	60.9	265.8	63.1	213.6	65.0	201.6	65.5	235.8	64.1
Backhoe	625.0	77.6	656.2	55.2	561.8	56.6	469.7	58.1	381.6	59.9	301.0	62.0	235.8	64.1
Backhoe	875.0	77.6	897.6	52.5	800.4	53.5	704.0	54.6	608.8	55.9	515.4	57.3	425.0	59.0
Excavator	125.0	80.7	235.8	67.2	201.6	68.6	213.6	68.1	265.8	66.2	340.0	64.0	425.0	62.1
Excavator	375.0	80.7	425.0	62.1	340.0	64.0	265.8	66.2	213.6	68.1	201.6	68.6	235.8	67.2
Excavator	625.0	80.7	656.2	58.3	561.8	59.7	469.7	61.2	381.6	63.0	301.0	65.1	235.8	67.2
Excavator	875.0	80.7	897.6	55.6	800.4	56.6	704.0	57.7	608.8	59.0	515.4	60.4	425.0	62.1
15-Ton Crane	125.0	80.6	235.8	67.1	201.6	68.5	213.6	68.0	265.8	66.1	340.0	63.9	425.0	62.0
15-Ton Crane	375.0	80.6	425.0	62.0	340.0	63.9	265.8	66.1	213.6	68.0	201.6	68.5	235.8	67.1
15-Ton Crane	625.0	80.6	656.2	58.2	561.8	59.6	469.7	61.1	381.6	62.9	301.0	65.0	235.8	67.1
15-Ton Crane	875.0	80.6	897.6	55.5	800.4	56.5	704.0	57.6	608.8	58.9	515.4	60.3	425.0	62.0
Water truck	250.0	76.5	320.2	60.4	250.0	62.5	206.2	64.2	206.2	64.2	250.0	62.5	320.2	60.4

Table II-11, cont. Calculation of Maximum Noise Level at a Distance of 200 Feet from the Construction Activity

Construction Equipment	x, ft.	Lp @ 50', dBA	Receiver 1		Receiver 2		Receiver 3		Receiver 4		Receiver 5		Receiver 6	
			x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.	x, ft.	y, ft.
			0	200	100	200	200	200	300	200	400	200	500	200
Water truck	750.0	76.5	776.2	52.7	680.1	53.8	585.2	55.1	492.4	56.6	403.1	58.4	320.2	60.4
Compactor	125.0	83.2	235.8	69.7	201.6	71.1	213.6	70.6	265.8	68.7	340.0	66.5	425.0	64.6
Compactor	375.0	83.2	425.0	64.6	340.0	66.5	265.8	68.7	213.6	70.6	201.6	71.1	235.8	69.7
Compactor	625.0	83.2	656.2	60.8	561.8	62.2	469.7	63.7	381.6	65.5	301.0	67.6	235.8	69.7
Compactor	875.0	83.2	897.6	58.1	800.4	59.1	704.0	60.2	608.8	61.5	515.4	62.9	425.0	64.6
Hydraulic jack	166.7	82.0	260.3	67.7	210.8	69.5	202.8	69.8	240.4	68.4	307.3	66.2	388.7	64.2
Hydraulic jack	500.0	82.0	538.5	61.4	447.2	63.0	360.6	64.8	282.8	66.9	223.6	69.0	200.0	70.0
Hydraulic jack	833.3	82.0	857.0	57.3	760.1	58.4	664.2	59.5	569.6	60.9	477.3	62.4	388.7	64.2
Auger machine	166.7	84.4	260.3	70.1	210.8	71.9	202.8	72.2	240.4	70.8	307.3	68.6	388.7	66.6
Auger machine	500.0	84.4	538.5	63.8	447.2	65.4	360.6	67.2	282.8	69.3	223.6	71.4	200.0	72.4
Auger machine	833.3	84.4	857.0	59.7	760.1	60.8	664.2	61.9	569.6	63.3	477.3	64.8	388.7	66.6
Welding truck w/gen	166.7	80.6	260.3	66.3	210.8	68.1	202.8	68.4	240.4	67.0	307.3	64.8	388.7	62.8
Welding truck w/gen	500.0	80.6	538.5	60.0	447.2	61.6	360.6	63.4	282.8	65.5	223.6	67.6	200.0	68.6
Welding truck w/gen	833.3	80.6	857.0	55.9	760.1	57.0	664.2	58.1	569.6	59.5	477.3	61.0	388.7	62.8
40 kW generator	166.7	80.6	260.3	66.3	210.8	68.1	202.8	68.4	240.4	67.0	307.3	64.8	388.7	62.8
40 kW generator	500.0	80.6	538.5	60.0	447.2	61.6	360.6	63.4	282.8	65.5	223.6	67.6	200.0	68.6
40 kW generator	833.3	80.6	857.0	55.9	760.1	57.0	664.2	58.1	569.6	59.5	477.3	61.0	388.7	62.8
Drill/bore rig	500.0	84.4	538.5	63.8	447.2	65.4	360.6	67.2	282.8	69.3	223.6	71.4	200.0	72.4
Mud rig	500.0	80.9	538.5	60.3	447.2	61.9	360.6	63.7	282.8	65.8	223.6	67.9	200.0	68.9
Paver	250.0	77.2	320.2	61.1	250.0	63.2	206.2	64.9	206.2	64.9	250.0	63.2	320.2	61.1
Paver	750.0	77.2	776.2	53.4	680.1	54.5	585.2	55.8	492.4	57.3	403.1	59.1	320.2	61.1
Open trench excavation				81.8		83.5		84.2		84.2		84.6		84.8
Pipe jacking				82.0		83.7		84.4		84.5		84.8		85.0
Directional drilling				82.2		83.9		84.6		84.6		84.9		85.2