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Environmental Noise Study for the Proposed Torrance Transit Park and Ride Regional Terminal in the City of Torrance

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Preliminary Report for Review Only

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1 Introduction/Project Description

The purpose of this study is to identify and assess the potential noise and vibration impacts associated with the construction and operation of the Torrance Transit Park and Ride Regional Terminal (Project) in the City of Torrance, California. Refer to Figure 1-1 for the location of the Project and Figure 1-2 for the current development plan.

The proposed Project consists of construction and operation of a regional transit center proposed on the west side of Crenshaw Boulevard south of 208th Street, at 465 Crenshaw Boulevard. The site is bordered on one side by existing railroad infrastructure and is currently vacant. The transit center will be constructed on 6.95 acres of the total 15 acre parcel. No project has been identified for the remainder of the site, resulting in 7.2 acres of undeveloped land after consideration of 0.8 acres of public roadway and shared roadway dedications.

The transit center includes two buildings, a bus terminal, and a parking lot. The transit plaza west building is 3,342 square feet in size and will serve as a public plaza with ancillary retail amenities. The retail services are estimated to require 17 employees. The transit plaza east building is a two-story structure totaling 13,061 square feet. This facility will serve as an operations center and transit store. The facility includes offices, a lounge, and multi-purpose training room. The operations center is estimated to require four employees and the transit center is estimated to require three employees.

The transit center includes a bus terminal with eight layover berths with a tensile fabric canopy supported by steel columns. The project includes a 251 space parking lot and 67,311 square feet of landscaping in the form of detention basin and perimeter plantings, raised planters, and mow strips. Other surfaces include concrete and gravel paving, retaining walls, and a concrete basin.

The transit center will serve existing Torrance Transit Routes 1, 4, and 10 and Max Route 3. Approximately 648 buses will be served within the transit center per day. Routes 1 and 4 currently run on Torrance Boulevard and will divert north on Crenshaw Boulevard to the facility, resulting in approximately 2.5 miles added to the existing routes. Routes 3 and 10 currently run on Crenshaw Boulevard and will turn directly into the facility at 208th Street, resulting in approximately 0.75 miles added to the existing routes.

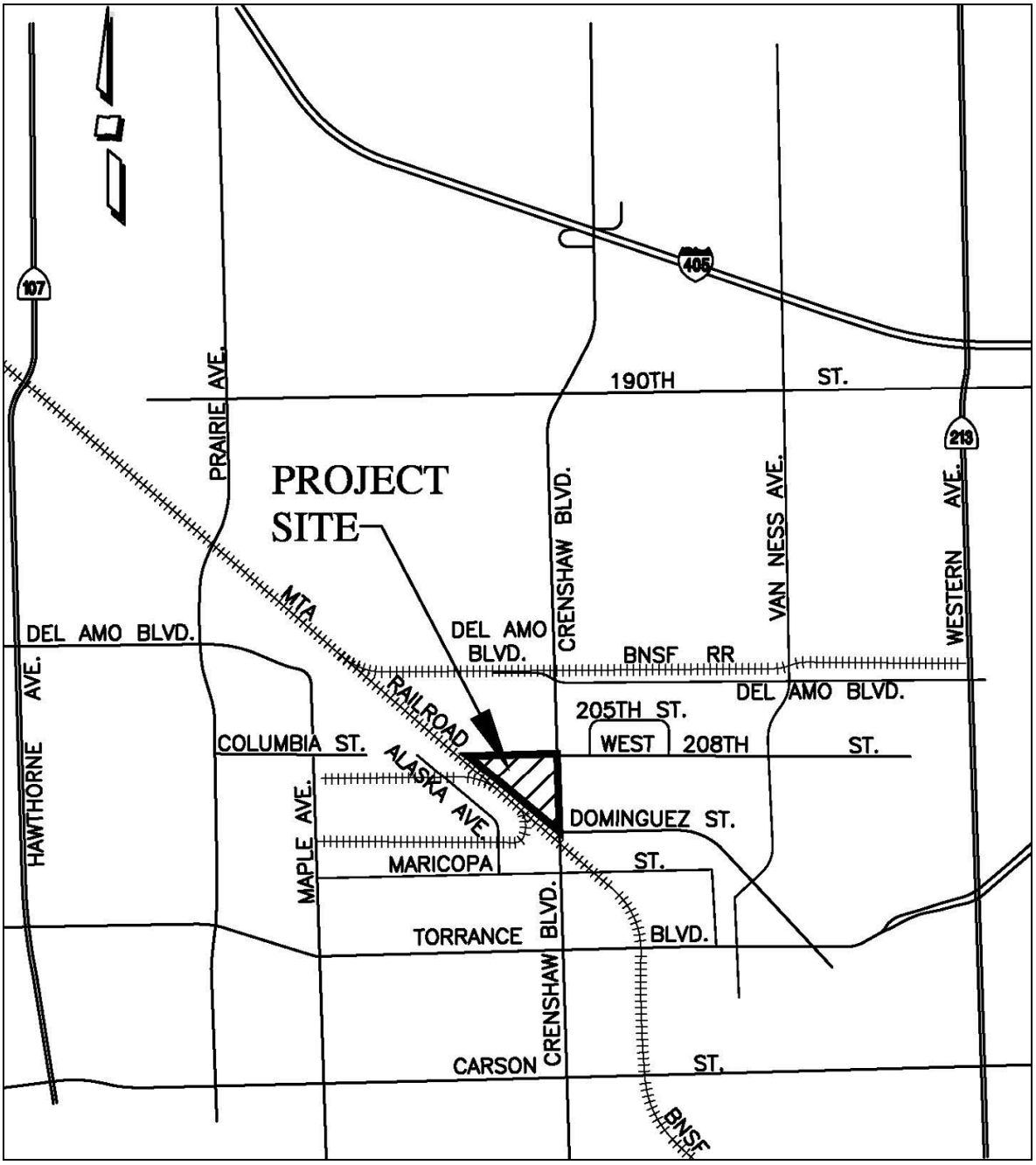

Figure 1-1. Location of the Project Site

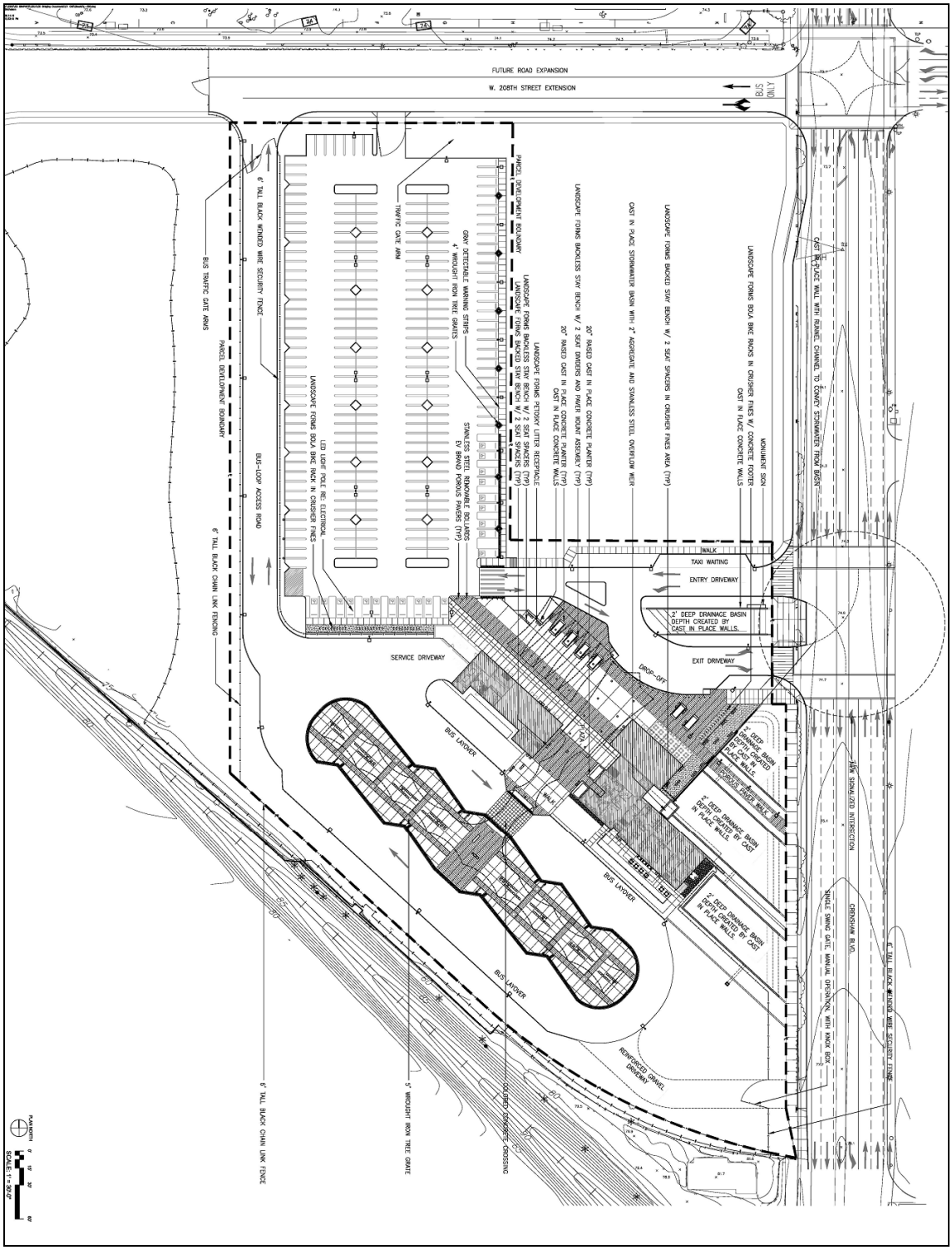

Figure 1-2. Project Site Plan

2 Fundamentals of Sound, and Noise Descriptors

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 state 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 can be confused with ground-borne 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 2.1.

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

2.1 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 (approximately 20 to 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.

2.2 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 within 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-weighted sound levels of those sounds. A range of noise levels associated with common indoor and outdoor activities is shown in Figure 2-1.

2.3 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 acoustical energy over the duration of the exposure. For many noise sources, the L_{eq} will vary depending on the time of day – a prime example is traffic noise which rises and falls depending on the amount of traffic on a given street or freeway.

2.4 Community Noise Equivalent Level (CNEL)

It is recognized that a given level of noise may be more or less tolerable depending on the duration of exposure experienced by an individual. There are numerous measures of noise exposure that consider not only the A-level variation of noise but also the duration of the disturbance. The State Department of Aeronautics and the California Commission on Housing and Community Development have adopted the community noise equivalent level (CNEL). This measure weights the average noise levels for the evening hours (7:00 p.m. to 10:00 p.m.), increasing them by 5 dB, and weights the late evening and morning hour noise levels (10:00 p.m. to 7:00 a.m.) by 10 dB. The daytime noise levels are combined with these weighted levels and are averaged to obtain a CNEL value. Figure 2-2 indicates the outdoor CNEL at typical locations.

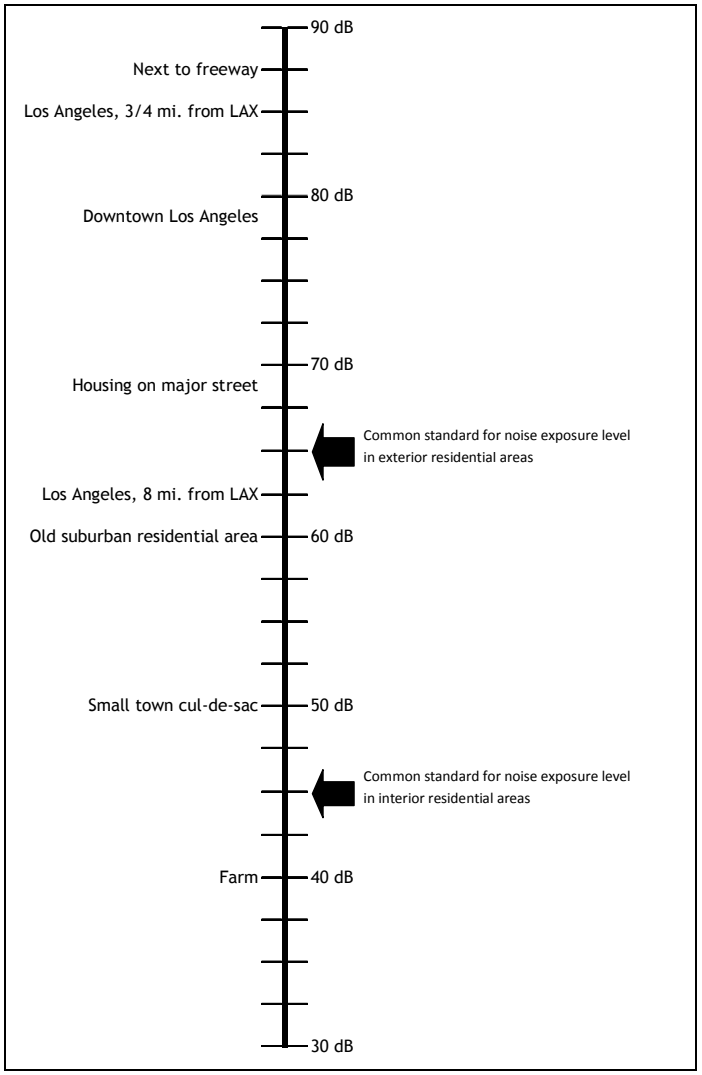

Figure 2-1. Common Noise Sources and A-Weighted Noise Levels

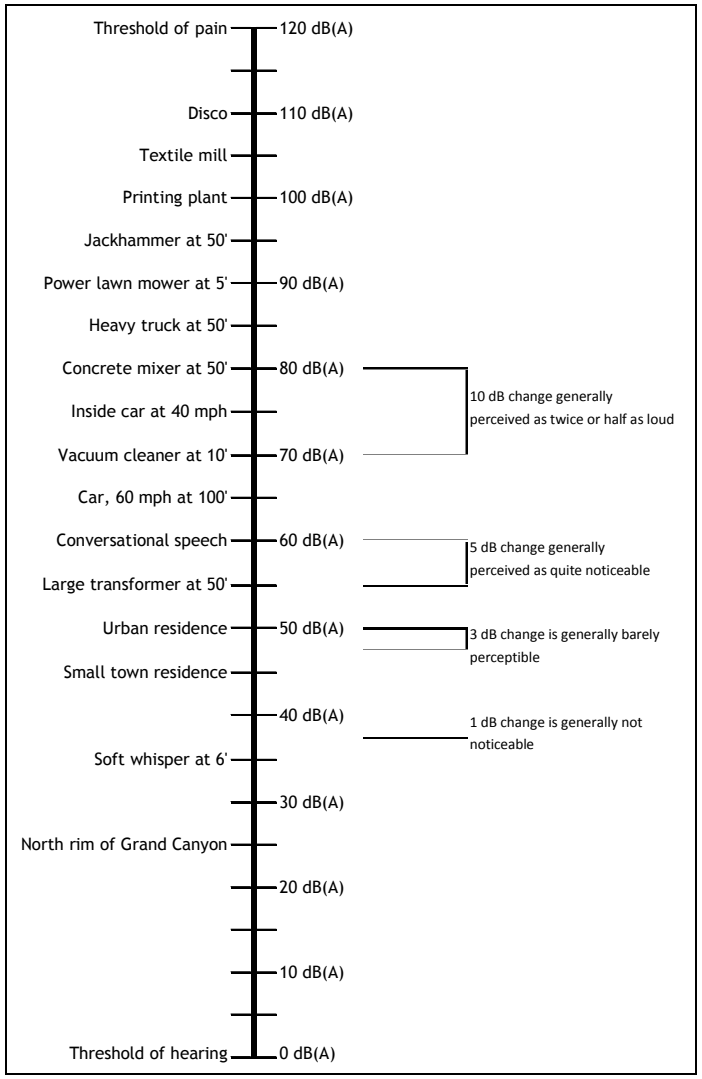

Figure 2-2. Common CNEL/L_{dn} Noise Exposure Levels at Various Locations

2.5 Day-Night Sound Level (L_{dn})

It is recognized that a given level of noise may be more or less tolerable depending on the duration of the exposure experienced by an individual, as well as the time of day during which the noise occurs. The day-night sound level (L_{dn}) is a measure of the cumulative 24-hour noise exposure that considers not only the variation of the A-weighted noise level but also the duration and the time of day of the disturbance. The L_{dn} is derived from the twenty-four A-weighted 1-hour L_{eq}s that occur in a day, with "penalties" applied to the L_{eq}s occurring during the nighttime hours (10 p.m. to 7 a.m.) to account for increased noise sensitivity during these hours. Specifically, the L_{dn} is calculated by adding 10 dBA to each of the nighttime L_{eq}s, and then taking the average value for all 24 hours. It is noted that various federal, state, and local agencies have adopted L_{dn} as the measure of community noise, including the United States Environmental Protection Agency (EPA). Figure 2-2 indicates the typical outdoor L_{dn} at various locations for typical noise sources.

3 Fundamentals of Ground-Borne Vibration, and Vibration Descriptors

Ground-borne 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 ground-borne vibration; the precise vibration descriptors used are described in Section 5.

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

3.1 Peak Particle Velocity (PPV)

Vibration consists of rapidly fluctuating motions with an average motion of zero. The peak particle velocity (PPV) is defined as the maximum instantaneous positive or negative peak amplitude of the vibration velocity. The accepted unit for measuring PPV in the USA is inches per second (in/s); therefore, this is the unit that is used throughout this report. PPV is only applicable to this Project in the assessment of potential building damage due to ground-borne vibration (PPV is related to the stresses that are experienced by buildings subjected to ground-borne vibration); it is not used in the assessment of operational vibration.

3.2 RMS Vibration Velocity

Although PPV is appropriate for evaluating the potential for building damage, it is not suitable for evaluating human response to ground-borne 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.

4 Noise Criteria

4.1 City of Torrance General Plan

The Noise Element of the City of Torrance General Plan includes the noise/land use compatibility guidelines identified in Table 4-1. These guidelines would typically be used to assess potential noise impacts associated with transportation sources such as streets, freeways, railroads and airports.

Table 4-1. City of Torrance Noise/Land Use Compatibility Guidelines

Property Receiving Noise		Maximum Noise Level, L_{dn} or CNEL	
Type of Use	Land Use Designations	Interior	Exterior
Residential[3]	Low Density Residential Low Medium Density Residential Medium Density Residential	45 dB	60 / 65 dB[1]
	Medium High Density Residential	45 dB	65 / 70[2] dB
	High Density Residential	45 dB	70[1] dB
Commercial and Office	General Commercial Commercial Center	-	70 dB
	Residential Office	50 dB	70 dB
Industrial	Business Park Light Industrial Heavy Industrial	55 dB	75 dB
Public and Medical Uses	Public/Quasi-Public/Open Space	50 dB	65 dB
	Hospital/Medical	50 dB	70 dB
Airport	Airport	-	70 dB

Notes:
1. The normally acceptable standard is 60 dB CNEL. The higher standard is acceptable subject to inclusion of noise-reduction features in project design and construction.
2. Maximum exterior noise levels up to 70 dB CNEL are allowed for multiple-family housing.
3. Regarding aircraft-related noise, the maximum acceptable exposure for new residential development is 60 dB CNEL.

4.2 City of Torrance Municipal Code

The City of Torrance Municipal Code provides noise standards that apply to stationary (i.e., non-transportation) noise sources such as commercial and industrial activities. For the purposes of defining the noise standards, the city is divided into four *Noise Regions*, as illustrated in Figure 4-1. Referring to the figure, it is noted that the proposed Project site and the closest surrounding properties are all located within Region 1. However, other properties within the study area are located within Region 4, or within the 500 foot *Noise Transition Area* between Regions 1 and 4. Tables 4-2 and 4-3 provide the noise standards that would apply to the proposed Project; Table 4-2 summarizes the basic noise limits and Table 4-3 summarizes various corrections to the limits that are required for certain noise conditions.

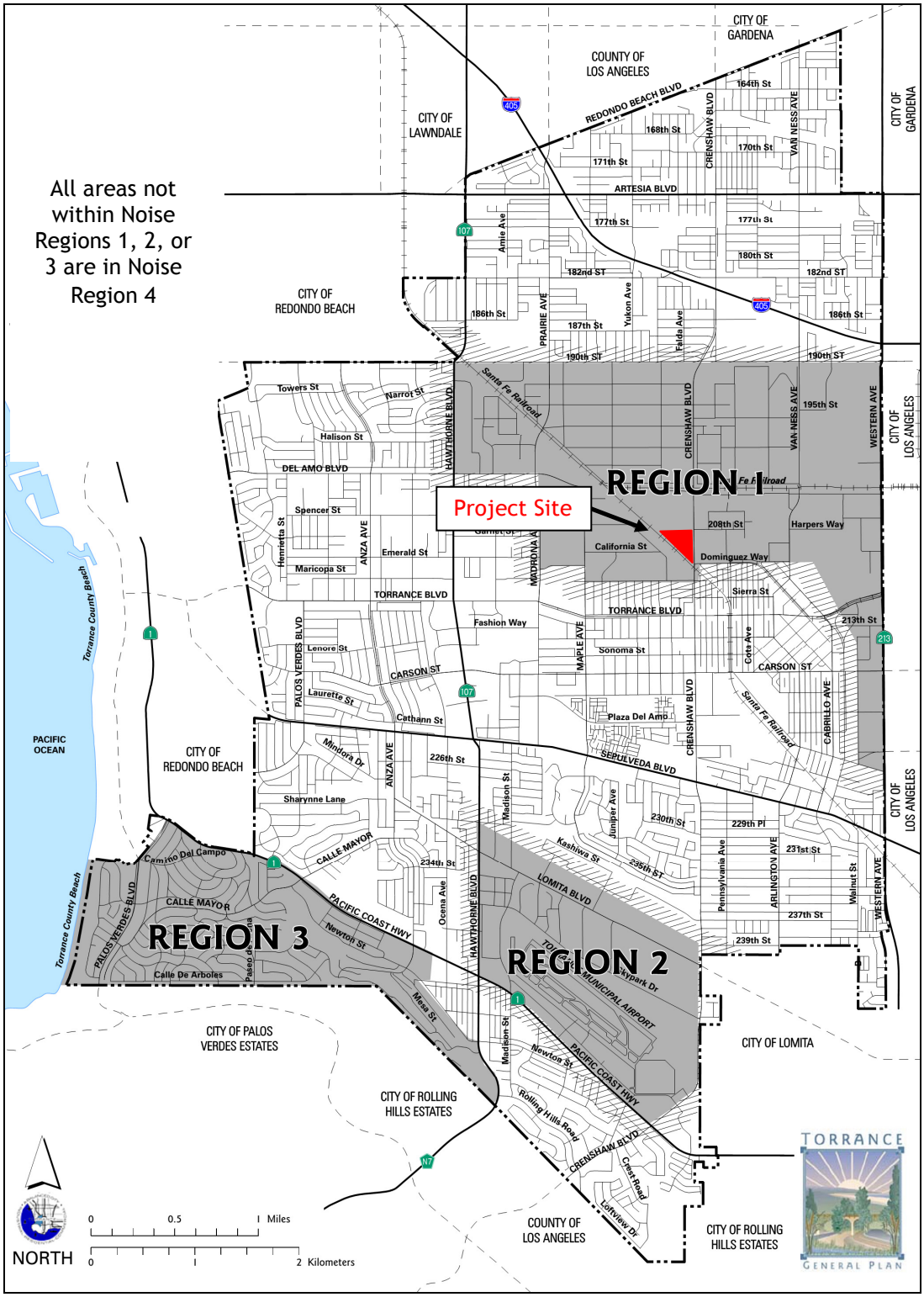

Figure 4-1. City of Torrance Noise Regions

Table 4-2. City of Torrance Municipal Code Standards for Noise Sources in Region 1

Noise Level May Not Exceed…		When Measured At…
Daytime (7 AM to 10 PM)	Nighttime (10 PM to 7 AM)	
70 dBA	65 dBA	The boundary of Region 1
60 dBA, or 5 dBA above the ambient noise level (whichever is lower)	55 dBA, or 5 dBA above the ambient noise level (whichever is lower)	Any residential land use in Region 4, within 500' of Region 1
55 dBA	50 dBA	Any residential land use within Region 4, 500' or more from Region 1

Table 4-3. Corrections to the City of Torrance Noise Limits

Noise Conditions	Correction to the Noise Limit
Noise contains a steady, audible tone, such as a whine, screech or hum	-5 dBA
Noise is a repetitive impulsive noise, such as hammering or riveting	-5 dBA
If the noise is not continuous, one of the following corrections to the limits shall be applied: Noise occurs less than 5 hours per day or less than 1 hour per night Noise occurs less than 90 minutes per day or less than 20 minutes per night Noise occurs less than 30 minutes per day or less than 6 minutes per night	 +5 dBA +10 dBA +15 dBA
Noise occurs on Sunday morning between 12:01 a.m. and 12:01 p.m.	-5 dBA

The municipal code standards would typically be applied to all activities occurring within the boundaries of a transit center, including car and bus movements within the parking lots, driveways and bus berths.

Other provisions of the Municipal Code that may apply to the Project include the following:

- *Section 46.2.1* – It shall be unlawful for any person within the City of Torrance to use or operate any radio receiving set, musical instrument, phonograph, television set, or other machine or device for the producing or reproducing of sound at any time in such a manner as to produce noise levels on residential land which would disturb the peace, quiet and comfort of neighboring residents or any reasonable person of normal sensitiveness residing in the area. Any noise exceeding the ambient noise level at the property line of any residential land by more than 5 dB shall be deemed to be prima facie evidence of a violation.
- *Section 46.2.6* – It shall be unlawful for any person to operate any machinery, equipment, pump, fan, air conditioning apparatus or similar mechanical device in any manner so as to create any noise which would cause the noise level at the property line of any residential land to exceed the ambient noise level by more than 5 dB.
- *Section 46.3.1* – It shall be unlawful for any person within the City of Torrance to operate power construction tools, equipment, or engage in the performance of any outside construction or repair work on buildings, structures, or projects in or adjacent to a residential area involving the creation of noise beyond 50 dBA as measured at property lines, except between the hours of 7:30 a.m. to 6:00 p.m. Monday through Friday and 9:00 a.m. to 5:00 p.m. on Saturdays. Construction shall be prohibited on Sundays and holidays observed by City Hall. Heavy construction equipment such as pile drivers, mechanical shovels, derricks, hoists, pneumatic hammers, compressors or similar devices shall not be operated at any time, within or adjacent

to a residential area, without first obtaining from the Community Development Director permission to do so. The applicant shall be required to show that the selection of equipment and construction techniques has been based on minimization of noise within the limitations of such equipment as is commercially available or combinations of such equipment and auxiliary sound barriers.

- *Section 46.5.2* – It shall be unlawful for any person, other than law enforcement or governmental agencies, to install, use or operate within the City a loudspeaker or sound amplifying equipment in a fixed or movable position for the purposes of giving instructions, directions, talks, addresses, lectures or transmitting music to any persons or assemblages of persons in or upon any street, alley, sidewalk, park, place or public property without first filing an application and obtaining a permit.
- *Section 46.5.3* – The commercial use of sound amplifying equipment shall be subject to the following regulations: (a) The only sounds permitted shall be either music or human speech or both; (b) The operation of sound amplifying equipment shall only occur between the hours of 9:00 a.m. and 9:00 p.m. each day except on Sundays and legal holidays; (c) No sound emanating from sound amplifying equipment shall exceed 15 dB above the ambient as measured at any property line; (d) In any event, the volume of sound shall be so controlled that it will not be unreasonably loud, raucous, jarring, disturbing or a nuisance to reasonable persons of normal sensitiveness within the area of audibility.

4.3 California Green Building Standards Code (CALGreen)

Section 5.507 of the 2010 California Green Building Standards Code (CALGreen) identifies mandatory interior noise standards for non-residential construction, which apply to buildings that are located within the 65 dB CNEL noise contour of an airport, freeway, expressway, railroad, industrial source, or fixed-guideway source as determined by the Noise Element of the General Plan.

Two alternative methods for demonstrating compliance with the standards are provided in the CALGreen Code. These are: (1) the prescriptive method, and (2) the performance method. Under the prescriptive method, the Applicant must show that the wall and roof-ceiling assemblies making up the building envelope that is exposed to the noise source meet a composite sound transmission class (STC) rating of at least 50, or a composite outdoor-indoor transmission class (OITC) rating of no less than 40, with exterior windows that provide a minimum STC of 40 or OITC of 30. The performance method of compliance requires that an acoustical analysis be prepared demonstrating that the walls and roof-ceiling assemblies making up the building envelope that are exposed to the noise source shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq}) of 50 dBA in occupied areas during any hour of operation. It should be noted that the noise standard does not apply to "buildings with few or no occupants or where occupants are not likely to be affected by exterior noise, as determined by the enforcement authority, such as factories, stadiums, storage, enclosed parking structures and utility buildings."

To control noise transmission within the interior of non-residential buildings, Section 5.507.4.3 of the CALGreen Code requires that "(W)all and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40."

5 Vibration Criteria

There are two types of potential vibration impact: (1) annoyance or interference with vibration-sensitive activities, and (2) vibration-induced building damage. The City of Torrance does not have standards that address permissible levels of vibration. However, criteria and guidelines developed by the Federal Transit Administration (FTA) and Caltrans are often used to evaluate vibration levels. These criteria are discussed in the following sections.

5.1 Annoyance or Interference with Vibration-Sensitive Activities

Criteria developed by the Federal Transit Administration **[1]** indicate that when ground-borne vibration exceeds 72 VdB, it is usually perceived as annoying to occupants of residential buildings. For schools, churches, other institutions, and quiet offices, a ground-borne vibration level of more than 75 VdB is usually perceived as annoying. The criteria do not provide any standards for vibration annoyance or interference at commercial properties.

5.2 Vibration-Induced Building Damage

General vibration damage criteria developed by Caltrans **[2]** are summarized in Table 5-1.

Table 5-1. Guideline Vibration Damage Potential Threshold Criteria

Building Category	PPV (in/s)	
	Continuous/Frequent Intermittent Sources	Transient Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.08	0.12
Fragile buildings	0.10	0.20
Historic and some old buildings	0.25	0.50
Older residential structures	0.30	0.50
New residential structures	0.50	1.00
Modern industrial/commercial buildings	0.50	2.00
Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seal equipment, vibratory pile drivers, and vibratory compaction equipment.		

6 Thresholds of Significance

Based on the noise criteria discussed above, and the CEQA guidelines, a significant impact will be assessed if any of the following conditions occur:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the General Plan or Municipal Code of the City of Torrance, or applicable standards of other agencies. This impact would occur if:

  1. The CNEL exceeded 70 dB at outdoor living areas within the Project site; or,

2. Project-generated traffic was to increase the CNEL at any off-site noise-sensitive receptor (residence, park, school, church, or medical facility) from below to above the exterior noise/land use compatibility guideline provided in the Noise Element of the City of Torrance's General Plan (refer to Table 4-1); or,
3. On-site Project operational noise was to exceed the applicable noise standards of the City of Torrance's municipal code (refer to Tables 4-2 and 4-3); or,
4. On-site Project equipment noise was to exceed the applicable noise standards of the City of Torrance's municipal code Sections 46.2.1, 46.2.6, 46.5.2, and 46.5.3; or,
5. Project construction did not comply with the requirements of the City of Torrance's municipal code Section 46.3.1; or,
6. The design of the Project building(s) did not comply with the acoustical requirements outlined in Section 5.507 of the 2010 California Green Building Standards Code.

- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels. This impact would occur if:
  1. Any construction activity was to cause the vibration velocity level to exceed 72 VdB at any residential building, or 75 VdB at any school, church, or other vibration-sensitive institutional use, or at any professional office building; or,
  2. Any construction activity was to cause the PPV to exceed the threshold criteria for potential building damage as described in Table 5-2 at any existing building; or,
  3. The railroad-generated vibration velocity level was to exceed 75 VdB at the proposed Project buildings.
  4. Any railroad-generated vibration was to exceed 0.5 in/s PPV at the proposed Project buildings.
- A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project. This impact would occur if Project-related construction activities were to increase the noise levels by 5 dBA or more at any off-site noise-sensitive receptor (residence, park, school, church, or medical facility).
- A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project. This impact would occur if:
  1. The existing ambient noise level (1-hour L_{eq}) is less than the applicable noise standard of the City of Torrance's municipal code (refer to Table 4-2) and noise generated by the Project's operation was to increase the noise level above the standards at any noise-sensitive receiver; or,
  2. The existing ambient noise level (1-hour L_{eq}) is equal to or greater than the applicable noise standard of the City of Torrance's municipal code and noise generated by the Project's operation was to increase the ambient noise level by 3 dBA or more at any noise-sensitive receiver; or,
  3. Project-generated traffic was to increase the CNEL at any off-site noise-sensitive receptor by 3 dB or more; or,

- The Project would expose people residing or working in the Project area to excessive noise levels as a result of activities at an airport or private airstrip. The nearest airport is Torrance Municipal Airport, which is located approximately 2½ miles south of the Project. At this distance, the Project site is not exposed to significant levels of aircraft noise. Therefore, this threshold is not analyzed any further in the remainder of this report.

7 Existing Noise Environment

The land uses within the immediate vicinity of the Project site include a Dow Chemical facility to the north across the future extension of W. 208th Street, an industrial property to the east across Crenshaw Boulevard, single family and duplex homes to the southeast across Crenshaw Boulevard, and an elevated rail line to the southwest. Across the rail line are more industrial properties.

7.1 Noise Measurements

In order to document the existing noise environment, measurements were obtained at seven (7) locations throughout the study area. (Refer to Figure 7-1.) The locations are identified as follows:

#1 - At the northwest corner of Crenshaw Boulevard and 187th Place, in front of 18621 187th Place.

#2 - In the rear yard of 3511 W. 190th Street.

#3 - In the vacant lot across from 2327 Del Amo Boulevard.

#4 - In the rear yard of 611 Pine Drive.

#5 - At the northwest corner of Torrance Boulevard and Faysmith Avenue, in front of 1121 Faysmith Avenue.

#6 - At the southeast corner of Crenshaw Boulevard and Eldorado Street, in front of 1402 Crenshaw Boulevard.

#7 - At the southeast corner of Torrance Boulevard and Amapola Avenue.

At locations #2 and #4 the noise measurements were obtained over continuous periods of 15 to 24 hours, with the microphone positioned at a height of 5' above the ground. At the remaining locations each measurement was obtained for a period of 20 minutes; to obtain the measurement, the microphone was positioned at a height of 5' above the ground, and extraneous noise sources (such as sirens) were excluded from the measurement by placing the sound level meter on "standby" until the noise event concluded. The results of the noise measurements, provided in Appendix I, are summarized Table 7-1.

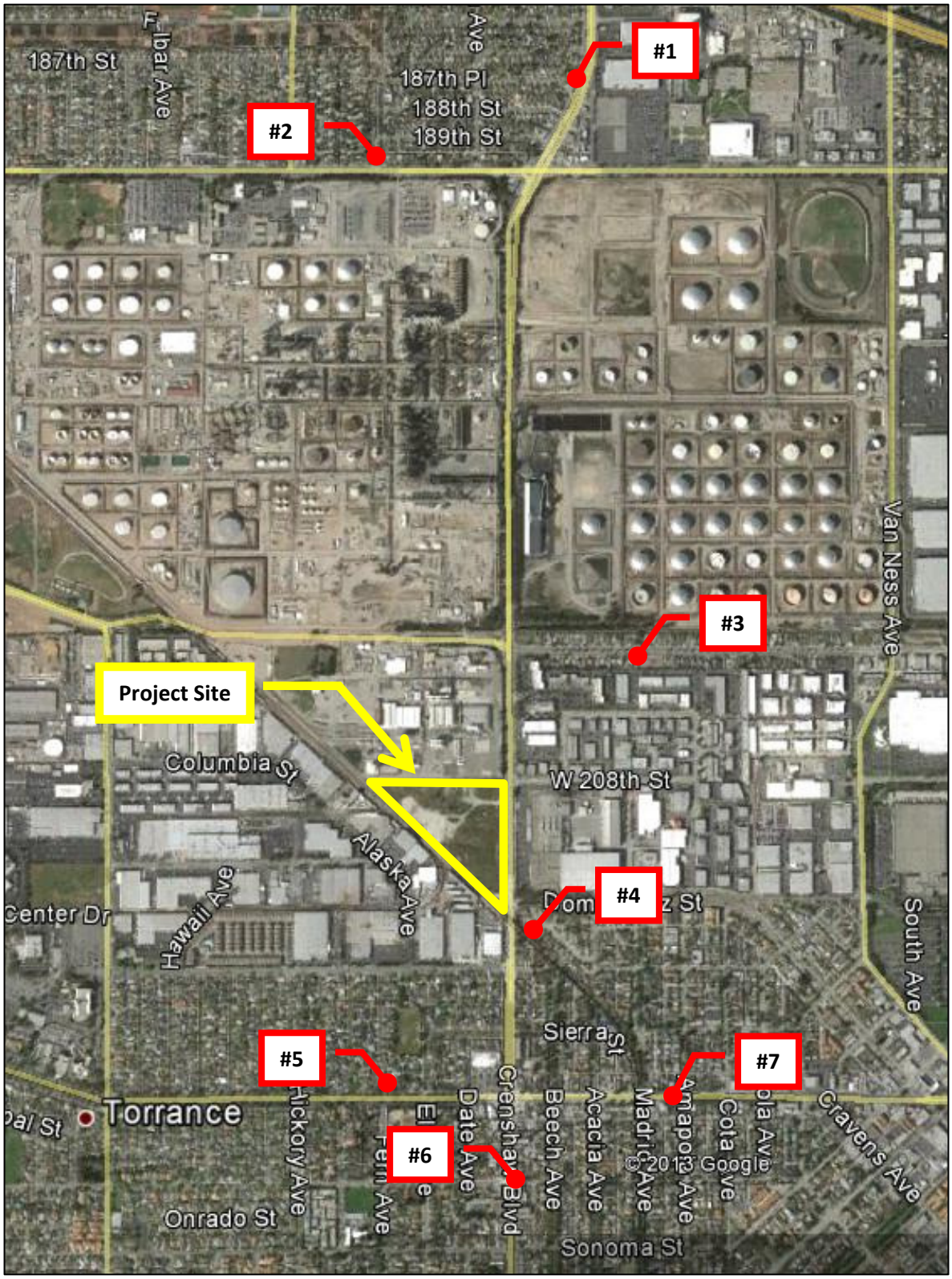

Figure 7-1. Noise Measurement Locations

Table 7-1. Summary of Noise Measurements

Location #	Location Description	Measurement Period	Measured Average Noise Level, dB(A)	CNEL, dB
1	187th & Crenshaw	11:20 AM to 11:40 AM	69.0	Not measured
2	3511 W.190th St.	7:00 AM to 10:00 PM	64.1 - 67.9	Not measured
3	Vacant lot, Del Amo Blvd.	1:40 PM to 2:00 PM	63.5	Not measured
4	611 Pine Dr.	24 hours	42.2 - 74.7	62.0
5	Torrance & Faysmith	1:15 PM to 1:35 PM	62.7	Not measured
6	Crenshaw & Eldorado	12:10 PM to 12:30 PM	72.7	Not measured
7	Torrance & Amapola	12:40 PM to 1:00 PM	65.6	Not measured

The instrumentation used to obtain the noise measurements consisted of integrating sound level meters (Models 712 and 820) and an acoustical calibrator (Model CAL200) manufactured by Larson Davis Laboratories. The accuracy of the calibrator 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.

7.2 Traffic

The analysis of traffic noise was conducted using data provided by Linscott, Law & Greenspan **[3]** and the lookup tables developed by the Federal Highway Administration (FHWA) for their Traffic Noise Model (TNM) **[4,5]**. The model was used to estimate existing traffic noise levels adjacent to the streets based on traffic volumes, speeds, truck mix, site conditions, and distance from the roadway to the receptor. The results of the modeling effort, provided in Appendix II, are summarized in Table 7-2. Referring to the table, the results are presented in terms of an unmitigated CNEL at the distance of the nearest receptor from the centerline of the roadway.

Table 7-2. Existing Traffic Noise Levels

Street Segment	Land Use of Nearest Receptor	Unmitigated CNEL @ Nearest Receptor	Distance to CNEL Contour From Roadway Centerline, feet		
			60 dB	65 dB	70 dB
W. 190th Street					
West of Crenshaw Blvd.	Residential	74.5 dB	941'	392'	139'
East of Crenshaw Blvd.	Office	72.2 dB	900'	372'	130'
W. 208th Street					
East of Crenshaw Blvd.	Office	61.3 dB	60'	N/A	N/A
Crenshaw Boulevard					
North of 190th St.	Residential	73.1 dB	>985'	466'	170'
North of Del Amo Blvd.	Residential	68.3 dB	>985'	440'	158'
South of 208th St.	Residential	72.6 dB	724'	284'	94'
South of Torrance Blvd.	Residential	72.3 dB	692'	270'	89'
Del Amo Boulevard					
East of Crenshaw Blvd.	Residential	65.9 dB	184'	58'	N/A
Torrance Boulevard					
West of Crenshaw Blvd.	Residential	71.0 dB	490'	179'	58'
East of Crenshaw Blvd.	Residential	71.4 dB	532'	197'	63'

Notes:
N/A signifies that there is insufficient traffic volume to generate a noise contour outside of the right-of-way.

Comparing these CNEL values with those of the City's land use compatibility guidelines (refer to Table 4-1), it can be seen that the existing CNEL values exceed the City's guidelines at all of the residential properties adjacent to the streets, exceed the City's guideline at the office properties adjacent to W. 190th Street, and comply with the City's guideline at the office properties adjacent to W. 208th Street.

7.3 Railroad Operations

The rail line that is adjacent to the Project's southwestern property line handles only a few slow-moving freight trains each day. These are sporadic events, occurring randomly throughout the day and night. Based on measurements obtained at Location #4 (refer to Figure 7-1), these rail movements generate a CNEL of about 62 dB at a distance of 59 feet from the centerline of the tracks.

7.4 Industrial Activities

A dominant noise source in the vicinity of the Project site is activities at the Dow Chemical facility. Noise measurements indicate that these activities produce an average noise level of about 56.5 dBA at a distance of 75 feet south of the Dow property line.

8 Future Noise Environment at Off-Site Locations within the Study Area

For ease of presentation, the discussion of future conditions in the study area with the Project has been divided into two sections: construction and operation. Each is discussed in greater detail in the following sections.

8.1 Construction

The Project will be constructed in seven phases: (1) roadway construction, (2) site preparation, (3) grading, (4) utilities trenching, (5) buildings and terminal construction, (6) parking lot paving, and (7) architectural coating. Construction of the Project will occur only between 7:30 a.m. and 6:00 p.m. on weekdays, and between 9:00 a.m. and 5:00 p.m. on Saturdays. There will be no construction activities on Sundays or holidays observed by City Hall. Prior to beginning construction, the contractor will obtain all necessary permissions from the City's Community Development Director.

8.1.1 Construction Noise

Construction noise levels in the vicinity of the Project will fluctuate depending on the particular type, number and duration of use of various pieces of construction equipment. The exposure of persons to the temporary periodic increase in noise levels will occur over a period of approximately 18 months. Each phase of construction is anticipated to take up to one month, with the exception of Phase 4, buildings and terminal construction, which is expected to last approximately 10 months.

The equipment schedule for each phase, along with the source noise levels for each piece of equipment are provided in Table 8-1. The analysis of the estimated noise levels at the nearby noise-sensitive properties (homes) is provided in Table 8-2.

The estimated increase in noise level that will occur at the nearby residences as a result of construction activities is obtained by adding together, on an energy basis, the ambient noise level and the construction noise levels provided in Table 8-2. This calculation is provided in Table 8-3.

Referring to Table 8-3, it is estimated that construction activities will increase the ambient noise level at the nearest residences by 4 dB or less. This is less than the significance threshold of 5 dBA; therefore, construction of the Project will not result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project.

Table 8-1. Construction Equipment Noise Levels for Each Construction Phase

Equipment Type	Maximum Noise Level @ 50', dBA[1]	Number of Units	Correction for Number of Units, dBA[2]	Usage Factor[1]	Correction for Usage Factor[3]	Estimated Average Noise Level at 50', dBA
Roadway Construction						
Rubber tired dozer	85	1	0	0.4	-4	81
Scrapers	89	3	+5	0.4	-4	90
Signal boards	73	4	+6	0.5	-3	76
Excavators	85	1	0	0.4	-4	81
Graders	85	2	+3	0.4	-4	84
Rubber tired loaders	80	1	0	0.4	-4	76
Plate compactors	83	1	0	0.2	-7	76
Trenchers	80	1	0	0.4	-4	76
Pavers	89	1	0	0.5	-3	86
Paving equipment	89	1	0	0.5	-3	86
Rollers	74	1	0	0.2	-7	67
Total:						**94**
Site Preparation						
Rubber tired dozer	85	3	+5	0.4	-4	86
Tractor/ loader/ backhoe	80	4	+6	0.4	-4	82
Total:						**87**
Grading						
Excavator	85	2	+3	0.4	-4	84
Grader	85	1	0	0.4	-4	81
Rubber tired dozer	85	1	0	0.4	-4	81
Scraper	89	2	+3	0.4	-4	88
Tractor/ loader/ backhoe	80	2	+3	0.4	-4	79
Total:						**91**
Utilities Trenching						
Excavator	85	2	+3	0.4	-4	84
Other gen'l ind. equip.	80	1	0	0.4	-4	76
Rubber tired loader	85	1	0	0.4	-4	81
Total:						**86**
Buildings and Terminal Construction						
Crane	83	1	0	0.16	-8	75
Forklift	85	3	+5	0.4	-4	86
Generator set	81	1	0	0.5	-3	78
Tractor/ loader/ backhoe	80	3	+5	0.4	-4	81
Welder	74	1	0	0.4	-4	70
Total:						**88**
Parking Lot Paving						
Paver	89	2	+3	0.5	-3	89
Paving Equipment	89	2	+3	0.5	-3	89
Roller	74	2	+3	0.2	-7	70
Total:						**92**

(Table continued on next page)

Table 8-1, cont. Construction Equipment Noise Levels for Each Construction Phase

Equipment Type	Maximum Noise Level @ 50', dBA[1]	Number of Units	Correction for Number of Units, dBA[2]	Usage Factor[1]	Correction for Usage Factor[3]	Estimated Average Noise Level at 50', dBA
Architectural Coating						
Air compressor	81	1	0	0.4	-4	77
Total:						**77**

Notes:
1. Maximum noise levels and usage factors obtained or estimated from: "Transit Noise and Vibration Impact Assessment", FTA, (FTA-VA-90-1003-06), May 2006; FHWA Roadway Construction Noise Model (RCNM), Version 1.0, February 2, 2006; and, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971.
2. Correction = 10×log(number of units).
3. Correction = 10×log(usage factor).

Table 8-2. Analysis of Estimated Construction Noise Levels at Nearby Homes

Construction Phase	Estimated Average Noise Level at 50', dBA	Distance to Nearest Home, ft	Attenuation Due to Distance, dB[1]	Estimated Average Noise Level at 50', dBA
Roadway Construction	94	500	-20	74
Site Preparation	87	410	-18	69
Grading	91	410	-18	73
Utilities Trenching	86	410	-18	68
Buildings and Terminal Construction	88	500	-20	68
Parking Lot Paving	92	410	-18	74
Architectural Coating	77	500	-20	57

Notes:
1. Based on a reduction of 6 dB per doubling of distance. Distance is an "acoustical equivalent" distance that accounts for the size/shape and location of the construction area. For the roadway construction phase, the construction area is considered to be the extension of 208th Street. For the site preparation, grading, utilities trenching, and paving phases, the construction area is considered to be the entire Project site. For the building and terminal construction and architectural coating phases, the construction area is considered to be the building and terminal footprint.

Table 8-3. Estimated Increase in Noise Level at Residences Due to Construction Activities

Construction Phase	Estimated Construction Noise Level	Estimated Average Daytime Ambient Traffic Noise Level	Combined Construction and Ambient Noise Level	Increase Due to Construction Noise
Road Construction	74 dBA	72 dBA	76 dBA	4 dBA
Site Preparation	69 dBA	72 dBA	74 dBA	2 dBA
Grading	73 dBA	72 dBA	76 dBA	4 dBA
Utilities Trenching	68 dBA	72 dBA	73 dBA	1 dBA
Buildings and Terminal Construction	68 dBA	72 dBA	73 dBA	1 dBA
Parking Lot Paving	74 dBA	72 dBA	76 dBA	4 dBA
Architectural Coating	57 dBA	72 dBA	72 dBA	0 dBA

8.1.2 Construction Vibration

Referring to the list of construction equipment items in Table 8-1, the main items that will generate ground-borne vibration are heavy construction vehicles (excavators, backhoes, loaders, graders, etc.). Using vibration data and calculation methodologies developed by the FTA **[1]**, it is possible to estimate the distances from the Project site at which the vibration impact thresholds developed for the study will be exceeded. This analysis is summarized in Table 8-4.

Table 8-4. Analysis of Estimated Vibration Levels from Construction Equipment

Vibration Source			Vibration Impact Thresholds			Distance at Which Threshold is Exceeded
Construction Equipment	Estimated L_V at 25', VdB	Estimated PPV at 25', in/s	Type of Impact	Type of Receiver	Threshold of Potential Impact	
Heavy construction vehicle	87	0.089	Potential annoyance/ interference at:	Residence	72 VdB	77 feet
				Professional office building or school, church, or other vibration-sensitive institutional use	75 VdB	61 feet
			Potential building damage at:	Older residential structures	0.30 in/sec PPV	11 feet
				New residential structures	0.50 in/sec PPV	8 feet
				Modern industrial/commercial buildings	0.50 in/sec PPV	8 feet

There are no residences within 77 feet of the Project site and no professional office buildings, schools, churches, or other vibration-sensitive institutional uses within 61 feet of the Project site. Therefore, there are no significant impacts with respect to potential ground-borne vibration annoyance/interference from Project construction activities.

There are no residential buildings within 11 feet of the Project site and no industrial/commercial buildings within 8 feet of the Project site. Therefore, there are no significant impacts with respect to potential building damage due to ground-borne vibration from Project construction activities.

8.2 Project Operation

There are two primary sources of noise associated with the Project's operation: (1) additional traffic on the streets, and (2) activities on the Project site. Each of these sources is discussed in greater detail in the following sections.

The operation of the Project is not expected to generate ground-borne vibration levels that will be perceptible beyond the property lines. Therefore, this impact is not significant.

8.2.1 Traffic

Using data provided by Linscott, Law & Greenspan **[3]**, analyses were conducted to identify the traffic noise exposures that will occur in the study area with and without the Project. The analyses

were conducted using the FHWA's Traffic Noise Model (TNM) lookup tables **[4, 5]**. The results of the analyses are provided in Appendix II and summarized in Tables 8-5 and 8-6.

Table 8-5. Existing Year Traffic Noise Levels With and Without Project

Street Segment	Land Use of Nearest Receptor	CNEL @ Nearest Receptor		Change in CNEL Due to Project
		Without Project	With Project	
W. 190th Street				
West of Crenshaw Blvd.	Residential	74.5 dB	74.5 dB	0.0 dB
East of Crenshaw Blvd.	Office	72.2 dB	72.2 dB	0.0 dB
W. 208th Street				
West of Crenshaw Blvd.	Industrial	0.0 dB	57.9 dB	57.9 dB
East of Crenshaw Blvd.	Office	61.3 dB	61.3 dB	0.0 dB
Crenshaw Boulevard				
North of 190th St.	Residential	73.1 dB	73.2 dB	0.1 dB
North of Del Amo Blvd.	Residential	68.3 dB	68.4 dB	0.1 dB
South of 208th St.	Residential	72.6 dB	72.9 dB	0.3 dB
South of Torrance Blvd.	Residential	72.3 dB	72.4 dB	0.1 dB
Del Amo Boulevard				
East of Crenshaw Blvd.	Residential	65.9 dB	65.9 dB	0.0 dB
Torrance Boulevard				
West of Crenshaw Blvd.	Residential	71.0 dB	71.1 dB	0.1 dB
East of Crenshaw Blvd.	Residential	71.4 dB	71.5 dB	0.1 dB

Table 8-6. Future Year (2015) Traffic Noise Levels With and Without Project

Street Segment	Land Use of Nearest Receptor	CNEL @ Nearest Receptor		Change in CNEL Due to Project
		Without Project	With Project	
W. 190th Street				
West of Crenshaw Blvd.	Residential	74.7 dB	74.7 dB	0.0 dB
East of Crenshaw Blvd.	Office	72.4 dB	72.4 dB	0.0 dB
W. 208th Street				
West of Crenshaw Blvd.	Industrial	0.0 dB	57.9 dB	57.9 dB
East of Crenshaw Blvd.	Office	61.3 dB	61.3 dB	0.0 dB
Crenshaw Boulevard				
North of 190th St.	Residential	73.7 dB	73.7 dB	0.0 dB
North of Del Amo Blvd.	Residential	68.9 dB	69.0 dB	0.1 dB
South of 208th St.	Residential	73.0 dB	73.3 dB	0.3 dB
South of Torrance Blvd.	Residential	72.7 dB	72.7 dB	0.0 dB
Del Amo Boulevard				
East of Crenshaw Blvd.	Residential	66.3 dB	66.4 dB	0.1 dB
Torrance Boulevard				
West of Crenshaw Blvd.	Residential	71.3 dB	71.4 dB	0.3 dB
East of Crenshaw Blvd.	Residential	71.7 dB	71.8 dB	0.1 dB

Referring to the tables, additional traffic generated by the Project is not expected to increase the CNEL at any location in the study area to a level that exceeds the City's compatibility guideline for that land use. Therefore, the Project will not result in the exposure of persons to or generation of noise levels in excess of standards established in the Torrance General Plan, and the impact is not significant.

Referring to the tables, additional traffic generated by the Project is expected to only increase the CNEL in the study area by up to 0.3 dB (with one exception, which is discussed later). This is less than the 3 dB threshold of significance; therefore, the Project will not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project, and the impact is not significant. The one exception to this conclusion is at the Dow Chemical facility

located north of the proposed extension of W. 208th Street. Since there is currently no street at this location, the construction of the extension and the traffic associated with the Project will result in a CNEL increase of 57.9 dB at this location. However, this is not considered to be a significant impact because the resulting CNEL is well below the City's compatibility guideline of 75 dB for industrial properties.

8.3 Project Operation

Operation of the proposed Project would add a number of new noise sources to the area. Primarily these noise sources would consist of: (1) buses driving within the Transit Center (on the access road and around the bus terminal), (2) buses idling at the berths, (3) cars driving within the Transit Center (on the entry and exit driveways, and at the Kiss-N-Ride drop-off); and, (4) activities at the new parking lot. All four of these sources are included in the noise modeling and analysis for the Project. Noise will also be generated by rooftop mechanical equipment serving the Project buildings. However, this is not anticipated to be a significant contributor to the Project noise levels at off-site locations because the closest noise-sensitive receptors (homes) are approximately 400 to 700 feet away from the Project buildings and because the mechanical equipment will be shielded by parapet walls around the roofs of the buildings.

In order to estimate the noise levels due to Project activities, a computer noise model was prepared utilizing SoundPLAN software and noise data gathered from field measurements and published sources. This model takes a number of significant variables into account, including source sound power levels, the distance from sources to receivers, the heights of sources and receivers, ground conditions, barrier effects provided by walls, buildings and topography, and noise reflected from hard surfaces such as buildings and walls.

Based on information provided in the Project's *Traffic Impact Analysis Report* **[3]**, the following points describe the operational scenario that was analyzed in the SoundPLAN model:

- 24 buses entering the Transit Center and 24 buses exiting during the busiest hour. Noise levels were estimated using the traffic noise modeling capabilities of the SoundPLAN software, which are based on the FHWA's Traffic Noise Model (TNM), Version 2.5. The model predicts noise levels based on the vehicle type (i.e., bus) and speed (an on-site speed of 25 miles per hour [mph] was assumed).
- Each of the Metro buses (i.e., Routes 1, 4, and 10) use their on-board Automated Voice Annunciator (AVA) to announce arrivals and departures for their unit. It is assumed that each announcement lasts for 10 seconds. Based on an internal memo prepared for Metro[1], the desired exterior noise level produced by the AVA is 85 dBA at a position 3 to 4 feet from the front door of the bus.
- All eight berths occupied by an idling bus throughout the busiest hour. Noise measurements from a previous study **[6]** were used to estimate the noise levels generated by the buses at the

[1] *Determination volume range settings for internal and external AVA system*. Internal Memo from Hoan Nguyen to Cynthia Garrett. June 1, 2006.

Project site (measurements were obtained of approximately 20 idling buses at an existing bus transfer stop). The data indicated an average sound power of 94.4 dBA for an idling bus.

- 141 cars using the entry drive way and 117 cars using the exit driveway (including the Kiss-N-Ride drop-off) during the busiest hour. Noise levels were estimated using the traffic noise modeling capabilities of the SoundPLAN software, as discussed above. The vehicle type was assumed to be a car and the on-site speed was assumed to be 25 mph.
- 178 vehicle movements within the parking lot during the busiest hour (each vehicle entering or exiting the lot is counted as one vehicle movement). Noise from the parking lot was estimated using the parking lot modeling capabilities of the SoundPLAN software, which predicts noise levels based on the size of the parking lot, the number of parking spaces, and the number of hourly vehicle movements.

This scenario represents the "worst-case" (i.e., loudest) 1-hour period of weekday operations at the Project site. During off-peak hours (including weekends) activity levels are anticipated to be lower, which will lead to correspondingly lower noise levels.

The results of the noise modeling are shown in Figure 8-1 as a noise contour map. Referring to the figure, the noise level (1-hour L_{eq}) due to Project operations is estimated to be 53 dBA at the closest residential property. This location also represents the closest boundary of Noise Region 1. The noise level drops to 50 dBA or less at approximately 200 feet beyond the Region 1 boundary.

The estimated noise level of 53 dBA is below the municipal code standards of 75 dBA (daytime) and 65 dBA (nighttime) for the boundary of Noise Region 1. It is also below the municipal code standards of 60 dBA (daytime) and 55 dBA (nighttime) for residential land uses within 500 feet of Noise Region 1. Referring to the noise measurements of Section 7.1 and the traffic noise analyses of Section 7.2, the ambient noise levels at these residences are already significantly above the estimated noise level of 53 dBA, so the Project operations will not appreciably increase the noise levels at these properties. At residential land uses 500 feet or more from Noise Region 1, the noise levels from Project operations will be well below 50 dBA, which will comply with the applicable municipal code standards of 55 dBA (daytime) and 50 dBA (nighttime) and will not appreciably increase the noise levels at these properties above the existing ambient levels. Therefore (with the exception of possible address system noise discussed below), there are no significant impacts from the on-site Project operations with respect to the City's municipal code noise standards and there are no substantial permanent increases in ambient noise levels at noise-sensitive receivers as a result of on-site Project operations.

An outdoor public address system will be included as part of the Project's design. However, it will only be used for emergency situations and never for day-to-day operations. Therefore, it has been excluded from consideration in this study.

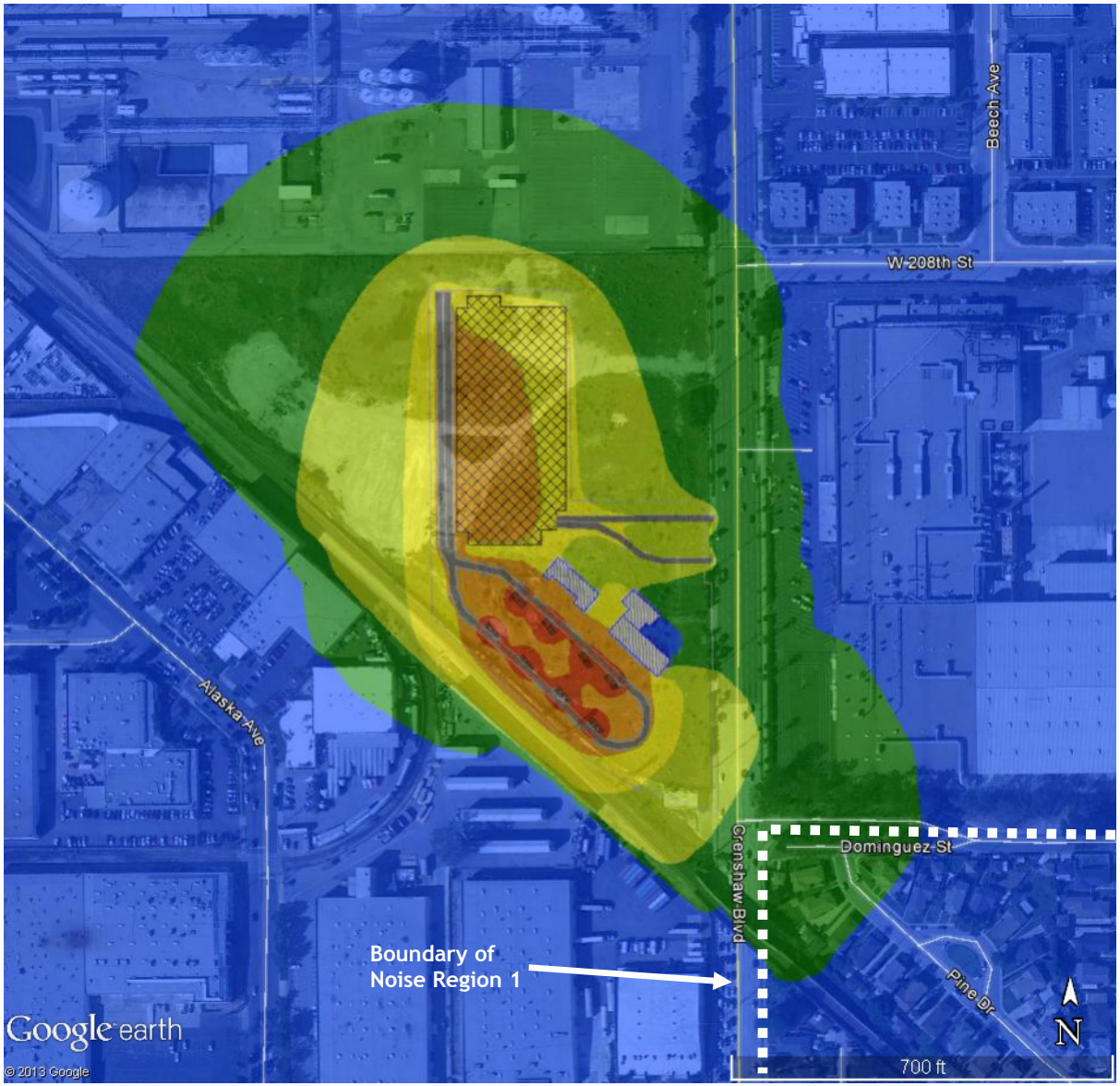

Figure 8-1. Noise Levels Due to Worst-Case 1-Hour Project Operations

1-Hour L_{eq}, dBA

- > 70
- 65 - 70
- 60 - 65
- 55 - 60
- 50 - 55
- <= 50

9 Future Noise and Vibration Environments at the Project Site

There are a number of noise and vibration sources that may have an impact on the proposed Project. Each of these is discussed in the following sections.

9.1 Traffic and Rail Noise

A continuous 94-hour measurement was obtained on the Project site at the location of the nearest proposed building façade to both Crenshaw Boulevard and the railroad. The results of the measurement, provided in Appendix I, indicate that the Project site is exposed to a combined CNEL of 66.7 dB as a result of traffic and rail movements. The highest 1-hour average noise level was 64.2 dBA.

Using data provided by Linscott, Law & Greenspan **[3]**, an analysis was conducted to identify the future traffic noise exposures that will occur at the Project site. The results of our analysis are summarized in Table 9-1.

Table 9-1. Future Traffic Noise Levels at the Project Site

Building	Unmitigated CNEL @ Nearest Facade		Unmitigated 1 Hr Leq @ Nearest Facade	
	Exterior	Interior[1]	Exterior	Interior[1]
East Building	67.7 dB	47.7 dB	65.3 dBA	45.3 dBA
West Building	66.7 dB	44.7 dB	64.2 dBA	44.2 dBA

Notes:
1. Assumes standard commercial construction provides at least 20 dB of noise reduction with windows and doors closed.

Referring to Table 9-1, the exterior CNELs at the Project buildings are estimated to be below the City's compatibility guideline of 70 dB for commercial and office buildings. Therefore, the impact is not significant.

At the proposed buildings, the estimated interior L_{eq} will be 44.2 to 45.3 dBA. This is less than the CALGreen standard of 50 dBA; therefore, the impact is not significant.

9.2 Industrial Noise

The Dow Chemical facility located to the north generates noise that is experienced at the Project site. To quantify this noise level, a measurement was obtained on the Project site at the location of the nearest proposed building façade. The results of the measurement, provided in Appendix I, indicate an average noise level of 55.3 dBA. Assuming the noise is continuous throughout the day, this is equivalent to a CNEL of 62.0 dB. Since standard commercial construction provides at least 20 dB of noise reduction with windows and doors closed, the estimated average interior noise level will be 35.3 dBA and the estimated interior CNEL will be 42.0 dB. These levels are below the City's land use compatibility guidelines and below the CALGreen standards; therefore, the impact is not significant.

9.3 Vibration from Train Movements

A continuous 94-hour measurement was obtained on the Project site at the location of the nearest proposed building façade to both Crenshaw Boulevard and the rail line. The results of the measurements, provided in Appendix III, indicate peak particle velocities (PPVs) of 0.018 in/s or less. This is less than the threshold of 0.50 in/s; therefore, the impact is not significant.

Assuming a crest factor of 4, the measured PPV of 0.018 in/s is equivalent to a vibration velocity level of 73 VdB. This is less than the annoyance threshold of 75 VdB; therefore, the impact is not significant.

10 Summary of Impacts

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

- The Project will not result in the exposure of persons to, or generation of, noise levels in excess of standards established in the Municipal Code of the City of Torrance.
- The Project will not result in the exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne noise levels.
- The Project will not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project.
- Construction of the Project will not result in a substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project.
- The Project will not result in a substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project.

11 Mitigation Measures

There are no significant impacts associated with the construction or operation of the proposed Project. Therefore, mitigation measures are not required.

12 References

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5. *Traffic Noise Model (FHWA TNM) LookUp Program, Software Version 2.1 (Data Generated by TNM Version 2.5)*. U.S. Department of Transportation, Federal Highway Administration. February 22, 2007.
6. *Environmental Noise & Vibration Study for the Proposed Lompoc Transit Center in the City of Lompoc*. Wieland Acoustics, Inc. May 17, 2011.
7. *Torrance Transit Park and Ride Regional Terminal, 30% Construction Drawings*. Prepared by RNL; Psomas; Diaz, Yourman & Associates; Miyamoto; Glumac; and Ambient Energy. September 26, 2012.

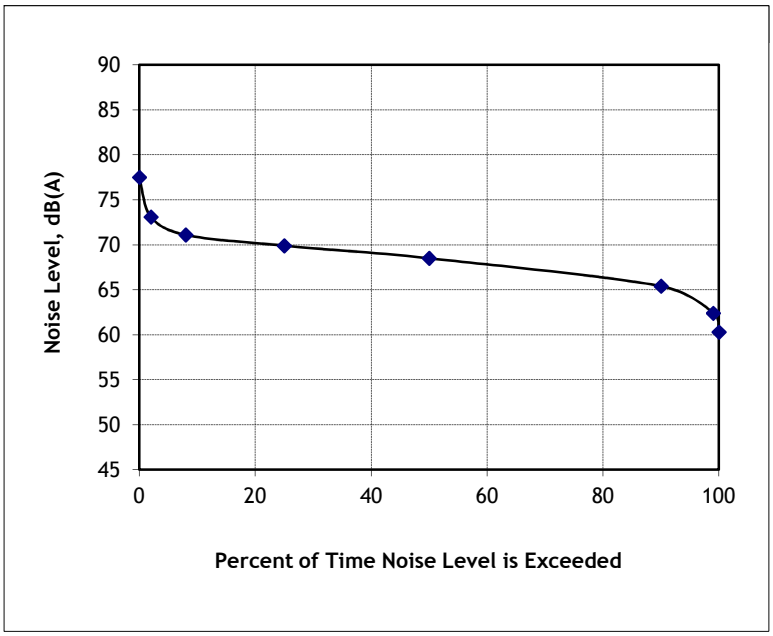
APPENDIX I

Noise Measurements

Table I-1. Noise Survey

Project:	Torrance Regional Transit Center
Position:	#1, at northwest corner of Crenshaw Blvd. and 187th Pl., in front of 18621 187th Pl.
Date:	June 20, 2013
Time:	Noted
Noise Source:	Ambient traffic
Distance:	62' from Crenshaw Blvd.
SLM Height:	5'
LD 820 S/N:	0997
LD CAL200 Calibrator S/N:	2916
Operator:	David Limberg

	Measurement Period		
	11:20 AM to 11:40 AM	to	to
n*	Ln	Ln	Ln
2	73.1		
8	71.1		
25	69.9		
50	68.5		
90	65.4		
99	62.4		
Leq	69.0		
Lmax	77.5		
Lmin	60.3		



* 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.

WIELAND ACOUSTICS, INC.

Table I-2. Measured Hourly Noise Levels and CNEL

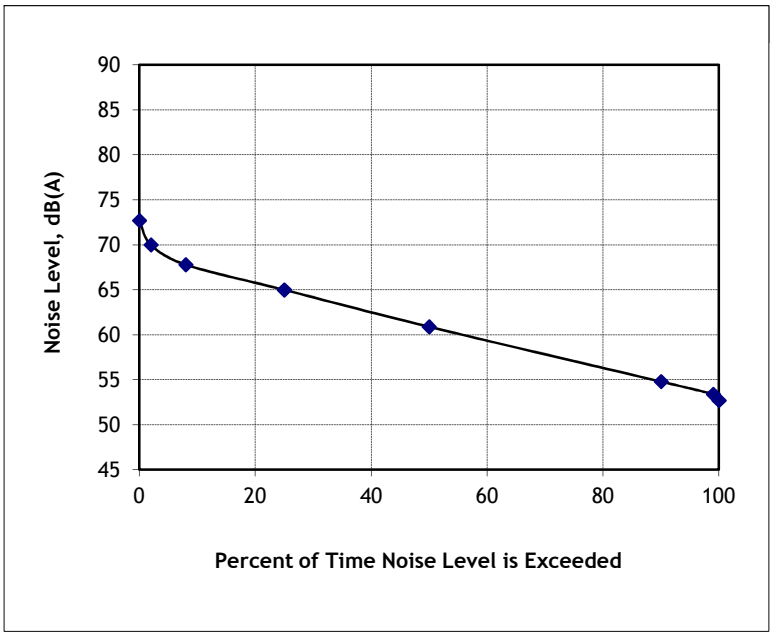
Location: #2, back yard of 3511 W. 190th St.

Date	Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)	CNEL
20Jun 13	11:00	65.6	73.0	55.2	70.5	68.5	66.8	65.1	
20Jun 13	12:00	65.7	74.4	54.6	70.3	68.5	66.9	65.3	
20Jun 13	13:00	65.6	78.1	54.2	69.9	68.4	66.8	65.1	
20Jun 13	14:00	66.5	84.3	56.3	70.9	68.9	67.3	65.7	
20Jun 13	15:00	66.5	76.5	58.0	70.8	69.0	67.6	66.1	
20Jun 13	16:00	66.6	78.4	57.8	70.2	68.8	67.6	66.2	
20Jun 13	17:00	66.8	76.6	57.9	70.6	68.9	67.7	66.5	
20Jun 13	18:00	67.2	89.7	55.4	69.9	68.7	67.3	65.7	
20Jun 13	19:00	65.3	83.9	54.2	69.5	67.8	66.2	64.4	
20Jun 13	20:00	64.1	71.9	58.1	68.2	66.9	65.4	63.5	
20Jun 13	21:00	65.4	85.4	59.3	68.9	67.6	66.2	64.9	
21Jun 13	7:00	67.9	76.2	57.5	72.6	71.3	68.9	67.1	
21Jun 13	8:00	67.1	83.3	56.8	71.4	69.6	68.0	66.5	
21Jun 13	9:00	66.5	80.2	58.0	71.0	69.0	67.5	65.8	
21Jun 13	10:00	65.7	77.3	54.5	70.7	68.8	66.8	64.9	

Table I-3. Noise Survey

Project:	Torrance Regional Transit Center
Position:	#3, in the vacant lot across from 2327 Del Amo Blvd.
Date:	June 20, 2013
Time:	Noted
Noise Source:	Ambient traffic
Distance:	25' from Del Amo Blvd.
SLM Height:	5'
LD 820 S/N:	0997
LD CAL200 Calibrator S/N:	2916
Operator:	David Limberg

	Measurement Period		
	1:40 PM to 2:00 PM	to	to
n*	Ln	Ln	Ln
2	70.0		
8	67.8		
25	65.0		
50	60.9		
90	54.8		
99	53.4		
Leq	63.5		
Lmax	72.7		
Lmin	52.7		



* 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.

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Table I-4. Measured Hourly Noise Levels and CNEL

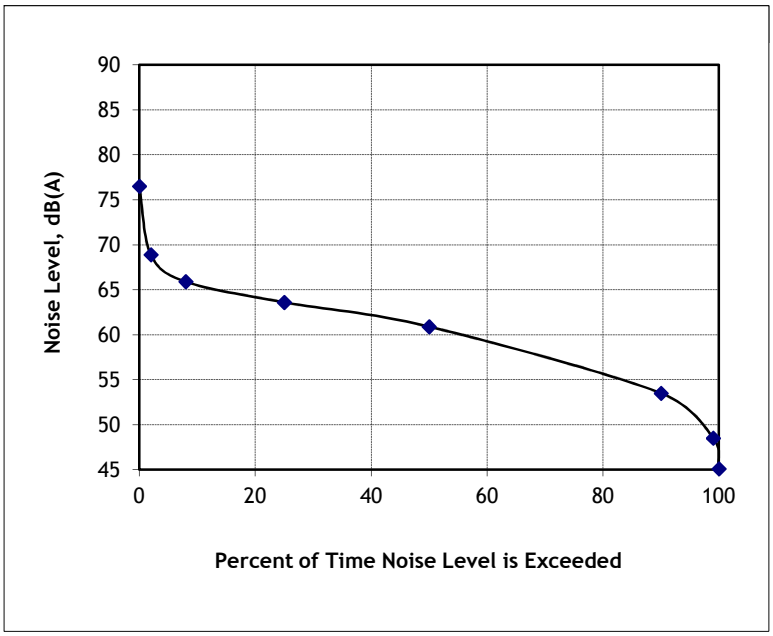
Location: #4, back yard of 611 Pine Dr.

Date	Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)	L(90)	L(99)	CNEL
20Jun 13	10:00	49.9	69.2	39.5	55.0	52.4	50.5	48.2	43.4	40.5	
20Jun 13	11:00	53.2	75.5	38.8	58.7	52.6	50.5	48.2	43.4	39.8	
20Jun 13	12:00	49.4	58.9	39.9	54.6	52.8	50.7	48.5	43.9	40.8	
20Jun 13	13:00	51.7	60.3	41.2	56.7	55.0	53.1	50.7	45.8	42.3	
20Jun 13	14:00	53.0	67.8	42.7	57.8	55.9	54.1	52.1	47.1	43.8	
20Jun 13	15:00	52.5	68.0	41.1	57.6	55.6	53.7	51.6	47.4	43.8	
20Jun 13	16:00	54.1	74.2	41.7	61.0	56.4	53.5	51.2	46.4	43.2	
20Jun 13	17:00	51.7	67.6	40.2	55.9	54.4	52.9	50.9	45.8	42.3	
20Jun 13	18:00	54.2	73.4	41.2	61.4	56.0	53.8	51.5	46.0	43.2	
20Jun 13	19:00	52.4	60.0	42.0	57.0	55.7	53.9	51.5	46.2	44.1	
20Jun 13	20:00	51.0	59.7	42.6	55.8	54.3	52.4	50.0	45.6	43.4	
20Jun 13	21:00	51.0	65.7	41.9	56.2	53.8	51.9	49.6	44.9	43.1	
20Jun 13	22:00	49.1	69.1	40.9	53.9	52.5	50.1	47.3	42.9	41.3	
20Jun 13	23:00	47.3	57.5	39.7	52.7	50.9	48.6	45.9	41.9	40.4	
21Jun 13	0:00	50.7	73.6	39.8	56.8	50.9	47.9	45.3	41.6	40.2	
21Jun 13	1:00	44.5	52.7	38.7	50.1	48.0	45.4	42.8	40.3	39.2	
21Jun 13	2:00	42.2	52.8	36.1	48.6	46.2	43.0	40.0	37.5	37.0	
21Jun 13	3:00	42.6	54.3	36.9	50.0	46.8	42.9	39.7	37.7	37.1	
21Jun 13	4:00	45.3	57.0	37.9	51.9	49.2	46.2	43.1	39.2	38.1	
21Jun 13	5:00	50.5	64.2	40.1	57.1	53.7	51.3	48.7	43.1	41.1	
21Jun 13	6:00	50.7	62.5	40.5	56.6	54.5	52.0	49.1	43.7	41.6	
21Jun 13	7:00	50.1	61.4	40.4	55.2	53.1	51.3	49.2	44.0	41.2	
21Jun 13	8:00	49.3	61.1	39.7	54.0	52.2	50.5	48.7	43.8	41.1	
21Jun 13	9:00	74.7	90.8	39.9	86.4	80.2	54.7	50.7	44.6	41.1	62.0

Table I-5. Noise Survey

Project:	Torrance Regional Transit Center
Position:	#5, at the northwest corner of Torrance Blvd. and Faysmith Ave., in front of 1121 Faysmith
Date:	June 20, 2013
Time:	Noted
Noise Source:	Ambient traffic
Distance:	70' from Torrance Blvd.
SLM Height:	5'
LD 820 S/N:	0997
LD CAL200 Calibrator S/N:	2916
Operator:	David Limberg

	Measurement Period		
	1:15 PM to 1:35 PM	to	to
n*	Ln	Ln	Ln
2	68.9		
8	65.9		
25	63.6		
50	60.9		
90	53.5		
99	48.5		
Leq	62.7		
Lmax	76.5		
Lmin	45.1		



* 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.

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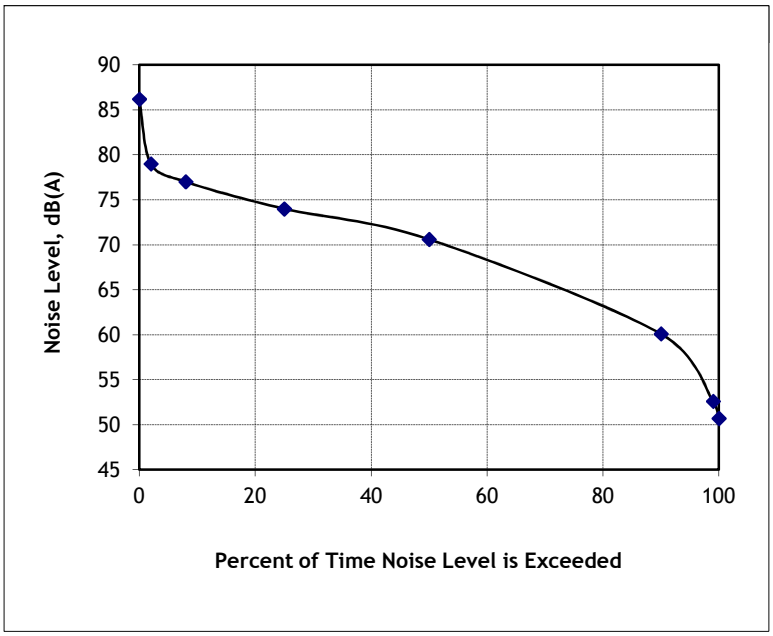
Table I-6. Noise Survey

Project:	Torrance Regional Transit Center
Position:	#6, at the southeast corner of Crenshaw Blvd. and Eldorado St., in front of 1402 Crenshaw
Date:	June 20, 2013
Time:	Noted
Noise Source:	Ambient traffic
Distance:	13' from Crenshaw Blvd.
SLM Height:	5'
LD 820 S/N:	0997
LD CAL200 Calibrator S/N:	2916
Operator:	David Limberg

	Measurement Period		
	12:10 PM to 12:30 PM	to	to
n*	Ln	Ln	Ln
2	79.0		
8	77.0		
25	74.0		
50	70.6		
90	60.1		
99	52.6		
Leq	72.7		
Lmax	86.2		
Lmin	50.7		



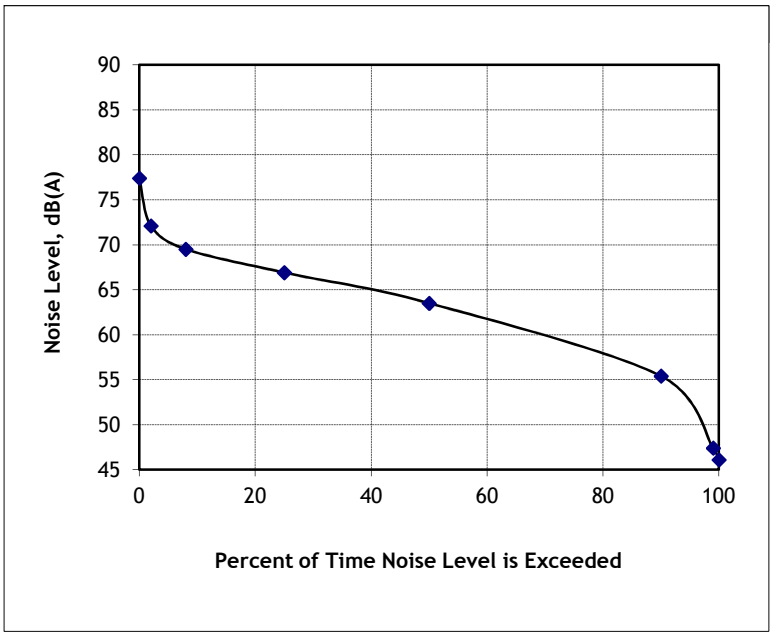
* Leq is the average sound level during the measurement period.
Ln is the sound level exceeded n% of the time during the measurement period.
Lmax and Lmin are the maximum and minimum sound levels during the measurement period.

WIELAND ACOUSTICS, INC.

Table I-7. Noise Survey

Project:	Torrance Regional Transit Center
Position:	#7, at the southeast corner of Torrance Blvd. and Amapola Avenue
Date:	June 20, 2013
Time:	Noted
Noise Source:	Ambient traffic
Distance:	24' from Torrance Blvd.
SLM Height:	5'
LD 820 S/N:	0997
LD CAL200 Calibrator S/N:	2916
Operator:	David Limberg

	Measurement Period		
	12:40 PM to 1:00 PM	to	to
n*	Ln	Ln	Ln
2	72.1		
8	69.5		
25	66.9		
50	63.5		
90	55.4		
99	47.4		
Leq	65.6		
Lmax	77.4		
Lmin	46.1		



* 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.

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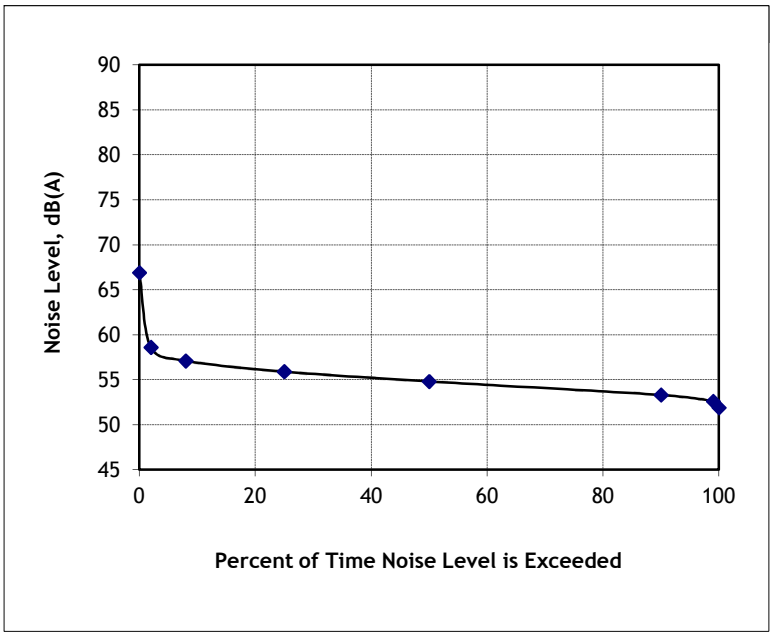
Table I-8. Noise Survey

Project:	Torrance Regional Transit Center
Position:	On project site at approximate corner of nearest proposed building to Dow Chemical
Date:	June 17, 2013
Time:	Noted
Noise Source:	Ambient traffic and Dow Chemical
Distance:	
SLM Height:	5'
LD 820 S/N:	0996
LD CAL200 Calibrator S/N:	2916
Operator:	Jonathan Higginson

	Measurement Period		
	1:03 PM to 1:23 PM	to	to
n*	Ln	Ln	Ln
2	58.6		
8	57.1		
25	55.9		
50	54.8		
90	53.3		
99	52.6		
Leq	55.3		
Lmax	66.9		
Lmin	51.9		



* 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.

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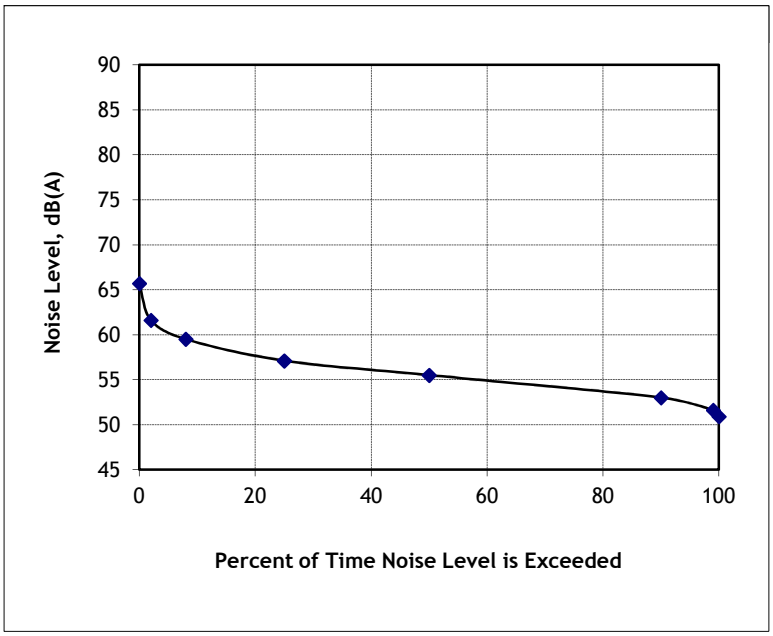
Table I-9. Noise Survey

Project:	Torrance Regional Transit Center
Position:	On project site
Date:	June 21, 2013
Time:	Noted
Noise Source:	Ambient traffic and Dow Chemical
Distance:	75'
SLM Height:	5'
LD 820 S/N:	0997
LD CAL200 Calibrator S/N:	2916
Operator:	David Limberg

	Measurement Period		
	10:00 AM to 10:20 AM	to	to
n*	Ln	Ln	Ln
2	61.6		
8	59.5		
25	57.1		
50	55.5		
90	53.0		
99	51.6		
Leq	56.5		
Lmax	65.7		
Lmin	50.9		



* 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.

WIELAND ACOUSTICS, INC.

Table I-10. Measured Hourly Noise Levels and CNEL

Location: On project site, at approx. location of nearest proposed building façade to Crenshaw & the rail line

Date	Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)	L(90)	L(99)	CNEL
17Jun 13	12:06	59.2	78.7	49.5	64.8	62.0	59.7	57.7	53.3	50.8	
17Jun 13	13:00	58.6	74.8	49.0	64.2	61.5	59.4	57.1	53.0	50.7	
17Jun 13	14:00	58.4	71.5	50.1	63.3	61.3	59.4	57.5	53.3	51.0	
17Jun 13	15:00	58.6	69.3	50.4	63.6	61.6	59.7	57.7	53.2	51.2	
17Jun 13	16:00	59.0	73.8	51.1	63.5	61.8	60.0	58.3	54.5	53.0	
17Jun 13	17:00	61.5	79.9	49.6	69.5	62.9	60.4	58.6	53.9	51.2	
17Jun 13	18:00	59.1	73.1	48.2	63.9	62.1	60.4	58.1	52.7	50.0	
17Jun 13	19:00	59.7	71.7	48.1	64.7	63.1	61.2	58.5	52.8	49.7	
17Jun 13	20:00	60.2	78.9	48.1	65.8	63.3	61.2	58.4	52.0	49.3	
17Jun 13	21:00	59.7	70.7	48.0	64.7	63.2	61.2	58.7	52.1	49.5	
17Jun 13	22:00	59.3	67.7	46.0	64.9	63.4	60.9	57.7	50.3	47.3	
17Jun 13	23:00	58.5	72.0	46.7	64.7	62.7	60.0	56.8	49.9	47.6	
18Jun 13	0:00	56.7	71.0	47.0	63.4	61.1	57.8	54.0	49.1	47.2	
18Jun 13	1:00	55.3	68.5	46.1	61.9	59.7	56.4	51.7	48.2	46.6	
18Jun 13	2:00	54.3	70.0	43.2	61.7	58.9	55.1	49.4	45.3	44.0	
18Jun 13	3:00	54.3	69.8	44.7	62.5	59.0	54.2	49.1	46.1	45.1	
18Jun 13	4:00	58.5	69.9	45.8	65.7	63.0	59.5	55.5	49.1	47.2	
18Jun 13	5:00	62.3	78.2	46.1	68.5	66.5	63.5	60.3	51.9	48.1	
18Jun 13	6:00	63.2	72.9	45.5	69.0	67.1	64.8	61.3	52.9	47.3	
18Jun 13	7:00	63.5	73.0	44.8	68.5	67.0	65.1	62.8	54.6	47.7	
18Jun 13	8:00	63.0	75.7	46.4	67.7	66.3	64.5	62.4	55.2	48.4	
18Jun 13	9:00	61.8	71.0	44.4	66.6	65.1	63.5	60.9	54.1	47.6	
18Jun 13	10:00	61.0	72.7	45.4	66.4	64.5	62.5	60.2	53.4	47.5	
18Jun 13	11:00	59.6	77.1	48.6	65.5	62.6	60.1	58.0	53.2	50.0	66.1
18Jun 13	12:00	58.4	71.0	49.1	63.5	61.4	59.5	57.6	53.6	51.2	66.1
18Jun 13	13:00	58.6	77.4	49.1	64.0	61.4	59.4	57.4	52.8	50.5	66.1
18Jun 13	14:00	58.7	71.5	49.1	64.8	61.7	59.4	57.5	53.0	50.8	66.1
18Jun 13	15:00	58.4	73.5	49.6	63.8	61.4	59.5	57.4	52.8	50.9	66.1
18Jun 13	16:00	58.5	67.2	50.8	62.9	61.4	59.7	57.8	53.9	51.7	66.1
18Jun 13	17:00	59.9	79.3	51.2	65.6	62.2	60.3	58.5	54.1	52.2	66.0
18Jun 13	18:00	60.2	73.5	48.9	65.7	62.9	61.0	58.9	53.9	51.2	66.1
18Jun 13	19:00	59.9	74.7	48.8	64.4	63.0	61.3	58.9	53.0	49.7	66.1
18Jun 13	20:00	60.0	74.5	47.8	64.8	63.2	61.5	58.8	52.8	49.6	66.1
18Jun 13	21:00	60.1	68.6	50.6	64.9	63.6	61.6	58.9	54.2	52.0	66.1

Table I-10, cont. Measured Hourly Noise Levels and CNEL

Location: On project site, at approx. location of nearest proposed building façade to Crenshaw & the rail line

Date	Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)	L(90)	L(99)	CNEL
18Jun 13	22:00	61.3	85.5	48.0	65.8	63.2	61.0	57.9	51.9	49.1	66.3
18Jun 13	23:00	58.6	78.6	47.5	63.9	61.9	59.6	56.5	50.8	48.5	66.3
19Jun 13	0:00	56.5	66.4	46.5	62.4	60.6	57.9	54.8	49.3	47.2	66.3
19Jun 13	1:00	55.0	67.5	46.0	61.8	59.3	55.8	52.2	48.4	46.6	66.3
19Jun 13	2:00	54.8	67.8	47.6	61.5	58.8	55.5	52.1	49.1	48.1	66.3
19Jun 13	3:00	55.4	69.5	48.7	62.9	59.8	55.8	51.8	49.4	49.0	66.3
19Jun 13	4:00	59.1	69.6	50.2	65.2	63.2	60.2	57.1	52.6	50.8	66.4
19Jun 13	5:00	62.5	75.8	50.2	67.9	66.4	63.8	61.1	55.6	53.2	66.4
19Jun 13	6:00	62.9	73.4	48.2	68.0	66.7	64.6	61.6	53.7	50.2	66.3
19Jun 13	7:00	63.8	86.0	48.3	67.9	66.3	64.3	61.6	54.5	50.3	66.3
19Jun 13	8:00	62.3	75.7	47.8	67.3	65.6	63.6	61.4	54.1	50.0	66.3
19Jun 13	9:00	60.3	80.2	48.8	64.9	63.0	61.1	59.1	54.4	51.2	66.3
19Jun 13	10:00	59.0	75.0	50.4	63.9	62.1	60.1	58.1	53.8	51.6	66.3
19Jun 13	11:00	62.9	91.7	51.0	63.7	61.8	60.0	58.1	54.5	52.5	66.3
19Jun 13	12:00	59.8	76.4	51.8	65.8	62.5	60.0	58.4	55.3	53.1	66.3
19Jun 13	13:00	60.1	80.7	49.8	64.4	62.1	60.1	58.1	53.9	51.3	66.4
19Jun 13	14:00	59.2	74.6	48.7	64.6	61.9	60.2	58.1	53.9	51.0	66.4
19Jun 13	15:00	58.7	69.4	50.0	63.8	61.8	59.7	57.8	53.7	51.4	66.4
19Jun 13	16:00	59.8	76.0	49.6	65.7	62.4	60.4	58.6	55.1	52.5	66.4
19Jun 13	17:00	61.3	77.1	50.9	69.0	63.2	61.0	59.2	55.4	52.9	66.4
19Jun 13	18:00	60.9	74.6	50.2	67.2	63.3	61.3	59.2	54.4	51.5	66.4
19Jun 13	19:00	60.7	69.0	48.1	65.8	64.2	62.2	59.8	53.7	49.8	66.4
19Jun 13	20:00	61.2	77.7	47.8	65.9	64.3	62.4	60.1	54.3	50.3	66.5
19Jun 13	21:00	60.4	74.7	49.6	64.9	63.7	61.9	59.4	53.6	50.7	66.5
19Jun 13	22:00	60.9	74.5	46.2	66.9	64.6	62.3	59.4	52.1	47.8	66.4
19Jun 13	23:00	60.4	78.3	43.7	66.0	63.7	61.0	58.0	50.1	46.0	66.6
20Jun 13	0:00	57.7	81.3	43.0	63.6	61.1	57.7	53.3	45.2	44.0	66.6
20Jun 13	1:00	55.1	71.8	44.9	62.1	59.6	56.0	51.1	46.2	45.1	66.6
20Jun 13	2:00	53.5	65.5	43.5	61.4	58.4	54.3	48.3	44.6	43.8	66.6
20Jun 13	3:00	54.3	71.6	44.1	62.2	59.3	54.8	48.7	45.3	44.2	66.6
20Jun 13	4:00	58.5	69.7	45.6	65.7	63.1	59.6	55.8	47.8	46.2	66.5
20Jun 13	5:00	62.4	72.0	49.2	68.6	66.4	63.7	60.8	53.4	50.3	66.5
20Jun 13	6:00	63.2	74.9	48.6	68.5	66.9	65.0	62.0	53.6	49.4	66.6
20Jun 13	7:00	63.8	76.6	47.7	68.7	67.1	65.2	63.1	55.6	49.8	66.6

Table I-10, cont. Measured Hourly Noise Levels and CNEL

Location: On project site, at approx. location of nearest proposed building façade to Crenshaw & the rail line

Date	Time	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)	L(90)	L(99)	CNEL
20Jun 13	8:00	63.0	75.0	45.5	68.0	66.4	64.6	62.2	54.0	46.9	66.6
20Jun 13	9:00	64.2	86.3	45.9	68.6	66.1	64.2	61.9	54.9	48.4	66.6
20Jun 13	10:00	62.2	79.7	45.3	66.9	65.3	63.4	61.1	54.4	47.9	66.7
20Jun 13	11:00	62.2	74.4	46.2	68.0	65.6	63.4	61.0	53.5	48.2	66.7
20Jun 13	12:00	61.0	73.2	47.7	66.5	64.6	62.3	59.5	54.0	50.0	66.7
20Jun 13	13:00	58.4	73.2	50.3	63.6	61.5	59.4	57.3	53.2	51.3	66.7
20Jun 13	14:00	58.5	72.1	50.0	63.7	61.1	59.4	57.5	53.4	51.2	66.7
20Jun 13	15:00	58.6	75.9	50.5	63.0	61.5	59.7	57.8	54.2	52.1	66.7
20Jun 13	16:00	59.8	74.3	49.5	65.6	62.1	60.1	58.1	53.7	51.1	66.7
20Jun 13	17:00	58.7	66.5	47.9	63.4	61.7	60.0	58.0	52.9	49.6	66.6
20Jun 13	18:00	61.1	77.7	49.1	70.9	63.0	60.6	58.6	53.5	51.1	66.6
20Jun 13	19:00	60.2	69.8	52.1	64.4	63.1	61.7	59.7	55.1	53.2	66.6
20Jun 13	20:00	60.8	68.4	52.5	65.2	63.7	62.2	59.9	56.2	53.7	66.6
20Jun 13	21:00	60.9	69.3	50.6	65.7	64.1	62.4	60.1	55.2	52.4	66.6
20Jun 13	22:00	60.4	67.5	49.3	65.5	64.2	62.0	59.1	53.4	50.7	66.6
20Jun 13	23:00	59.5	73.0	46.6	65.3	63.6	61.2	57.8	50.3	47.3	66.5
21Jun 13	0:00	59.5	81.0	48.4	65.8	62.2	59.5	56.3	50.7	49.0	66.6
21Jun 13	1:00	55.5	63.9	46.8	61.9	59.9	56.8	52.7	48.7	47.4	66.6
21Jun 13	2:00	54.1	65.7	42.5	61.5	59.0	55.4	49.5	44.2	43.0	66.6
21Jun 13	3:00	55.0	68.2	42.4	63.3	60.0	55.8	49.7	44.4	43.1	66.7
21Jun 13	4:00	58.1	72.5	45.0	64.9	62.4	59.2	55.2	47.5	45.6	66.6
21Jun 13	5:00	62.0	73.0	47.3	68.0	66.1	63.4	60.2	52.1	48.2	66.6
21Jun 13	6:00	62.8	73.7	49.0	68.4	66.8	64.4	60.9	53.7	50.2	66.5
21Jun 13	7:00	63.8	83.9	46.5	68.3	66.9	65.2	62.6	55.1	48.8	66.5
21Jun 13	8:00	63.5	76.5	46.1	68.0	66.6	64.9	62.9	55.1	48.2	66.5
21Jun 13	9:00	62.9	71.5	46.8	67.9	66.4	64.4	62.0	54.8	48.4	66.5

APPENDIX II

Traffic Noise Analysis

Table II-1. Analysis of Existing (2013) Without Project Traffic Noise Levels

Arterial / Reach	Speed Limit, mph	% Trucks		Traffic Dist.*	Avg. Daily Traffic (- Buses)	Number of Buses			Hard (H) or Soft (S) Site?	Dist., Sens. Rec. to C/L	Average Hourly Leq, dBA			CNEL at Sens. Rec.
		Med.	Hvy.			Day	Eve	Nite			Day	Eve	Nite	
190TH STREET														
West of Crenshaw Blvd	45	3.00%	5.00%	1	37,484	0	0	0	H	52'	73.4	69.7	65.6	74.5
East of Crenshaw Blvd	45	3.00%	5.00%	1	35,045	0	0	0	H	80'	71.1	67.4	63.3	72.2
208TH STREET														
East of Crenshaw Blvd	35	1.84%	0.74%	1	4,542	0	0	0	H	46'	60.0	57.5	52.2	61.3
CRENSHAW BOULEVARD														
North of 190th St	45	3.00%	5.00%	1	46,094	54	13	12	H	85'	72.0	68.4	64.2	73.1
North of Del Amo Blvd	45	3.00%	5.00%	1	42,837	54	13	12	H	229'	67.2	63.5	59.4	68.3
South of 208th St	35	3.00%	5.00%	1	44,648	54	13	12	H	53'	71.6	67.4	63.8	72.6
South of Torrance Blvd	35	3.00%	5.00%	1	42,083	55	12	12	H	54'	71.3	67.0	63.5	72.3
DEL AMO BOULEVARD														
East of Crenshaw Blvd	35	1.84%	0.74%	1	13,847	0	0	0	H	49'	64.6	62.0	56.8	65.9
TORRANCE BOULEVARD														
West of Crenshaw Blvd	35	3.00%	5.00%	1	26,847	39	7	9	H	47'	70.0	65.7	62.2	71.0
East of Crenshaw Blvd	35	3.00%	5.00%	1	29,922	39	7	9	H	48'	70.4	66.1	62.6	71.4

* The following summarizes the traffic distribution used in the analysis:

Traffic Distribution No.	Day			Evening			Night		
	A	MT	HT	A	MT	HT	A	MT	HT
1	75.51%	1.56%	0.64%	12.57%	0.09%	0.02%	9.34%	0.19%	0.08%

A = automobiles; MT = medium (2-axle) trucks; HT = heavy (3+ axle) trucks

The above values are adjusted as needed so that the overall medium truck and heavy truck percentages for a traffic distribution number agree with the values entered into the "% Trucks" columns on the summary table.

** For street segments with barriers, noise levels and contour distances are only reported for locations 10m (approx. 30') or more beyond the noise barrier.

Table II-2. Analysis of Existing (2013) Plus Project Traffic Noise Levels

Arterial / Reach	Speed Limit, mph	% Trucks		Traffic Dist.*	Avg. Daily Traffic (- Buses)	Number of Buses			Hard (H) or Soft (S) Site?	Dist., Sens. Rec. to C/L	Average Hourly Leq, dBA			CNEL at Sens. Rec.
		Med.	Hvy.			Day	Eve	Nite			Day	Eve	Nite	
190TH STREET														
West of Crenshaw Blvd	45	3.00%	5.00%	1	37,541	0	0	0	H	52'	73.4	69.7	65.6	74.5
East of Crenshaw Blvd	45	3.00%	5.00%	1	35,102	0	0	0	H	80'	71.1	67.4	63.3	72.2
208TH STREET														
West of Crenshaw Blvd	35	0.00%	0.00%	N/A	0	449	99	100	H	142'	54.9	54.4	49.7	57.9
East of Crenshaw Blvd	35	1.84%	0.74%	1	4,542	0	0	0	H	46'	60.0	57.5	52.2	61.3
CRENSHAW BOULEVARD														
North of 190th St	45	3.00%	5.00%	1	46,242	115	28	25	H	85'	72.1	68.4	64.3	73.2
North of Del Amo Blvd	45	3.00%	5.00%	1	43,098	115	28	25	H	229'	67.2	63.6	59.5	68.4
South of 208th St	35	3.00%	5.00%	1	44,914	328	79	73	H	53'	71.8	67.8	64.1	72.9
South of Torrance Blvd	35	3.00%	5.00%	1	42,401	117	25	26	H	54'	71.3	67.1	63.6	72.4
DEL AMO BOULEVARD														
East of Crenshaw Blvd	35	1.84%	0.74%	1	13,904	0	0	0	H	49'	64.6	62.0	56.7	65.8
TORRANCE BOULEVARD														
West of Crenshaw Blvd	35	3.00%	5.00%	1	26,859	111	20	25	H	47'	70.0	65.8	62.3	71.1
East of Crenshaw Blvd	35	3.00%	5.00%	1	29,968	111	20	25	H	48'	70.4	66.2	62.7	71.5

* The following summarizes the traffic distribution used in the analysis:

Traffic Distribution No.	Day			Evening			Night		
	A	MT	HT	A	MT	HT	A	MT	HT
1	75.51%	1.56%	0.64%	12.57%	0.09%	0.02%	9.34%	0.19%	0.08%

A = automobiles; MT = medium (2-axle) trucks; HT = heavy (3+ axle) trucks

The above values are adjusted as needed so that the overall medium truck and heavy truck percentages for a traffic distribution number agree with the values entered into the "% Trucks" columns on the summary table.

** For street segments with barriers, noise levels and contour distances are only reported for locations 10m (approx. 30') or more beyond the noise barrier.

Table II-3. Analysis of Future (2015) Without Project Traffic Noise Levels

Arterial / Reach	Speed Limit, mph	% Trucks		Traffic Dist.*	Avg. Daily Traffic (- Buses)	Number of Buses			Hard (H) or Soft (S) Site?	Dist., Sens. Rec. to C/L	Average Hourly Leq, dBA			CNEL at Sens. Rec.
		Med.	Hvy.			Day	Eve	Nite			Day	Eve	Nite	
190TH STREET														
West of Crenshaw Blvd	45	3.00%	5.00%	1	39,207	0	0	0	H	52'	73.6	69.9	65.8	74.7
East of Crenshaw Blvd	45	3.00%	5.00%	1	36,729	0	0	0	H	80'	71.3	67.6	63.5	72.4
208TH STREET														
East of Crenshaw Blvd	35	1.84%	0.74%	1	4,542	0	0	0	H	46'	60.0	57.5	52.2	61.3
CRENSHAW BOULEVARD														
North of 190th St	45	3.00%	5.00%	1	52,294	54	13	12	H	85'	72.6	68.9	64.8	73.7
North of Del Amo Blvd	45	3.00%	5.00%	1	49,073	54	13	12	H	229'	67.8	64.1	60.0	68.9
South of 208th St	35	3.00%	5.00%	1	48,266	54	13	12	H	53'	72.0	67.7	64.2	73.0
South of Torrance Blvd	35	3.00%	5.00%	1	45,757	55	12	12	H	54'	71.7	67.4	63.9	72.7
DEL AMO BOULEVARD														
East of Crenshaw Blvd	35	1.84%	0.74%	1	15,421	0	0	0	H	49'	65.1	62.5	57.2	66.3
TORRANCE BOULEVARD														
West of Crenshaw Blvd	35	3.00%	5.00%	1	28,652	39	7	9	H	47'	70.3	66.0	62.5	71.3
East of Crenshaw Blvd	35	3.00%	5.00%	1	32,432	39	7	9	H	48'	70.7	66.4	62.9	71.7

* The following summarizes the traffic distribution used in the analysis:

Traffic Distribution No.	Day			Evening			Night		
	A	MT	HT	A	MT	HT	A	MT	HT
1	75.51%	1.56%	0.64%	12.57%	0.09%	0.02%	9.34%	0.19%	0.08%

A = automobiles; MT = medium (2-axle) trucks; HT = heavy (3+ axle) trucks

The above values are adjusted as needed so that the overall medium truck and heavy truck percentages for a traffic distribution number agree with the values entered into the "% Trucks" columns on the summary table.

** For street segments with barriers, noise levels and contour distances are only reported for locations 10m (approx. 30') or more beyond the noise barrier.

Table II-4. Analysis of Future (2015) Plus Project Traffic Noise Levels

Arterial / Reach	Speed Limit, mph	% Trucks		Traffic Dist.*	Avg. Daily Traffic (- Buses)	Number of Buses			Hard (H) or Soft (S) Site?	Dist., Sens. Rec. to C/L	Average Hourly Leq, dBA			CNEL at Sens. Rec.
		Med.	Hvy.			Day	Eve	Nite			Day	Eve	Nite	
190TH STREET														
West of Crenshaw Blvd	45	3.00%	5.00%	1	39,264	0	0	0	H	52'	73.6	69.9	65.8	74.7
East of Crenshaw Blvd	45	3.00%	5.00%	1	36,786	0	0	0	H	80'	71.3	67.6	63.5	72.4
208TH STREET														
West of Crenshaw Blvd	35	0.00%	0.00%	N/A	0	449	99	100	H	142'	54.9	54.4	49.7	57.9
East of Crenshaw Blvd	35	1.84%	0.74%	1	4,542	0	0	0	H	46'	60.0	57.5	52.2	61.3
CRENSHAW BOULEVARD														
North of 190th St	45	3.00%	5.00%	1	52,442	115	28	25	H	85'	72.6	69.0	64.8	73.7
North of Del Amo Blvd	45	3.00%	5.00%	1	49,334	115	28	25	H	229'	67.8	64.2	60.1	69.0
South of 208th St	35	3.00%	5.00%	1	48,532	328	79	73	H	53'	72.1	68.1	64.5	73.3
South of Torrance Blvd	35	3.00%	5.00%	1	46,075	117	25	26	H	54'	71.7	67.5	63.9	72.7
DEL AMO BOULEVARD														
East of Crenshaw Blvd	35	1.84%	0.74%	1	15,478	0	0	0	H	49'	65.1	62.5	57.3	66.4
TORRANCE BOULEVARD														
West of Crenshaw Blvd	35	3.00%	5.00%	1	28,664	111	20	25	H	47'	70.3	66.1	62.6	71.4
East of Crenshaw Blvd	35	3.00%	5.00%	1	32,478	111	20	25	H	48'	70.8	66.5	63.0	71.8

* The following summarizes the traffic distribution used in the analysis:

Traffic Distribution No.	Day			Evening			Night		
	A	MT	HT	A	MT	HT	A	MT	HT
1	75.51%	1.56%	0.64%	12.57%	0.09%	0.02%	9.34%	0.19%	0.08%

A = automobiles; MT = medium (2-axle) trucks; HT = heavy (3+ axle) trucks

The above values are adjusted as needed so that the overall medium truck and heavy truck percentages for a traffic distribution number agree with the values entered into the "% Trucks" columns on the summary table.

** For street segments with barriers, noise levels and contour distances are only reported for locations 10m (approx. 30') or more beyond the noise barrier.

Table II-5. Analysis of Future (2015) Plus Project Traffic Noise Levels at the Project Site

Arterial / Reach	Speed Limit, mph	% Trucks		Traffic Dist.*	Avg. Daily Traffic (- Buses)	Number of Buses			Hard (H) or Soft (S) Site?	Dist., Sens. Rec. to C/L	Average Hourly Leq, dBA			CNEL at Sens. Rec.
		Med.	Hvy.			Day	Eve	Nite			Day	Eve	Nite	
208TH STREET														
West of Crenshaw Blvd	35	0.00%	0.00%	N/A	0	449	99	100	H	142'	54.9	54.4	49.7	57.9
CRENSHAW BOULEVARD														
South of 208th St	35	3.00%	5.00%	1	3,805	328	79	73	H	128'	58.8	56.6	52.2	60.7

* The following summarizes the traffic distribution used in the analysis:

Traffic Distribution No.	Day			Evening			Night		
	A	MT	HT	A	MT	HT	A	MT	HT
1	75.51%	1.56%	0.64%	12.57%	0.09%	0.02%	9.34%	0.19%	0.08%

A = automobiles; MT = medium (2-axle) trucks; HT = heavy (3+ axle) trucks

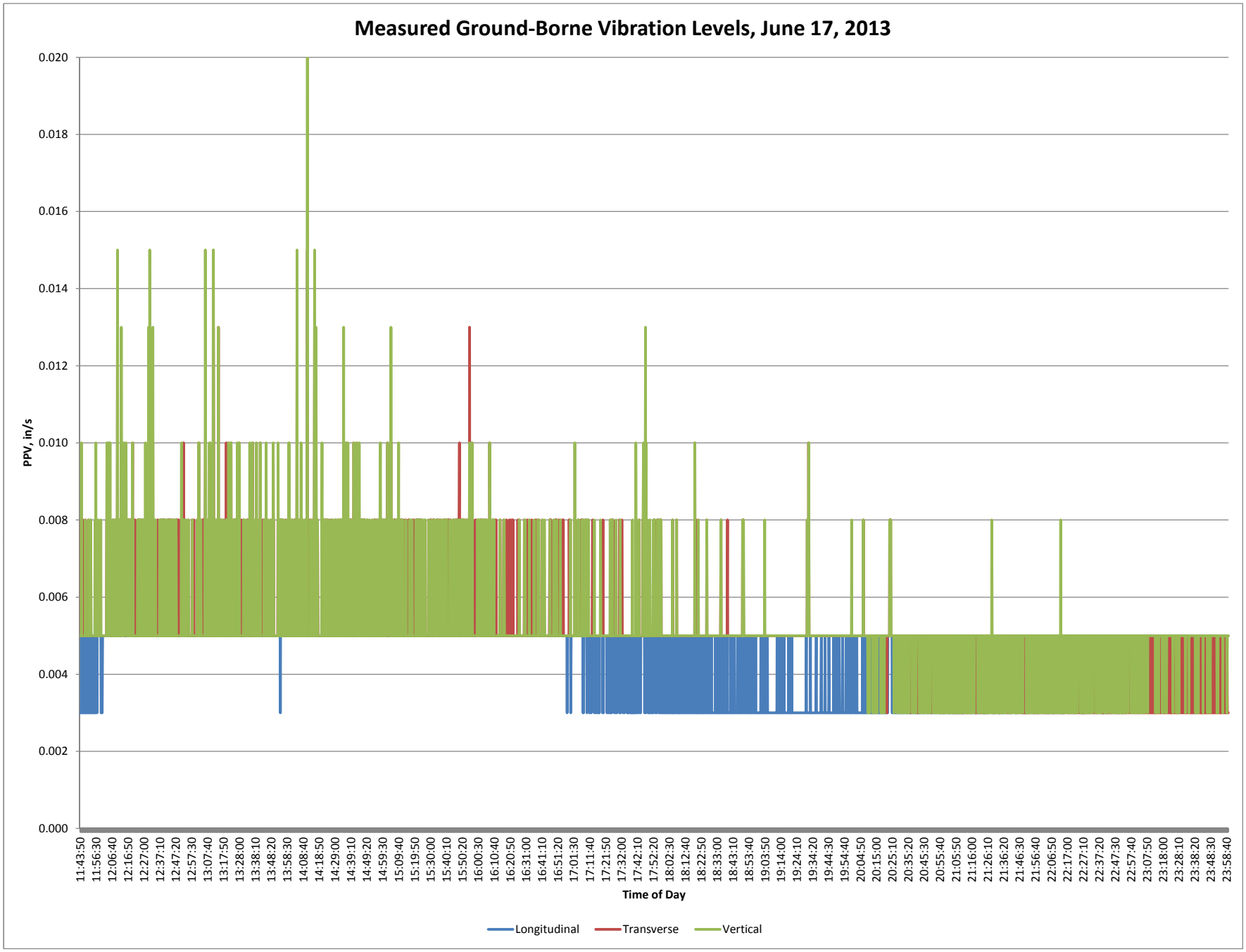
The above values are adjusted as needed so that the overall medium truck and heavy truck percentages for a traffic distribution number agree with the values entered into the "% Trucks" columns on the summary table.

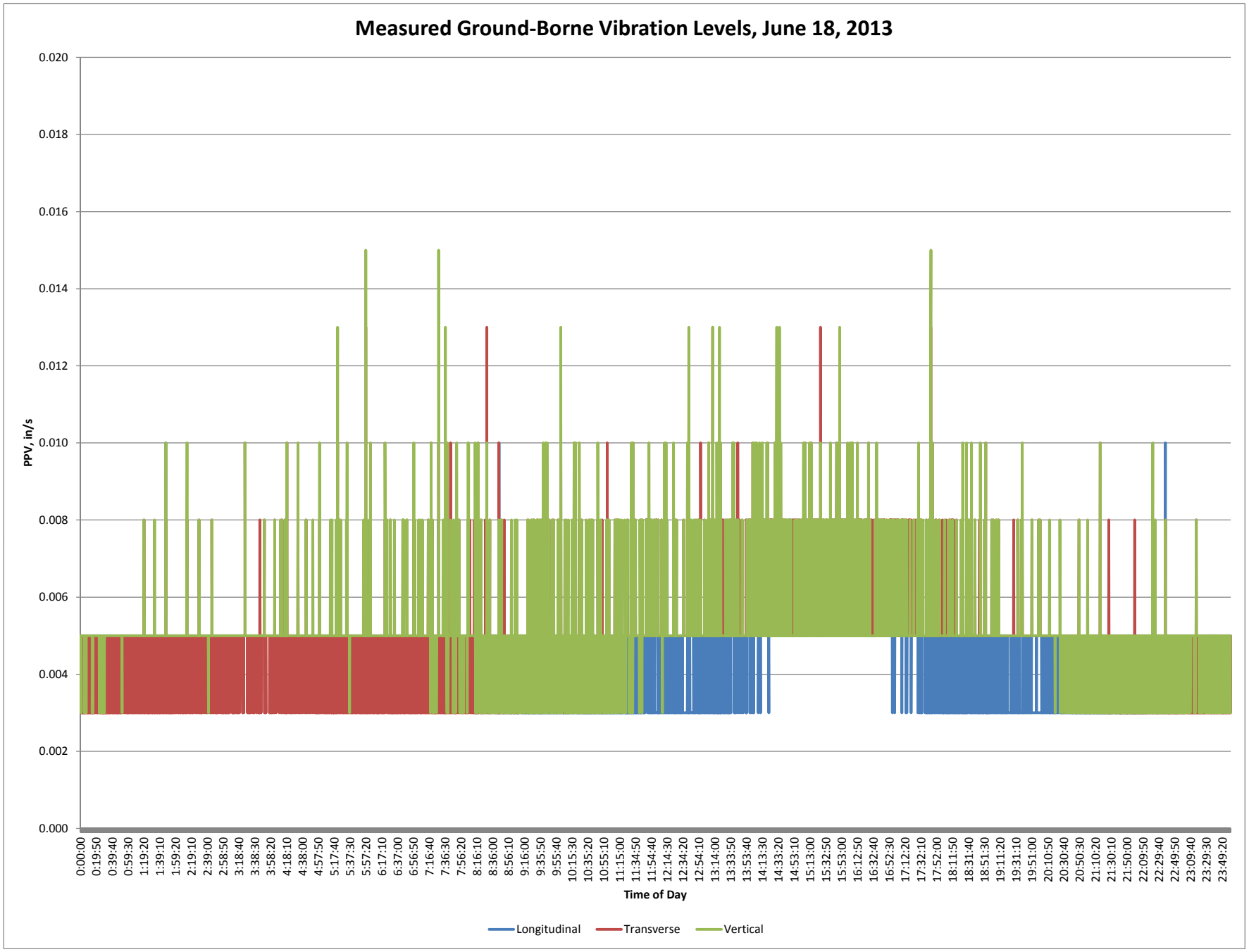
** For street segments with barriers, noise levels and contour distances are only reported for locations 10m (approx. 30') or more beyond the noise barrier.

** For street segments with barriers, noise levels and contour distances are only reported for locations 10m (approx. 30') or more beyond the noise barrier.

APPENDIX III

Vibration Measurements


Measured Ground-Borne Vibration Levels, June 17, 2013
PPV, in/s
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
11:43:50
11:56:30
12:06:40
12:16:50
12:27:00
12:37:10
12:47:20
12:57:30
13:07:40
13:17:50
13:28:00
13:38:10
13:48:20
13:58:30
14:08:40
14:18:50
14:29:00
14:39:10
14:49:20
14:59:30
15:09:40
15:19:50
15:30:00
15:40:10
15:50:20
16:00:30
16:10:40
16:20:50
16:31:00
16:41:10
16:51:20
17:01:30
17:11:40
17:21:50
17:32:00
17:42:10
17:52:20
18:02:30
18:12:40
18:22:50
18:33:00
18:43:10
18:53:40
19:03:50
19:14:00
19:24:10
19:34:20
19:44:30
19:54:40
20:04:50
20:15:00
20:25:10
20:35:20
20:45:30
20:55:40
21:05:50
21:16:00
21:26:10
21:36:20
21:46:30
21:56:40
22:06:50
22:17:00
22:27:10
22:37:20
22:47:30
22:57:40
23:07:50
23:18:00
23:28:10
23:38:20
23:48:30
23:58:40
Time of Day
Longitudinal
Transverse
Vertical


Measured Ground-Borne Vibration Levels, June 18, 2013
PPV, in/s
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0:00:00
0:19:50
0:39:40
0:59:30
1:19:20
1:39:10
1:59:20
2:19:10
2:39:00
2:58:50
3:18:40
3:38:30
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4:38:00
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6:37:00
6:56:50
7:16:40
7:36:30
7:56:20
8:16:10
8:36:00
8:56:10
9:16:00
9:35:50
9:55:40
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10:35:20
10:55:10
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11:54:40
12:14:30
12:34:20
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15:53:00
16:12:50
16:32:40
16:52:30
17:12:20
17:32:10
17:52:00
18:11:50
18:31:40
18:51:30
19:11:20
19:31:10
19:51:00
20:10:50
20:30:40
20:50:30
21:10:20
21:30:10
21:50:00
22:09:50
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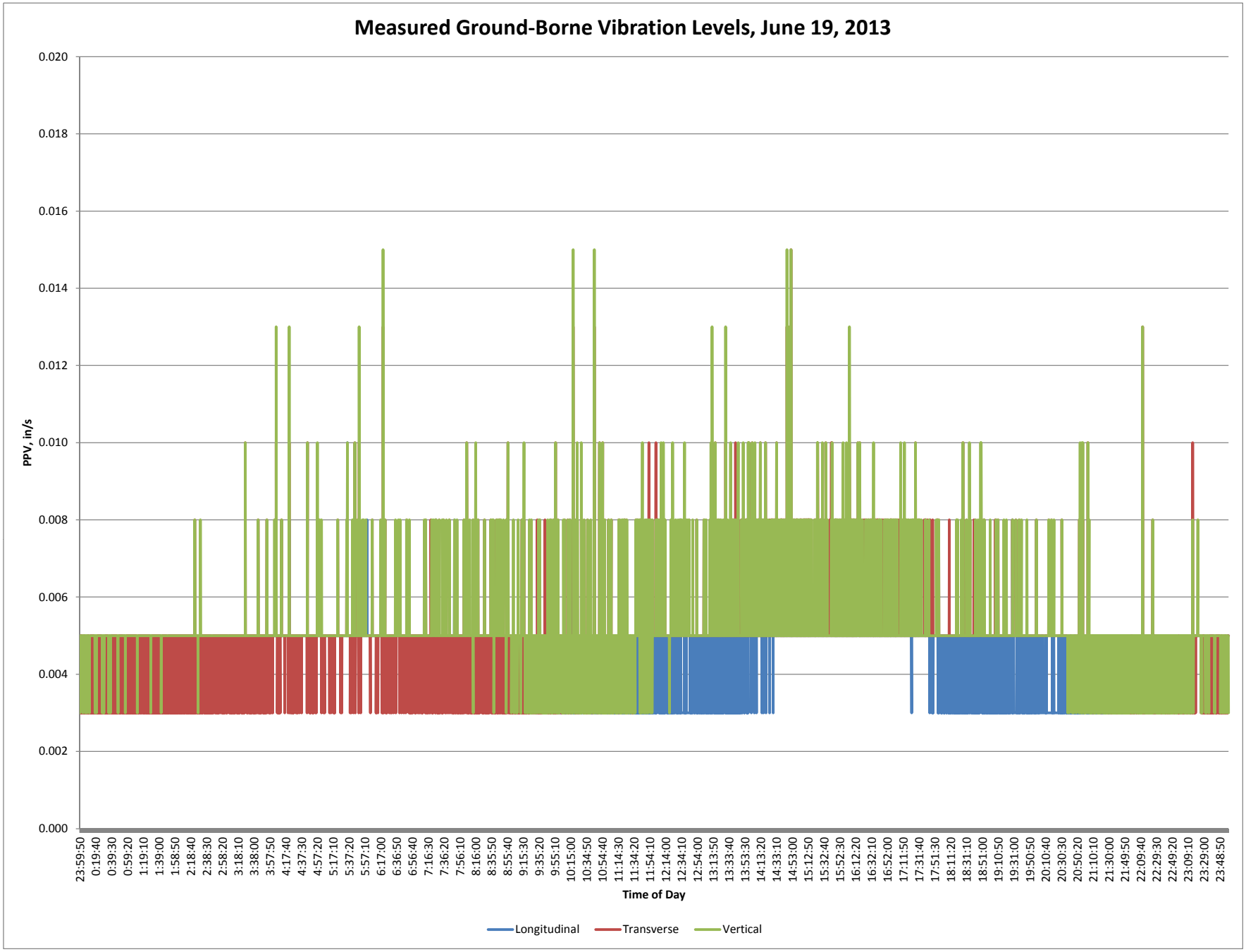
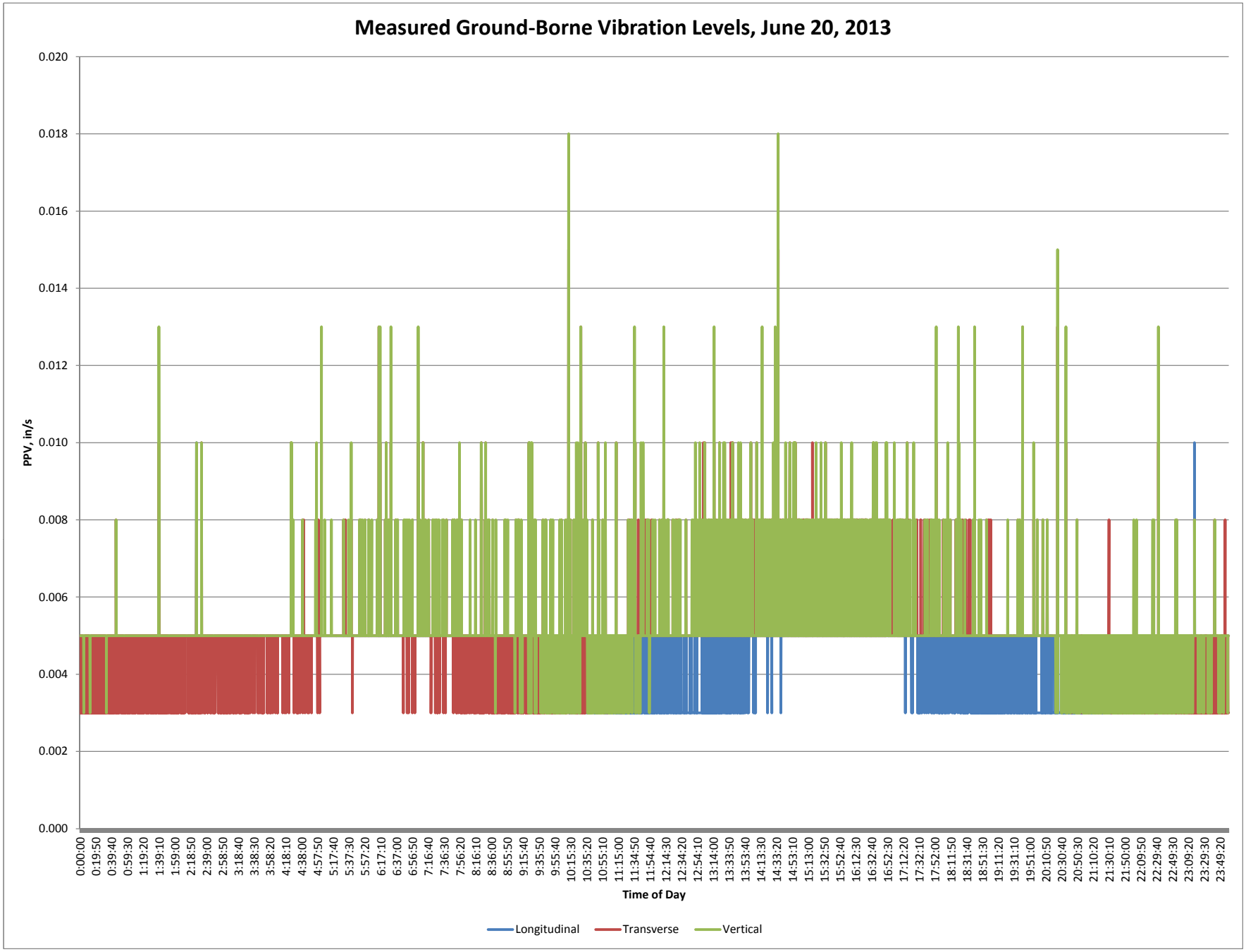
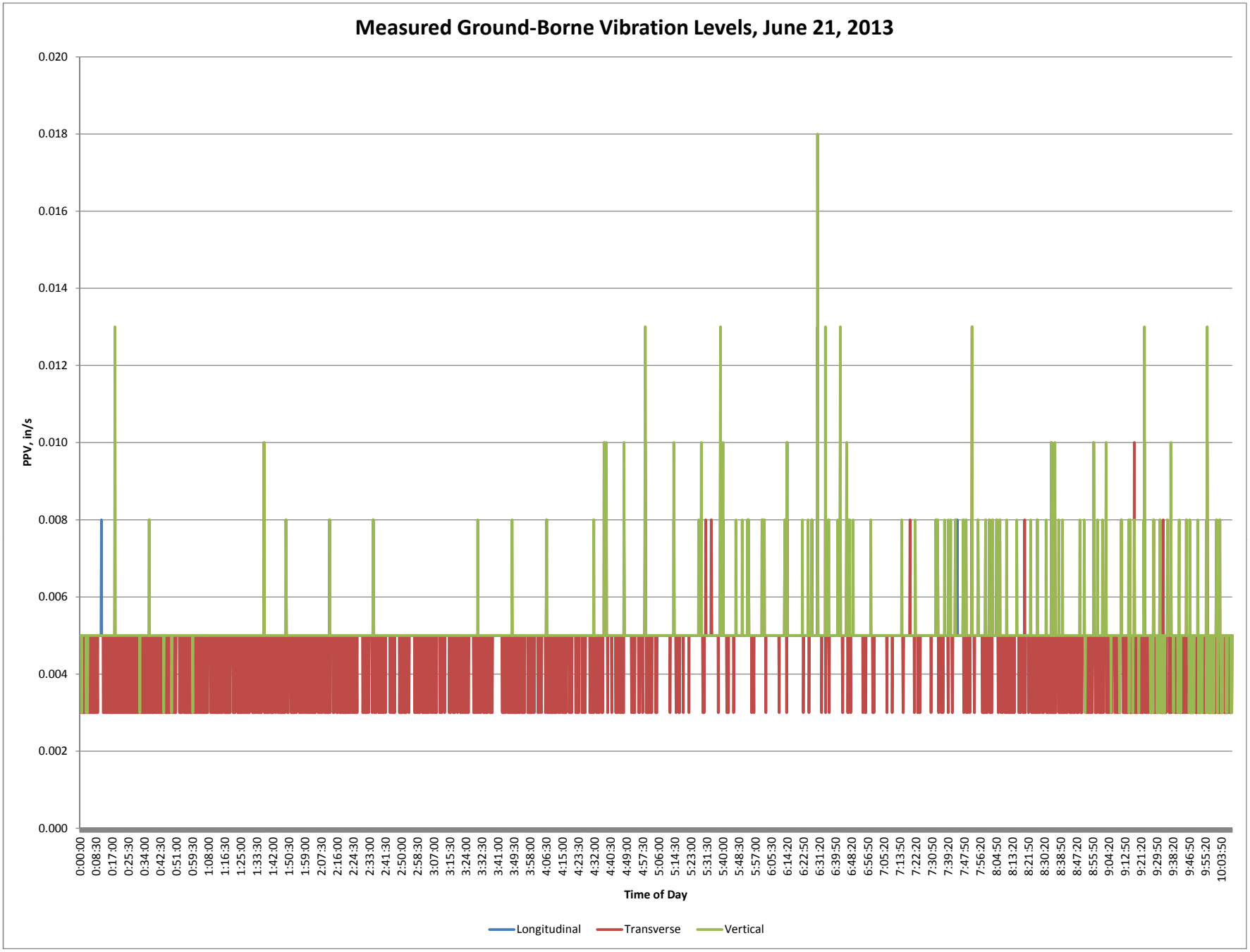
22:49:50
23:09:40
23:29:30
23:49:20
Time of Day
Longitudinal
Transverse
Vertical


Measured Ground-Borne Vibration Levels, June 19, 2013
PPV, in/s
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Time of Day
Longitudinal
Transverse
Vertical


Measured Ground-Borne Vibration Levels, June 20, 2013
PPV, in/s
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0:00:00
0:19:50
0:39:40
0:59:30
1:19:20
1:39:10
1:59:00
2:18:50
2:39:00
2:58:50
3:18:40
3:38:30
3:58:20
4:18:10
4:38:00
4:57:50
5:17:40
5:37:30
5:57:20
6:17:10
6:37:00
6:56:50
7:16:40
7:36:30
7:56:20
8:16:10
8:36:00
8:55:50
9:15:40
9:35:50
9:55:40
10:15:30
10:35:20
10:55:10
11:15:00
11:34:50
11:54:40
12:14:30
12:34:20
12:54:10
13:14:00
13:33:50
13:53:40
14:13:30
14:33:20
14:53:10
15:13:00
15:32:50
15:52:40
16:12:30
16:32:40
16:52:30
17:12:20
17:32:10
17:52:00
18:11:50
18:31:40
18:51:30
19:11:20
19:31:10
19:51:00
20:10:50
20:30:40
20:50:30
21:10:20
21:30:10
21:50:00
22:09:50
22:29:40
22:49:30
23:09:20
23:29:30
23:49:20
Time of Day
Longitudinal
Transverse
Vertical


Measured Ground-Borne Vibration Levels, June 21, 2013
PPV, in/s
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0:00:00
0:08:30
0:17:00
0:25:30
0:34:00
0:42:30
0:51:00
0:59:30
1:08:00
1:16:30
1:25:00
1:33:30
1:42:00
1:50:30
1:59:00
2:07:30
2:16:00
2:24:30
2:33:00
2:41:30
2:50:00
2:58:30
3:07:00
3:15:30
3:24:00
3:32:30
3:41:00
3:49:30
3:58:00
4:06:30
4:15:00
4:23:30
4:32:00
4:40:30
4:49:00
4:57:30
5:06:00
5:14:30
5:23:00
5:31:30
5:40:00
5:48:30
5:57:00
6:05:30
6:14:20
6:22:50
6:31:20
6:39:50
6:48:20
6:56:50
7:05:20
7:13:50
7:22:20
7:30:50
7:39:20
7:47:50
7:56:20
8:04:50
8:13:20
8:21:50
8:30:20
8:38:50
8:47:20
8:55:50
9:04:20
9:12:50
9:21:20
9:29:50
9:38:20
9:46:50
9:55:20
10:03:50
Time of Day
Longitudinal
Transverse
Vertical