Appendix D – Revised

Noise Impact Analysis Report

Elder Creek Channel Improvements

NOISE IMPACT ANALYSIS

CITY OF HIGHLAND

PREPARED BY:

Bill Lawson, PE, INCE
blawson@urbanxroads.com
(949) 336-5979

NOVEMBER 21, 2019

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LIST OF ABBREVIATED TERMS

(1)	Reference
ADT	Average Daily Traffic
ANSI	American National Standards Institute
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dBA	A-weighted decibels
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
INCE	Institute of Noise Control Engineering
L_{eq}	Equivalent continuous (average) sound level
L_{max}	Maximum level measured over the time interval
L_{min}	Minimum level measured over the time interval
mph	Miles per hour
PPV	Peak Particle Velocity
Project	Elder Creek Channel Improvements
RMS	Root-mean-square
VdB	Vibration Decibels

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EXECUTIVE SUMMARY

Urban Crossroads, Inc. has prepared this noise study to determine the noise exposure and the necessary noise mitigation measures, if any, for the proposed Elder Creek Channel Improvements ("Project"). The Project site is located between Old Greenspot to approximately 650 feet southwest of Abbey Road in the City of Highland. The proposed Project includes the construction of improvements to the Elder Creek Channel beginning downstream of Old Greenspot Road and terminating just below the confluence of Elder and Church Channel. This study has been prepared consistent with applicable City of Highland noise standards, and significance criteria based on guidance provided by Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (1)

CONSTRUCTION NOISE ANALYSIS

Construction activities are expected to create temporary and intermittent high-level noise conditions at receiver locations surrounding the Project site. This analysis includes an evaluation of typical construction equipment activities in addition to providing a focused assessment of potential impacts related to pile-driving equipment. While public works projects, such as the Elder Creek Channel Improvements, are considered exempt from the noise standards of the City of Highland Municipal Code, neither the General Plan nor Municipal Code establish numeric construction source noise level thresholds at potentially affected receivers for analysis under CEQA. Therefore, this noise analysis relies on the National Institute for Occupational Safety and Health (NIOSH) threshold of 85 dBA L_{eq}, which is consistent with and more conservative than the Federal Transit Administration (FTA) threshold of 90 dBA L_{eq} for daytime construction activities.

TYPICAL CONSTRUCTION ACTIVITY NOISE LEVELS

The highest unmitigated construction noise levels at each receiver location are expected to range from 74 to 92 dBA L_{eq} and will exceed the 85 dBA L_{eq} threshold at 8 of the 13 receiver locations: R1, R2, R3, R5, R6, R7, R8, and R9. Therefore, unmitigated Project construction noise levels from typical construction activities are considered *potentially significant* impacts at receiver locations R1, R2, R3, R5, R6, R7, R8, and R9, if they represent occupied, sensitive receiver locations (e.g., residential use) at the time of Project construction. As a part of the Construction Mitigation Plan for the Project, temporary construction noise mitigation measures are, therefore, required to reduce the impacts at receiver locations R1, R2, R3, R5, R6, R7, R8, and R9. This includes construction noise mitigation in the form of minimum 10-foot high temporary noise barriers when activities are within 25 feet of nearby, occupied receiver locations. The temporary construction noise barrier mitigation will reduce the construction noise levels at the potentially impacted receiver locations to satisfy the 85 dBA L_{eq} threshold for noise-sensitive receiver locations. Therefore, the noise impact due to typical Project construction activities is considered a *less than significant* impact with mitigation for receiver locations R1, R2, R3, R5, R6, R7, R8, and R9. The construction noise mitigation plan further outlines the required mitigation measures to reduce construction noise impacts.

PILE DRIVING CONSTRUCTION NOISE LEVELS

The pile driving construction noise analysis shows that the highest construction noise levels will occur if impact pile driving equipment is used at the closest point from the edge of primary construction activity to each of the nearby receiver locations. The impact pile driving equipment noise levels, ranging from 76 to 108 dBA L_{eq} will exceed the 85 dBA L_{eq} construction noise level threshold at 10 of the 13 receiver locations: R1 to R10. Pile driving equipment noise levels with alternative drilling equipment, instead of impact devices, are shown to range from 59 to 91 dBA L_{eq} and will exceed the 85 dBA L_{eq} construction noise level threshold at four of the 13 receiver locations: R1, R3, R5, and R8. Therefore, both the unmitigated impact and drilling pile driving equipment noise levels represent *potentially significant* noise impacts.

Construction noise mitigation measures are therefore required to reduce the impacts at the nearby, occupied sensitive receiver locations. Non-impact pile driving equipment (e.g., drilling or other non-impact methods) shall be required to reduce the pile driving equipment noise levels at adjacent receiver locations. Further, mitigation in the form of minimum 10-foot high temporary noise barriers when activities are within 25 feet of nearby receiver locations shall be required. The temporary construction noise barrier mitigation will reduce the pile driving (e.g., drilling or non-impact alternative) equipment noise levels at the potentially impacted, occupied receiver locations to satisfy the 85 dBA L_{eq} threshold for noise-sensitive receiver locations. Therefore, the noise impact due to typical Project construction activities is considered a *less than significant* impact with mitigation for receiver locations R1, R3, R5, and R8 during pile driving (e.g., drilling or non-impact alternative) activities. The Construction Mitigation Plan further outlines the required mitigation measures to reduce pile driving noise impacts.

CONSTRUCTION VIBRATION ANALYSIS

Construction activities are expected to create temporary and intermittent high-level vibration conditions at receivers surrounding the Project site. This analysis includes an evaluation of typical construction equipment activities in addition to providing a focused assessment of potential impacts related to pile-driving equipment.

TYPICAL CONSTRUCTION ACTIVITY VIBRATION LEVELS

At distances ranging from 10 to 73 feet from the Project site, typical construction activity vibration velocity levels are expected to range from 0.018 to 0.352 in/sec PPV. As such, Project construction vibration levels will exceed the County of San Bernardino Development Code threshold of 0.2 in/sec PPV at receiver locations R1, R3, and R8. In addition, construction vibration levels are shown to exceed the building damage threshold of 0.3 in/sec PPV at receiver locations R3 and R8. Therefore, the unmitigated temporary construction-related vibration levels are considered a *potentially significant* impact.

Temporary construction vibration mitigation measures are required to reduce the impacts at nearby sensitive receiver locations. The Construction Mitigation Plan outlined in this report identifies the measures required to satisfy the 0.3 in/sec PPV building damage vibration threshold at nearby sensitive receiver locations to *less than significant* impacts after mitigation. Mitigation includes ground-borne vibration monitoring of nearby residential structures, represented by receiver locations R3 and R8 adjacent to the channel between Old Greenspot Road and Merris Street, shall be required for the duration of Project construction between Old Greenspot Road and Merris Street. The monitoring shall be based on the Caltrans residential building damage threshold of 0.3 in/sec PPV. Though Caltrans identifies a residential building damage threshold of 0.3 in/sec PPV, the County of San Bernardino may require that vibration levels do not exceed a more conservative threshold (e.g., lower) at their discretion.

However, vibration levels will still exceed the human annoyance threshold of 0.2 in/sec PPV at receiver locations R1, R3, and R8, and therefore, Project typical construction vibration levels represent a *potentially significant* impact at occupied residential homes in relation to human annoyance with mitigation. The Construction Mitigation Plan outlined in this report identifies the measures required to satisfy the County's 0.2 in/sec PPV threshold at nearby sensitive receiver locations to *less than significant* impacts after mitigation. If monitored vibration levels exceed the 0.2 in/sec PPV annoyance threshold then relocation of residents, and/or hours restrictions to day(s)/time(s) when the impacted receiver(s) are unoccupied, shall be provided for the duration of activities within 25 feet of the affected receiver location(s).

Further, vibration levels at the site of the closest sensitive receiver are unlikely to be sustained during the entire construction period but will occur rather only during the times that heavy construction equipment is operating adjacent to the Project site perimeter. Moreover, construction at the Project site will be restricted to daytime hours consistent with City requirements thereby eliminating potential vibration impacts during the sensitive nighttime hours.

PILE DRIVING CONSTRUCTION VIBRATION LEVELS

At distances ranging from 10 to 384 feet from pile driving (impact) activities, vibration velocity levels are expected to range from 0.011 to 2.530 in/sec PPV. The Project construction vibration levels will exceed the County's human annoyance threshold of 0.2 in/sec PPV at receiver locations R1 to R8. In addition, pile driving (impact) vibration levels are shown to exceed the building damage threshold of 0.3 in/sec PPV at receiver locations R1, and R3 to R8. Therefore, the unmitigated temporary impact pile driving-related vibration levels are considered a *potentially significant* impact.

Temporary construction vibration mitigation measures are required to reduce the impacts at nearby sensitive receiver locations during pile driving activities. Consistent with the pile driving measures identified in this report to reduce impact pile driving noise levels, the use of alternative pile driving equipment (e.g., drilling or non-impact alternative) shall be required instead of impact devices. The mitigated pile driving vibration levels with alternative equipment (e.g., drilling or non-impact alternative) will be reduced to range from 0.001 to 0.352 in/sec PPV and will still exceed the Caltrans 0.3 in/sec PPV building damage threshold for older residential structures at

receiver locations R3 and R8. Therefore, the vibration monitoring as part of the Construction Mitigation Plan identified in this noise study shall be required to reduce impacts to *less than significant* levels.

In addition, pile driving (e.g., drilling or non-impact alternative) equipment vibration levels will potentially exceed the human annoyance threshold of 0.2 in/sec PPV at receiver locations R1, R3, and R8, and therefore, Project pile driving (e.g., drilling or non-impact alternative) vibration levels represent a *potentially significant* impact at occupied residential homes in relation to human annoyance with mitigation. However, the Construction Mitigation Plan outlined in this report identifies the measures required to satisfy the 0.2 in/sec PPV human annoyance vibration threshold at nearby sensitive receiver locations to *less than significant* impacts after mitigation.

CONSTRUCTION MITIGATION PLAN

The following construction noise and vibration mitigation plan is required to reduce potential impacts at adjacent, sensitive residential structures, and occupied sensitive residential receiver locations. Table ES-1 outlines the mitigated measures listed below.

1. MITIGATION MEASURES REQUIRED TO REDUCE IMPACTS AT SENSITIVE STRUCTURES

- The use of impact pile driving equipment shall be prohibited. Instead, alternative pile driving methods and equipment (e.g., drilling or non-impact alternative) shall be used to reduce Project construction noise and vibration levels.
- Pre- and post-construction surveys of the nearby residential structure(s), documenting the condition of the interior and exterior of the structures, shall be provided for residential structures represented by receiver locations R3 and R8, adjacent to the channel between Old Greenspot Road and Merris Street.
- Ground-borne vibration monitoring of nearby residential structures, represented by receiver locations R1, R3 and R8 adjacent to the channel between Old Greenspot Road and Merris Street, shall be required for the duration of Project construction between Old Greenspot Road and Merris Street. The monitoring shall be based on the Caltrans residential building damage threshold of 0.3 in/sec PPV. Though Caltrans identifies a residential building damage threshold of 0.3 in/sec PPV, the County of San Bernardino may require that vibration levels do not exceed a more conservative threshold (e.g., lower) at their discretion.

2. MITIGATION MEASURES REQUIRED TO REDUCE IMPACTS AT SENSITIVE RECEIVER LOCATIONS (IF OCCUPIED)

- If monitored vibration levels exceed the County of San Bernardino 0.2 in/sec PPV annoyance threshold then relocation of residents, and/or hours restrictions to day(s)/time(s) when the impacted receiver(s) are unoccupied, shall be provided for the duration of activities within 25 feet of the affected receiver location(s).
- Install the following temporary construction noise barriers at the minimum heights specified for each receiver location when Project construction activities are within 25 feet of occupied noise-sensitive residential homes:
    - Minimum 10-foot high temporary noise barriers for occupied residential homes represented by receiver locations R1, R2, R3, R5, R6, R7, R8 and R9;
    - The temporary noise control barriers shall be located at the edge of Project construction activities and must have a solid face from top to bottom. The noise control barrier must meet the minimum height and be constructed as follows:
        - The temporary noise barrier shall provide a minimum transmission loss of 20 Dba (Federal Highway Administration, Noise Barrier Design Handbook). The noise barrier shall be constructed using an acoustical blanket (e.g. vinyl acoustic curtains or quilted blankets) attached to the construction site perimeter fence or equivalent temporary fence posts. Example photos are provided in Appendix 7.3;
        - The noise barrier must be maintained, and any damage promptly repaired. Gaps, holes, or weaknesses in the barrier or openings between the barrier and the ground shall be promptly repaired;

- The noise control barrier and associated elements shall be completely removed, and the site appropriately restored upon the conclusion of the construction activity.

Relocation and/or Hours Restrictions

- If the above is not feasible then relocation of residents, and/or hours restrictions to day(s)/time(s) when the impacted receiver(s) are unoccupied, shall be provided for the duration of activities within 25 feet of the affected receiver location(s).

STANDARD MEASURES REQUIRED THROUGHOUT PROJECT CONSTRUCTION

- During all Project site construction, the construction contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with manufacturers' standards. The construction contractor shall place all stationary construction equipment so that emitted noise is directed away from the noise-sensitive receivers nearest the Project site.
- The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receivers nearest the Project site during all Project construction (i.e., south of Abbey Way).
- The contractor shall design delivery routes to minimize the exposure of sensitive land uses or residential dwellings to delivery truck-related noise.
- Residences and other noise-sensitive land uses within 100 feet of Project construction shall be notified of the construction in writing. The notification shall describe the activities anticipated, provide dates and hours of activity, and provide contact information with a description of a noise and/or vibration complaint and response procedure. The notification shall also advise residents to remain indoors with windows closed when construction activity is occurring outside of their homes to avoid elevated exterior noise and/or vibration levels.

TABLE ES-1: CONSTRUCTION NOISE & VIBRATION MITIGATION MEASURES

Construction Activity	Vibration Level Threshold (in/sec PPV)	Temporary Noise Barrier Screening Distance (Feet)	Noise Level Threshold (Dba L_{eq})	When Required?
MITIGATION MEASURES REQUIRED TO REDUCE IMPACTS AT SENSITIVE STRUCTURES				
Pile Driving *Impact*	The use of impact pile driving equipment shall be prohibited. Instead, alternative pile driving methods and equipment (e.g., drilling or non-impact alternative) shall be used to reduce Project construction noise and vibration levels.			
All Construction Activities *Between Old Greenspot Road and Merris Street*	0.3 in/sec PPV *Building Damage at sensitive structures*	-	-	Ground-borne vibration monitoring of nearby residential structures, represented by receiver locations R3 and R8 adjacent to the channel between Old Greenspot Road and Merris Street, shall be required for the duration of Project construction between Old Greenspot Road and Merris Street. The County of San Bernardino may require that vibration levels do not exceed a more conservative threshold (e.g., lower) at their discretion.
MITIGATION MEASURES REQUIRED TO REDUCE IMPACTS AT SENSITIVE RECEIVER LOCATIONS (IF OCCUPIED)				
Activities Generating Vibration Levels in Excess of 0.2 in/sec PPV *At Occupied Sensitive Receiver Locations*	0.2 in/sec PPV *Annoyance at occupied sensitive receiver locations*	-	-	If monitored vibration levels exceed the County's 0.2 in/sec annoyance threshold then relocation of residents, and/or hours restrictions to day(s)/time(s) when the impacted receiver(s) are unoccupied, shall be provided for the duration of activities within 25 feet of the affected receiver location(s).
All Construction Activities *Noise-specific mitigation*	-	25'	85 Dba L_{eq} *at occupied sensitive receiver locations*	Temporary 10-foot high noise barriers required if construction activity occurs within 25 feet of occupied sensitive receivers.
				If the noise level threshold cannot be satisfied, relocation of residents, and/or hours restrictions to day(s)/time(s) when the impacted receiver(s) are unoccupied, shall be provided.

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7 INTRODUCTION

This noise analysis has been completed to determine the noise impacts associated with the development of the proposed Elder Creek Channel Improvements ("Project"). This noise study briefly describes the proposed Project, provides information regarding noise fundamentals, describes the local regulatory setting, and provides the study methods and procedures for construction noise analysis.

7.3 SITE LOCATION

The proposed Elder Creek Channel Improvements Project is located between Old Greenspot to approximately 650 feet southwest of Abbey Road in the City of Highland, as shown on Exhibit 1-A. Existing noise-sensitive land uses in the Project study area include residential homes immediately adjacent to the Project site.

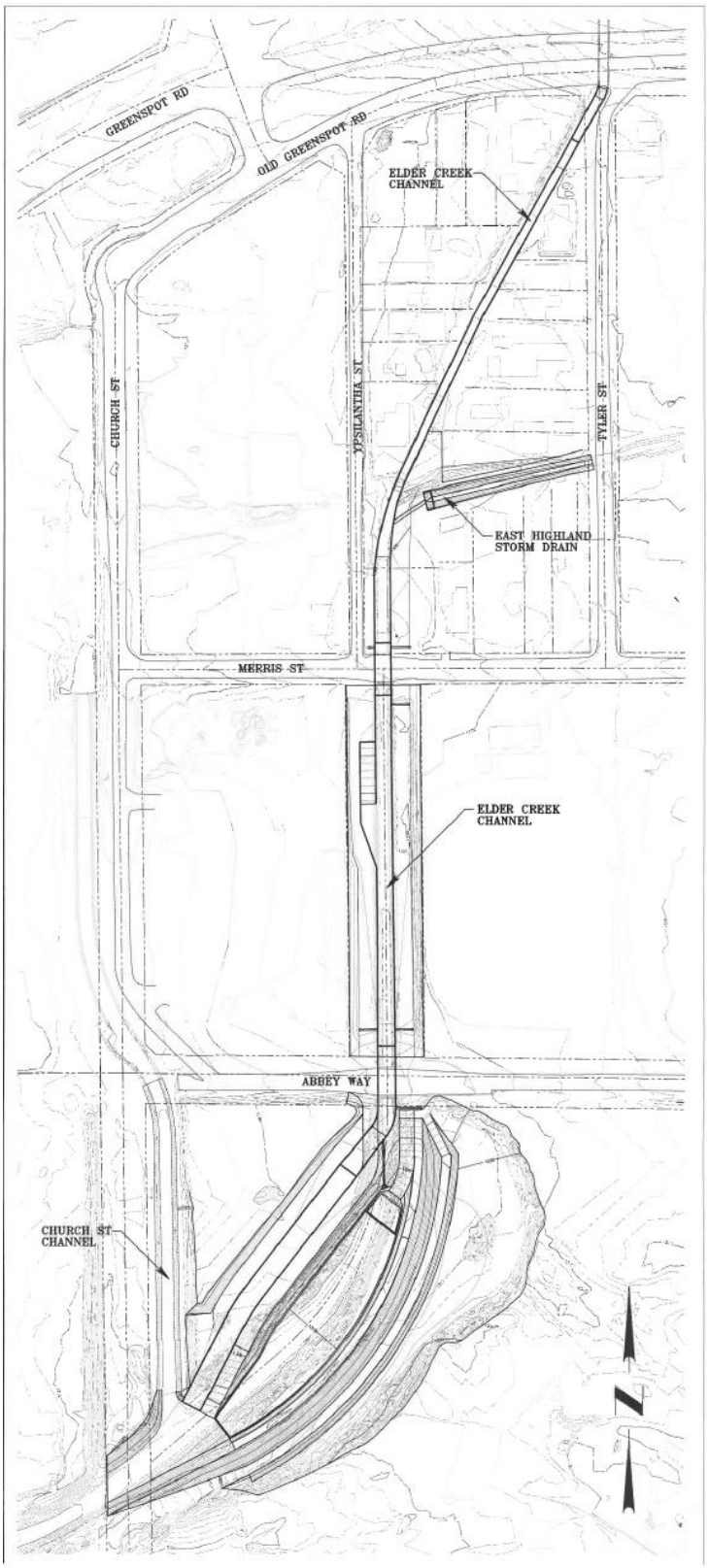
1.2 PROJECT DESCRIPTION

The proposed Project begins downstream of Old Greenspot Road, and terminates just below the confluence of Elder and Church Channel, as shown on Exhibit 1-B. With this Project, the Reinforced Concrete Box (RCB) between Old Greenspot Road and Merris Street will be deepened and may be redesigned as an open concrete channel. Additionally, the existing, open concrete channel just downstream of the RCB will be widened to approximately 26 feet and deepened to provide needed flow capacity. Downstream of this open concrete channel, the existing rip-rap and revetment-improved earthen channel between Merris Street and Abbey Way will be reconfigured to a 26-foot wide open horizontal concrete channel and deepened to meet the flows upstream. Dual access roads will remain at this location. Additionally, there will be two road box culverts replaced with approximately 26-foot wide culverts, one at Merris Street and one at Abbey Way. Downstream of Abbey Way, the proposed improvements consists of constructing an open concrete channel, approximately 26-foot wide, with a low flow diversion that feeds the existing earthen channel. The open concrete channel ties into existing Elder Creek approximately 600 linear feet below Abbey Way.

The system will require periodic maintenance, including the low-flow channel and possibly of the rip-rap tie-in-point of the Elder and Church Channel. The maintenance is anticipated to be minimal, occurring once a year or every few years, depending on duration and intensity of future storms. There may be a one-time maintenance of approximately 700 linear feet of Church Channel just upstream of the confluence with Elder, including sediment and vegetation and debris removal, prior to completion of the Project.

EXHIBIT 1-A: LOCATION MAP

EXHIBIT 1-B: SITE PLAN



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2 FUNDAMENTALS

Noise has been simply defined as "unwanted sound." Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm or when it has adverse effects on health. Noise is measured on a logarithmic scale of sound pressure level known as a decibel (Db). A-weighted decibels (Dba) approximate the subjective response of the human ear to broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies which are audible to the human ear. Exhibit 2-A presents a summary of the typical noise levels and their subjective loudness and effects that are described in more detail below.

EXHIBIT 2-A: TYPICAL NOISE LEVELS

COMMON OUTDOOR ACTIVITIES	COMMON INDOOR ACTIVITIES	A - WEIGHTED SOUND LEVEL dBA	SUBJECTIVE LOUDNESS	EFFECTS OF NOISE
THRESHOLD OF PAIN		140	INTOLERABLE OR DEAFENING	HEARING LOSS
NEAR JET ENGINE		130		
		120		
JET FLY-OVER AT 300m (1000 ft)	ROCK BAND	110		
LOUD AUTO HORN		100	VERY NOISY	
GAS LAWN MOWER AT 1m (3 ft)		90		
DIESEL TRUCK AT 15m (50 ft), at 80 km/hr (50 mph)	FOOD BLENDER AT 1m (3 ft)	80		SPEECH INTERFERENCE
NOISY URBAN AREA, DAYTIME	VACUUM CLEANER AT 3m (10 ft)	70	LOUD	
HEAVY TRAFFIC AT 90m (300 ft)	NORMAL SPEECH AT 1m (3 ft)	60		
QUIET URBAN DAYTIME	LARGE BUSINESS OFFICE	50	MODERATE	SLEEP DISTURBANCE
QUIET URBAN NIGHTTIME	THEATER, LARGE CONFERENCE ROOM (BACKGROUND)	40		
QUIET SUBURBAN NIGHTTIME	LIBRARY	30	FAINT	NO EFFECT
QUIET RURAL NIGHTTIME	BEDROOM AT NIGHT, CONCERT HALL (BACKGROUND)	20		
	BROADCAST/RECORDING STUDIO	10	VERY FAINT	
LOWEST THRESHOLD OF HUMAN HEARING	LOWEST THRESHOLD OF HUMAN HEARING	0		

Source: Environmental Protection Agency Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA/ONAC 550/9-74-004) March 1974.

2.1 RANGE OF NOISE

Since the range of intensities that the human ear can detect is so large, the scale frequently used to measure intensity is a scale based on multiples of 10, the logarithmic scale. The scale for measuring intensity is the decibel scale. Each interval of 10 decibels indicates a sound energy ten times greater than before, which is perceived by the human ear as being roughly twice as loud. (2) The most common sounds vary between 40 Dba (very quiet) to 100 Dba (very loud). Normal conversation at three feet is roughly at 60 Dba, while loud jet engine noises equate to 110 Dba

at approximately 100 feet, which can cause serious discomfort. (3) Another important aspect of noise is the duration of the sound and the way it is described and distributed in time.

2.2 NOISE DESCRIPTORS

Environmental noise descriptors are generally based on averages, rather than instantaneous, noise levels. The most commonly used figure is the equivalent level (L_{eq}). Equivalent sound levels are not measured directly but are calculated from sound pressure levels typically measured in A-weighted decibels (Dba). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period and is commonly used to describe the "average" noise levels within the environment.

Peak hour or average noise levels, while useful, do not completely describe a given noise environment. Noise levels lower than peak hour may be disturbing if they occur during times when quiet is most desirable, namely evening and nighttime (sleeping) hours. To account for this, the Community Noise Equivalent Level (CNEL), representing a composite 24-hour noise level is utilized. The CNEL is the weighted average of the intensity of a sound, with corrections for time of day, and averaged over 24 hours. The time of day corrections require the addition of 5 decibels to Dba L_{eq} sound levels in the evening from 7:00 p.m. to 10:00 p.m., and the addition of 10 decibels to Dba L_{eq} sound levels at night between 10:00 p.m. and 7:00 a.m. These additions are made to account for the noise sensitive time periods during the evening and night hours when sound appears louder. CNEL does not represent the actual sound level heard at any time, but rather represents the total sound exposure. The City of Highland relies on the 24-hour CNEL level to assess land use compatibility with transportation related noise sources.

2.3 SOUND PROPAGATION

When sound propagates over a distance, it changes in level and frequency content. The way noise reduces with distance depends on the following factors.

2.3.1 GEOMETRIC SPREADING

Sound from a localized source (i.e., a stationary point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 Db for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of 3 Db for each doubling of distance from a line source. (2)

2.3.2 GROUND ABSORPTION

The propagation path of noise from a highway to a receptor is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually

sufficiently accurate for distances of less than 200 ft. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receptor, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receptor such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 Db per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 Db per doubling of distance from a line source. (4)

2.3.3 ATMOSPHERIC EFFECTS

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects. (2)

2.3.4 SHIELDING

A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Shielding by trees and other such vegetation typically only has an "out of sight, out of mind" effect. That is, the perception of noise impact tends to decrease when vegetation blocks the line-of-sight to nearby resident. However, for vegetation to provide a substantial, or even noticeable, noise reduction, the vegetation area must be at least 15 feet in height, 100 feet wide and dense enough to completely obstruct the line-of sight between the source and the receiver. This size of vegetation may provide up to 5 Dba of noise reduction. The FHWA does not consider the planting of vegetation to be a noise abatement measure. (4)

2.4 NOISE CONTROL

Noise control is the process of obtaining an acceptable noise environment for an observation point or receptor by controlling the noise source, transmission path, receptor, or all three. This concept is known as the source-path-receptor concept. In general, noise control measures can be applied to these three elements.

2.5 NOISE BARRIER ATTENUATION

Effective noise barriers can reduce noise levels by 10 to 15 Dba, cutting the loudness of traffic noise in half. A noise barrier is most effective when placed close to the noise source or receptor. Noise barriers, however, do have limitations. For a noise barrier to work, it must be high enough and long enough to block the path of the noise source. (4)

2.6 LAND USE COMPATIBILITY WITH NOISE

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches, and residences are more sensitive to noise intrusion than are commercial or industrial developments and related activities. As ambient noise levels affect the perceived amenity or livability of a development, so too can the mismanagement of noise impacts impair the economic health and growth potential of a community by reducing the area's desirability as a place to live, shop and work. For this reason, land use compatibility with the noise environment is an important consideration in the planning and design process. The FHWA encourages State and Local government to regulate land development in such a way that noise-sensitive land uses are either prohibited from being located adjacent to a highway, or that the developments are planned, designed, and constructed in such a way that noise impacts are minimized. (5)

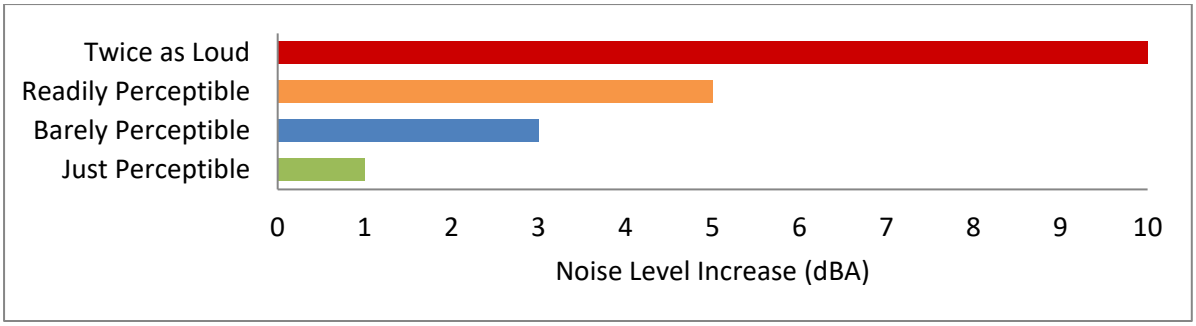
2.7 COMMUNITY RESPONSE TO NOISE

Community responses to noise may range from registering a complaint by telephone or letter, to initiating court action, depending upon everyone's susceptibility to noise and personal attitudes about noise. Several factors are related to the level of community annoyance including:

- Fear associated with noise producing activities;
- Socio-economic status and educational level;
- Perception that those affected are being unfairly treated;
- Attitudes regarding the usefulness of the noise-producing activity;
- Belief that the noise source can be controlled.

Approximately ten percent of the population has a very low tolerance for noise and will object to any noise not of their making. Consequently, even in the quietest environment, some complaints will occur. Another twenty-five percent of the population will not complain even in very severe noise environments. Thus, a variety of reactions can be expected from people exposed to any given noise environment. (6) Surveys have shown that about ten percent of the people exposed to traffic noise of 60 Dba will report being highly annoyed with the noise, and each increase of one Dba is associated with approximately two percent more people being highly annoyed. When traffic noise exceeds 60 Dba or aircraft noise exceeds 55 Dba, people may begin to complain. (6) Despite this variability in behavior on an individual level, the population can be expected to exhibit the following responses to changes in noise levels as shown on Exhibit 2-B. An increase or decrease of 1 Dba cannot be perceived except in carefully controlled laboratory experiments, a change of 3 Dba are considered *barely perceptible*, and changes of 5 Dba are considered *readily perceptible*. (4)

EXHIBIT 2-B: NOISE LEVEL INCREASE PERCEPTION



2.8 EXPOSURE TO HIGH NOISE LEVELS

The Occupational Safety and Health Administration (OSHA) sets legal limits on noise exposure in the workplace. The permissible exposure limit (PEL) for a worker over an eight-hour day is 90 Dba. The OSHA standard uses a 5 Dba exchange rate. This means that when the noise level is increased by 5 Dba, the amount of time a person can be exposed to a certain noise level to receive the same dose is cut in half. The National Institute for Occupational Safety and Health (NIOSH) has recommended that all worker exposures to noise should be controlled below a level equivalent to 85 Dba for eight hours to minimize occupational noise induced hearing loss. NIOSH also recommends a 3 Dba exchange rate so that every increase by 3 Dba doubles the amount of the noise and halves the recommended amount of exposure time. (7)

OSHA has implemented requirements to protect all workers in general industry (e.g. the manufacturing and the service sectors) for employers to implement a Hearing Conservation Program where workers are exposed to a time weighted average noise level of 85 Dba or higher over an eight-hour work shift. Hearing Conservation Programs require employers to measure noise levels, provide free annual hearing exams and free hearing protection, provide training, and conduct evaluations of the adequacy of the hearing protectors in use unless changes to tools, equipment and schedules are made so that they are less noisy and worker exposure to noise is less than the 85 Dba. This noise study does not evaluate the noise exposure of workers within a project or construction site based on CEQA requirements, and instead, evaluates Project-related operational and construction noise levels at the nearby sensitive receiver locations in the Project study area. Further, periodic exposure to high noise levels in short duration, such as Project construction, is typically considered an annoyance and not impactful to human health. It would take several years of exposure to high noise levels to result in hearing impairment. (8)

2.9 VIBRATION

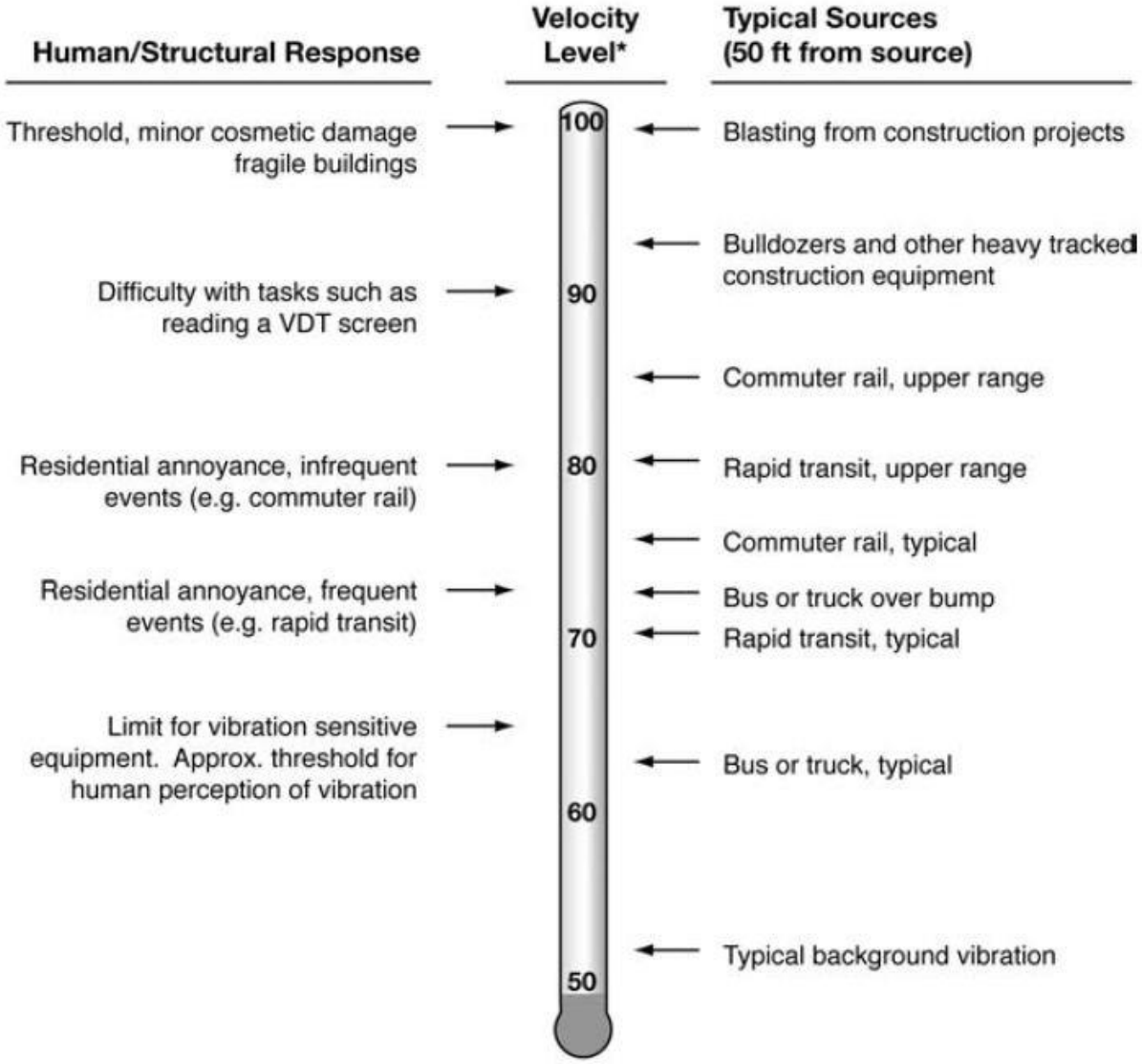
Per the Federal Transit Administration (FTA) *Transit Noise Impact and Vibration Assessment* (9), vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called structure-borne noise. Sources of ground-borne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions.

As is the case with airborne sound, ground-borne vibrations may be described by amplitude and frequency.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings but is not always suitable for evaluating human response (annoyance) because it takes some time for the human body to respond to vibration signals. Instead, the human body responds to average vibration amplitude often described as the root mean square (RMS). The RMS amplitude is defined as the average of the squared amplitude of the signal and is most frequently used to describe the effect of vibration on the human body. Decibel notation (VdB) is commonly used to measure RMS. Decibel notation (VdB) serves to reduce the range of numbers used to describe human response to vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receivers for vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration-sensitive equipment.

The background vibration-velocity level in residential areas is generally 50 VdB. Ground-borne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground-borne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Exhibit 2-C illustrates common vibration sources and the human and structural response to ground-borne vibration.

EXHIBIT 2-C: TYPICAL LEVELS OF GROUND-BORNE VIBRATION



* *RMS Vibration Velocity Level in VdB relative to 10^{-6} inches/second*

Source: Federal Transit Administration (FTA) Transit Noise Impact and Vibration Assessment.

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3 REGULATORY SETTING

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, various county governments, and most municipalities in the state have established standards and ordinances to control noise. In most areas, automobile and truck traffic is the major source of environmental noise. Traffic activity generally produces an average sound level that remains constant with time. Air and rail traffic, and commercial and industrial activities are also major sources of noise in some areas. Federal, state, and local agencies regulate different aspects of environmental noise. Federal and state agencies generally set noise standards for mobile sources such as aircraft and motor vehicles, while regulation of stationary sources is left to local agencies.

3.1 STATE OF CALIFORNIA NOISE REQUIREMENTS

The State of California regulates freeway noise, sets standards for sound transmission, provides occupational noise control criteria, identifies noise standards, and provides guidance for local land use compatibility. State law requires that each county and city adopt a General Plan that includes a Noise Element which is to be prepared per guidelines adopted by the Governor's Office of Planning and Research. (10) The purpose of the Noise Element is to *limit the exposure of the community to excessive noise levels*. In addition, the California Environmental Quality Act (CEQA) requires that all known environmental effects of a project be analyzed, including environmental noise impacts.

3.2 CITY OF HIGHLAND GENERAL PLAN NOISE ELEMENT

The City of Highland has adopted a Noise Element of the General Plan to provide goals and strategies to ensure a quiet noise environment for residents, employees, and visitors to Highland. (11) To ensure a quiet noise environment, the City of Highland General Plan Noise Element contains the following goals:

7.1 Protect sensitive land uses and the citizens of Highland from annoying and excessive noise through diligent planning and regulation.

7.2 Encourage the reduction of noise from transportation-related noise sources such as automobile and truck traffic.

7.3 Protect residents from the effects of "spill over" or nuisance noise.

The Policies and Actions specified in the City of Highland Noise Element provide the guidelines necessary to satisfy these goals. For example, Goal 7.3, Action 1 indicates that construction, as a condition of approval, shall be limited to daytime hours between 7:00 a.m. to 6:00 p.m. on weekdays. (11)

3.3 CONSTRUCTION NOISE STANDARDS

To control noise impacts associated with the construction of the proposed Project, the City of Highland has established limits to the hours of operation. The City of Highland General Plan Noise Element, Goal 7.3, Action 1 indicates that construction, as a condition of approval, shall be limited to daytime hours between 7:00 a.m. to 6:00 p.m. on weekdays. (11) Further, Section 8.50.060(K) of the City of Highland Municipal Code indicates that construction activities for public works projects, such as the Elder Creek Channel Improvements are considered exempt from the noise standards of the Municipal Code. However, the City's General Plan and Municipal Code do not establish numeric maximum acceptable construction source noise levels at potentially affected receivers, which would allow for a quantified determination of what CEQA constitutes as the *generation of noise levels in excess of standards* or as a *substantial temporary or periodic noise increase*, the following construction noise level thresholds are used in this noise study.

To evaluate whether the Project will generate potentially significant construction noise levels at off-site sensitive receiver locations, a construction-related noise level threshold is adopted from the *Criteria for Recommended Standard: Occupational Noise Exposure* prepared by the National Institute for Occupational Safety and Health (NIOSH). (12) A division of the U.S. Department of Health and Human Services, NIOSH identifies a noise level threshold based on the duration of exposure to the source. The construction related noise level threshold starts at 85 Dba for more than eight hours per day, and for every 3 Dba increase, the exposure time is cut in half. This results in noise level thresholds of 88 Dba for more than four hours per day, 92 Dba for more than one hour per day, 96 Dba for more than 30 minutes per day, and up to 100 Dba for more than 15 minutes per day. (12) For the purposes of this analysis, the lowest, more conservative construction noise level threshold of 85 Dba L_{eq} is used as an acceptable threshold for construction noise at the nearby sensitive receiver locations. Since this construction-related noise level threshold represents the energy average of the noise source over a given time, they are expressed as L_{eq} noise levels. Therefore, the noise level threshold of 85 Dba L_{eq} over a period of eight hours or more is used to evaluate the potential Project-related construction noise level impacts at the nearby sensitive receiver locations.

The 85 Dba L_{eq} threshold is also consistent with the FTA *Transit Noise and Vibration Impact Assessment* criteria for construction noise which identifies an hourly construction noise level threshold of 90 Dba L_{eq} during daytime hours, and 80 Dba L_{eq} during nighttime hours for construction for general assessment at noise-sensitive uses (e.g., residential, medical/hospital, school, etc.). (9) Therefore, the Noise Study relies on the NIOSH 85 Dba L_{eq} threshold, which is more conservative than the 90 Dba L_{eq} FTA general assessment criteria, for noise-sensitive uses and represents an appropriate threshold for construction noise analysis.

3.4 CONSTRUCTION VIBRATION STANDARDS

The City of Highland General Plan and Municipal Code do not identify specific vibration level standards. Therefore, applicable vibration standards identified by the California Department of Transportation ("Caltrans") *Transportation and Construction Vibration Guidance Manual* are used in this noise study to assess potential building damage impacts. (13) According to the Caltrans vibration manual, large mobile equipment, and large loaded trucks (e.g., haul trucks) used during construction activities can produce vibration which can potentially cause annoyance at sensitive land uses within the Project study area, or damage to adjacent structures. The Caltrans vibration manual establishes thresholds for determining potential vibration impacts resulting in building damage for older residential structures of 0.3 in/sec PPV.

In addition, the County of San Bernardino Development Code, Section 83.01.090 identifies vibration standards of 0.2 in/sec PPV which are used in this noise study to evaluate potential impacts related to human annoyance at nearby sensitive receiver locations. (14)

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4 SIGNIFICANCE CRITERIA

The following significance criteria are based on currently adopted guidance provided by Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (1) For the purposes of this report, impacts would be potentially significant if the Project results in or causes:

A. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

B. Generation of excessive ground-borne vibration or ground-borne noise levels?

C. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

While the City of Highland General Plan Guidelines provide direction on noise compatibility and establish noise standards by land use type that are sufficient to assess the significance of noise impacts, they do not define the levels at which increases are considered substantial for use under Guideline A. CEQA Appendix G Guideline C applies to nearby public and private airports, if any, and the Project's land use compatibility. The Project site is not located within two miles of a public airport; nor is the Project within the vicinity of a private airstrip. As such, the Project site would not be exposed to excessive noise levels from airport operations, and therefore, impacts are considered *less than significant,* and no further noise analysis is conducted in relation to Guidelines E and F.

Noise impacts shall be considered significant if any of the following occur as a direct result of the proposed development. Table 4-1 shows the significance criteria summary matrix.

CONSTRUCTION NOISE

- If temporary Project-related construction activities create noise levels which exceed the 85 Dba L_{eq} acceptable noise level threshold at the nearby noise-sensitive receiver locations (NIOSH, Criteria for Recommended Standard: Occupational Noise Exposure).

CONSTRUCTION VIBRATION

- If temporary Project-related construction activities generate vibration levels which:
    - exceed the Caltrans building damage vibration level threshold for older residential structures of 0.3 in/sec PPV (Caltrans Transportation and Construction Vibration Guidance Manual, Tables 19 & 20); or
    - the human annoyance vibration level threshold of 0.2 in/sec PPV at nearby sensitive receiver locations (County of San Bernardino Development Code, Section 83.01.090).

TABLE 4-1: SIGNIFICANCE CRITERIA SUMMARY

Analysis	Receiving Land Use	Condition(s)	Significance Criteria	
			Daytime	Nighttime
Construction	Noise-Sensitive	Noise Level Threshold[1]	85 Dba L_{eq}	n/a
		Vibration Level Threshold (Building Damage)[2]	0.3 in/sec PPV	n/a
		Vibration Level Threshold (Human Annoyance)[3]	0.2 in/sec PPV	n/a

[1] Source: NIOSH, Criteria for Recommended Standard: Occupational Noise Exposure, June 1998.
[2] Source: Caltrans Transportation and Construction Vibration Guidance Manual, September 2013, Tables 19 & 20.
[3] Source: County of San Bernardino Development Code, Section 83.01.090 .
"Daytime" = 7:00 a.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m.; "PPV" = peak particle velocity; "n/a" = No nighttime construction activity is permitted or planned, so no nighttime construction noise level limits are identified.

5 EXISTING NOISE LEVEL MEASUREMENTS

To assess the existing noise level environment, five 24-hour noise level measurements were taken at receiver locations in the Project study area. The receiver locations were selected to describe and document the existing noise environment within the Project study area. Exhibit 5-A provides the boundaries of the Project study area and the noise level measurement locations. To fully describe the existing noise conditions, noise level measurements were collected by Urban Crossroads, Inc. on Friday, June 22nd, 2018. Appendix 5.1 includes study area photos.

5.1 MEASUREMENT PROCEDURE AND CRITERIA

To describe the existing noise environment, the hourly noise levels were measured during typical weekday conditions over a 24-hour period. By collecting individual hourly noise level measurements, it is possible to describe the daytime and nighttime hourly noise levels and calculate the 24-hour CNEL. The long-term noise readings were recorded using Piccolo Type 2 integrating sound level meter and dataloggers. The Piccolo sound level meters were calibrated using a Larson-Davis calibrator, Model CAL 150. All noise meters were programmed in "slow" mode to record noise levels in "A" weighted form. The sound level meters and microphones were equipped with a windscreen during all measurements. All noise level measurement equipment satisfies the American National Standards Institute (ANSI) standard specifications for sound level meters ANSI S1.4-2014/IEC 61672-1:2013. (15)

5.2 NOISE MEASUREMENT LOCATIONS

The long-term noise level measurements were positioned as close to the nearest sensitive receiver locations as possible to assess the existing ambient hourly noise levels surrounding the Project site. Both Caltrans and the FTA recognize that it is not reasonable to collect noise level measurements that can fully represent any part of a private yard, patio, deck, or balcony normally used for human activity when estimating impacts for new development projects. This is demonstrated in the Caltrans general site location guidelines which indicate that, *sites must be free of noise contamination by sources other than sources of interest. Avoid sites located near sources such as barking dogs, lawnmowers, pool pumps, and air conditioners unless it is the express intent of the analyst to measure these sources*. (2) Further, FTA guidance states, t*hat it is not necessary nor recommended that existing noise exposure be determined by measuring at every noise-sensitive location in the project area. Rather, the recommended approach is to characterize the noise environment for clusters of sites based on measurements or estimates at representative locations in the community*. (9)

Based on recommendations of Caltrans and the FTA, it is not necessary to collect measurements at each individual building or residence, because each receiver measurement represents a group of buildings that share acoustical equivalence. (9) In other words, the area represented by the receiver shares similar shielding, terrain, and geometric relationship to the reference noise source. Receivers represent a location of noise sensitive areas and are used to estimate the future noise level impacts. Collecting reference ambient noise level measurements at the nearby sensitive receiver locations allows for a comparison of the before and after Project noise levels

and is necessary to assess potential noise impacts due to the Project's contribution to the ambient noise levels.

5.3 NOISE MEASUREMENT RESULTS

The noise measurements presented below focus on the average or equivalent sound levels (L_{eq}). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period. Further, only the daytime noise levels are presented below based on the daytime-only Project construction activity analyzed in this noise study, however, the full 24-hour noise level measurement data is provided in Appendix 5.2. Table 5-1 identifies the hourly daytime (7:00 a.m. to 10:00 p.m.) noise levels at each noise level measurement location. Appendix 5.2 provides a summary of the existing hourly ambient noise levels described below:

- Location L1 represents the noise levels north of the Project site on Old Greenspot Road near existing residential homes. The energy (logarithmic) average daytime noise level was calculated at 65.1 Dba L_{eq}.
- Location L2 represents the noise levels at the eastern Project site boundary adjacent to existing residential homes on Tyler Street. The energy (logarithmic) average daytime noise level was calculated at 49.8 Dba L_{eq}.
- Location L3 represents the noise levels at the eastern Project site boundary adjacent to existing residential homes on Tyler Street. The energy (logarithmic) average daytime noise level was calculated at 46.2 Dba L_{eq}.
- Location L4 represents the noise levels west of the Project site on Church Street near vacant land and existing residential homes. The energy (logarithmic) average daytime noise level was calculated at 50.5 Dba L_{eq}.
- Location L5 represents the noise levels on Merris Street within the Project site boundaries adjacent to existing residential homes and commercial uses. The energy (logarithmic) average daytime noise level was calculated at 52.3 Dba L_{eq}.
- Location L6 represents the noise levels on Abbey Way adjacent to the Project site near existing vacant land. The energy (logarithmic) average daytime noise level was calculated at 51.8 Dba L_{eq}.

Table 5-1 provides the (energy average) noise levels used to describe the daytime ambient conditions. These daytime energy average noise levels represent the average of all hourly noise levels observed during this time period expressed as a single number. Appendix 5.2 provides summary worksheets of the noise levels for each hour as well as the minimum, maximum, L_1, L_2, L_5, L_8, L_{25}, L_{50}, L_{90}, L_{95}, and L_{99} percentile noise levels observed during the daytime and nighttime periods.

TABLE 5-1: AMBIENT NOISE LEVEL MEASUREMENTS

Location[1]	Distance to Project Boundary (Feet)	Description	Energy Average Daytime Noise Level (Dba L_{eq})[2]
L1	10’	Located north of the Project site on Old Greenspot Road near existing residential homes.	65.1
L2	0’	Located at the eastern Project site boundary adjacent to existing residential homes on Tyler Street.	49.8
L3	0’	Located at the eastern Project site boundary adjacent to existing residential homes on Tyler Street.	46.2
L4	350’	Located west of the Project site on Church Street near vacant land and existing residential homes.	50.5
L5	0’	Located on Merris Street within the Project site boundaries adjacent to existing residential homes and commercial uses.	52.3
L6	0’	Located on Abbey Way adjacent to the Project site near existing vacant land.	51.8

[1] See Exhibit 5-A for the noise level measurement locations.
[2] Energy (logarithmic) average hourly levels. The long-term 24-hour measurement worksheets are included in Appendix 5.2. “Daytime” = 7:00 a.m. to 10:00 p.m.

EXHIBIT 5-A: NOISE MEASUREMENT LOCATIONS

6 RECEIVER LOCATIONS

To assess the potential for short-term construction noise impacts, the following receiver locations as shown on Exhibit 6-A were identified as representative locations for focused analysis. Sensitive receivers are generally defined as locations where people reside or where the presence of unwanted sound could otherwise adversely affect the use of the land. Noise-sensitive land uses are generally considered to include: schools, hospitals, single-family dwellings, mobile home parks, churches, libraries, and recreation areas. Moderately noise-sensitive land uses typically include: multi-family dwellings, hotels, motels, dormitories, out-patient clinics, cemeteries, golf courses, country clubs, athletic/tennis clubs, and equestrian clubs. Land uses that are considered relatively insensitive to noise include business, commercial, and professional developments. Land uses that are typically not affected by noise include: industrial, manufacturing, utilities, agriculture, natural open space, undeveloped land, parking lots, warehousing, liquid and solid waste facilities, salvage yards, and transit terminals.

Noise-sensitive receivers near the Project site include existing residential homes, as described below. Other sensitive land uses in the Project study area that are located at greater distances than those identified in this noise study will experience lower noise levels than those presented in this report due to the additional attenuation from distance and the shielding of intervening structures.

R1: Located approximately 13 feet west of the Project site, R1 represents an existing residential home south of Old Greenspot Road.

R2: Location R2 represents the existing residential home located approximately 15 feet southeast of the Project site on Tyler Street.

R3: Location R3 represents an existing residential home east of the Project site on Tyler Street at roughly 10 feet.

R4: Location R4 represents the outdoor living area (backyard) and pool of an existing residential property on Ypsilantha Street located roughly 38 feet west of the Project site.

R5: Location R5 represents the existing residential home located roughly 18 feet east of the Project site on Tyler Street.

R6: Location R6 represents existing outdoor area living area (backyard) of a residential property on Ypsilantha Street at roughly 21 feet west of the Project site.

R7: Located approximately 23 feet east of the Project site, R7 represents an existing outdoor living area (backyard) of a residential home on Tyler Street.

R8: Location R8 represents an existing residential home on Ypsilantha Street which is located approximately 10 feet west of the Project site.

R9: Location R9 represents an existing residential home north of the Project site on Tyler Street at an approximate distance of 21 feet.

R10: Location R10 represents the residential homes located roughly 73 feet northwest of the Project site on Ypsilantha Street.

R11: Location R11 represents the existing residential home located roughly 24 feet west of the Project site on Merris Street.

R12: Location R12 represents existing outdoor living area (backyard) of a residential home at roughly 26 feet east of the Project site on Merris Street.

R13: Location R13 represents an existing church use at roughly 69 feet west of the Project site.

EXHIBIT 6-A: RECEIVER LOCATIONS

7 CONSTRUCTION IMPACTS

This section analyzes potential impacts resulting from the short-term construction activities associated with the development of the Project. Exhibit 7-A shows the construction activity boundaries in relation to the nearby sensitive receiver locations.

7.1 CONSTRUCTION ANALYSIS INPUTS

Noise generated by the Project construction equipment can reach high levels at adjacent receiver locations. This analysis focuses on typical construction equipment activities, in addition to providing a focused assessment of potential impacts related to pile-driving equipment:

Typical Construction Activities

- Church Street Channel Muck Out
- Construction of the Channel Downstream of Abbey Way
- Construction of a Reinforced Concrete Box (RCB) at Abbey Way
- Construction of the Channel between Abbey Way and Merris Street
- Construction of a RCB at Merris Street
- Paving
- Construction of the Channel north of Merris Street
- Fencing & Cleanup

Pile Driving Activities

- Pile Driving Equipment

This construction noise analysis was prepared using reference construction equipment noise levels from the Federal Highway Administration (FHWA) published the Roadway Construction Noise Model (RCNM), which includes a national database of construction equipment reference noise emission levels. (16) The RCNM equipment database, as shown in Appendix 7.1, provides a comprehensive list of the noise generating characteristics for specific types of construction equipment. In addition, the database provides an acoustical usage factor to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation. The usage factor is a key input variable of the RCNM noise prediction model that is used to calculate the average L_{eq} noise levels using the L_{max} noise levels measured at a distance of 50 feet.

Noise levels generated by heavy construction equipment can range from approximately 68 Dba to in excess of 80 Dba when measured at 50 feet. Hard site conditions are used in the construction noise analysis which result in noise levels that attenuate (or decrease) at a rate of 6 Dba for each doubling of distance from a point source (i.e. construction equipment). For example, a noise level of 80 Dba measured at 50 feet from the noise source to the receiver would be reduced to 74 Dba at 100 feet from the source to the receiver and would be further reduced to 68 Dba at 200 feet from the source to the receiver. The number and mix of construction equipment by construction stage used in this analysis is consistent with data provided by the San Bernardino County Flood Control District. (17)

EXHIBIT 7-A: CONSTRUCTION ACTIVITY AND RECEIVER LOCATIONS

7.2 TYPICAL CONSTRUCTION ACTIVITY NOISE LEVELS

Tables 7-1 to 7-6 show the typical Project construction stages and the reference construction noise levels used for each stage at 50 feet. Table 7-7 provides a summary of the noise levels from each stage of construction at each of the sensitive receiver locations based on the distance to the Project site boundary. Based on the reference construction noise levels, the Project-related typical construction activity noise levels when the highest reference noise level is operating at the edge of primary construction activity nearest each sensitive receiver location will range from 71 to 92 Dba L_{eq} at the sensitive receiver locations, as shown on Table 7-7.

TABLE 7-1: CHURCH STREET MUCK OUT & ABBEY CHANNEL EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours of Operation[3]	Reference Noise Level @ 50 Feet (Dba L_{max})	Combined Level @ 50 Feet (Dba L_{eq})
Church Street Channel Muck Out					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Dump Truck	2	40%	3.2	76.0	75.0
Water Trucks	1	40%	3.2	76.0	72.0
Grade Downstream Abbey					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Dump Truck	1	40%	3.2	76.0	72.0
Water Trucks	1	40%	3.2	76.0	72.0
Steel for Channel Invert					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Invert					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Steel for Walls					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Walls					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8 hour workday.

TABLE 7-2: RCB AT ABBEY EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours of Operation[3]	Reference Noise Level @ 50 Feet (Dba L_{max})	Combined Level @ 50 Feet (Dba L_{eq})
Relocate Utilities					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Demo Asphalt at RCB					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Dump Truck	1	40%	3.2	76.0	72.0
Water Trucks	1	40%	3.2	76.0	72.0
Grade Subgrade					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Steel for Invert					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete Invert					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Steel for Walls and Deck					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete Walls and Deck					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Backfill RCB					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Water Trucks	1	40%	3.2	76.0	72.0

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8 hour workday.

TABLE 7-3: ABBEY TO MERRIS CHANNEL EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours of Operation[3]	Reference Noise Level @ 50 Feet (Dba L_{max})	Combined Level @ 50 Feet (Dba L_{eq})
Grade Subgrade					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Water Trucks	1	40%	3.2	76.0	72.0
Steel for Invert					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Invert					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Steel for Walls					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Walls & Grading					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Water Trucks	1	40%	3.2	76.0	72.0
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Generator Sets	1	50%	4.0	81.0	78.0

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8 hour workday.

TABLE 7-4: RCB AT MERRIS EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours of Operation[3]	Reference Noise Level @ 50 Feet (Dba L_{max})	Combined Level @ 50 Feet (Dba L_{eq})
Relocate Utilities					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Demo Asphalt at RCB					
Tractor/Loader/Backhoes	2	40%	3.2	78.0	77.0
Dump Truck	1	40%	3.2	76.0	72.0
Excavators	1	40%	3.2	81.0	77.0
Water Trucks	1	40%	3.2	76.0	72.0
Grade Subgrade					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Steel for Invert					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Invert					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Steel for Walls and Deck					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Walls and Deck					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Backfill RCB					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Water Trucks	1	40%	3.2	76.0	72.0

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8 hour workday.

TABLE 7-5: PAVING & CHANNEL NORTH OF MERRIS EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours of Operation[3]	Reference Noise Level @ 50 Feet (Dba L_{max})	Combined Level @ 50 Feet (Dba L_{eq})
Paving					
Pickup Trucks	2	40%	3.2	75.0	74.0
Water Trucks	1	40%	3.2	76.0	72.0
Pavers	1	50%	4.0	77.0	74.0
Rollers	3	20%	1.6	80.0	77.8
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Demo Channel and RCB					
Tractor/Loader/Backhoes	2	40%	3.2	78.0	77.0
Excavators	1	40%	3.2	81.0	77.0
Dump Truck	1	40%	3.2	76.0	72.0
Water Trucks	1	40%	3.2	76.0	72.0
Grade Subgrade					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Steel for Invert					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Invert					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Steel for Walls					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Concrete for Walls					
Concrete Mixer Truck	2	40%	3.2	79.0	78.0
Concrete Pump Trucks	1	20%	1.6	81.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8 hour workday.

TABLE 7-6: FENCING & CLEANUP EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours of Operation[3]	Reference Noise Level @ 50 Feet (Dba L_{max})	Combined Level @ 50 Feet (Dba L_{eq})
Fencing					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Generator Sets	1	50%	4.0	81.0	78.0
Remove Stockpile					
Excavators	1	40%	3.2	81.0	77.0
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Dump Truck	1	40%	3.2	76.0	72.0
Grade Earthen Channel					
Tractor/Loader/Backhoes	1	40%	3.2	78.0	74.0
Excavators	1	40%	3.2	81.0	77.0
Water Trucks	1	40%	3.2	76.0	72.0
Rock Slope Protection					
Excavators	1	40%	3.2	81.0	77.0
Dump Truck	1	40%	3.2	76.0	72.0
Final Grading/Cleanup					
Tractor/Loader/Backhoes	2	40%	3.2	78.0	77.0
Dump Truck	1	40%	3.2	76.0	72.0

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8 hour workday.

TABLE 7-7: UNMITIGATED EQUIPMENT NOISE LEVEL SUMMARY (DBA L_{EQ})

Construction Stage & Activities	Highest Equipment Noise Level @ 50 Feet (dBA L_{eq})	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13
		Distance to Edge of Construction Activity (Feet)												
		13'	15'	10'	38'	18'	21'	23'	10'	21'	73'	24'	26'	69'
Church Street Channel Muck Out														
Church Street Channel Muck Out	75	87	85	89	77	84	83	82	89	83	72	81	81	72
Channel Downstream of Abbey														
Grade Downstream Abbey	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Steel for Channel Invert	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Invert	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Steel for Walls	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Walls	78	90	88	92	80	87	86	85	92	86	75	84	84	75
RCB at Abbey														
Relocate Utilities	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Demo Asphalt at RCB	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Grade Subgrade	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Steel for Invert	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete Invert	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Steel for Walls and Deck	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete Walls and Deck	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Backfill RCB	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Channel Between Abbey & Merris														
Grade Subgrade	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Steel for Invert	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Invert	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Steel for Walls	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Walls & Grading	78	90	88	92	80	87	86	85	92	86	75	84	84	75
RCB at Merris														
Relocate Utilities	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Demo Asphalt at RCB	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Grade Subgrade	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Steel for Invert	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Invert	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Steel for Walls and Deck	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Walls and Deck	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Backfill RCB	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Paving & Channel North of Merris														
Paving	78	89	88	92	80	87	85	85	92	85	74	84	83	75
Demo Channel and RCB	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Grade Subgrade	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Steel for Invert	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Invert	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Steel for Walls	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Concrete for Walls	78	90	88	92	80	87	86	85	92	86	75	84	84	75
Fencing & Cleanup														
Fencing	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Remove Stockpile	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Grade Earthen Channel	74	86	84	88	76	83	82	81	88	82	71	80	80	71
Rock Slope Protection	77	89	87	91	79	86	85	84	91	85	74	83	83	74
Final Grading/Cleanup	77	89	87	91	79	86	85	84	91	85	74	83	83	74

7.3 TYPICAL CONSTRUCTION ACTIVITY NOISE LEVEL COMPLIANCE

The construction noise analysis shows that the highest construction noise levels will occur when construction activities take place at the closest point from the edge of primary construction activity to each of the nearby receiver locations. As shown on Table 7-8, the highest unmitigated construction noise levels at each receiver location are expected to range from 74 to 92 Dba L_{eq}, and will exceed the 85 Dba L_{eq} threshold at 8 of the 13 receiver locations: R1, R2, R3, R5, R6, R7, R8, and R9. Therefore, unmitigated Project construction noise levels from typical construction activities are considered *potentially significant* impacts at occupied receiver locations R1, R2, R3, R5, R6, R7, R8, and R9.

TABLE 7-8: UNMITIGATED CONSTRUCTION EQUIPMENT NOISE LEVEL COMPLIANCE

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})		
	Highest Levels[2]	Threshold[3]	Threshold Exceeded?[4]
R1	90	85	Yes
R2	88	85	Yes
R3	92	85	Yes
R4	80	85	No
R5	87	85	Yes
R6	86	85	Yes
R7	85	85	Yes
R8	92	85	Yes
R9	86	85	Yes
R10	75	85	No
R11	84	85	No
R12	84	85	No
R13	75	85	No

[1] Noise-sensitive receiver locations are shown on Exhibit 7-A.
[2] Highest construction noise levels during peak operating conditions at each receiver location, as shown on Table 7-7.
[3] Construction noise level threshold as shown on Table 4-1.
[4] Do the estimated Project construction noise levels exceed the construction noise level threshold?

Temporary, minimum 10-foot high construction noise mitigation measures are, therefore, required to reduce the impacts at occupied receiver locations R1, R2, R3, R5, R6, R7, R8, and R9. The construction noise mitigation measures are outlined in the Construction Mitigation Plan and Executive Summary.

The noise attenuation provided through temporary noise barriers depends on many factors including cost, wind loading, the location of the receiver, and the ability to place barriers such that the line-of-sight of the receiver is blocked to the noise source, among others. This analysis assumes a temporary noise barrier constructed using frame-mounted materials such as vinyl acoustic curtains or quilted blankets attached to the construction site perimeter fence.

As shown on Table 7-9, the temporary construction noise barrier mitigation will reduce the construction noise levels at the potentially impacted, occupied receiver locations to range from 74 to 80 dBA L_{eq} and will satisfy the 85 dBA L_{eq} threshold for noise-sensitive receiver locations. Therefore, the noise impact due to typical Project construction activities is considered a *less than significant* impact with mitigation for receiver locations R1, R2, R3, R5, R6, R7 R8, and R9. Appendix 7.2 includes the temporary construction noise barrier attenuation calculations. Sample temporary noise barrier photos are provided in Appendix 7.3 for reference.

TABLE 7-9: MITIGATED CONSTRUCTION EQUIPMENT NOISE LEVEL COMPLIANCE

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})				
	Highest Levels[2]	10' Temporary Noise Barrier Attenuation	Mitigated Construction Noise Levels	Threshold[3]	Threshold Exceeded?[4]
R1	90	-11	79	85	No
R2	88	-11	77	85	No
R3	92	-12	80	85	No
R5	87	-11	76	85	No
R6	86	-11	75	85	No
R7	85	-11	74	85	No
R8	92	-12	80	85	No
R9	86	-11	75	85	No

[1] Noise-sensitive receiver locations are shown on Exhibit 7-A.
[2] Highest construction noise levels during peak operating conditions at each receiver location, as shown on Table 7-8.
[3] Construction noise level threshold as shown on Table 4-1.
[4] Do the mitigated Project construction noise levels exceed the construction noise level threshold?

7.4 PILE DRIVING CONSTRUCTION NOISE LEVELS

Table 7-10 shows the Project construction noise levels due to pile driving (impact) equipment at the nearby sensitive receiver locations, based on the pile driving activity location and distances previously shown on Exhibit 7-A. As shown on Table 7-10, pile driving (impact) equipment noise levels will range from 76 to 108 dBA L_{eq} at the nearby sensitive receiver locations.

TABLE 7-10: PILE DRIVING (IMPACT) EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours Of Operation[3]	Reference Noise Level @ 50 Feet (dBA L_{max})	Noise Level @ 50 Feet (dBA L_{eq})
Pile Driver (Impact)	1	20%	1.6	101.0	94
				Hourly Noise Levels 50 Feet (dBA L_{eq})	94

Construction Noise Reference Distance	Distance To Closest Pile Driving Activity (Feet)[4]	Distance Attenuation (dBA L_{eq})[5]	Estimated Noise Barrier Attenuation (dBA L_{eq})	Construction Noise Level (dBA L_{eq})
R1	13'	11.7	0.0	106
R2	46'	0.7	0.0	95
R3	10'	14.0	0.0	108
R4	38'	2.4	0.0	96
R5	18'	8.9	0.0	103
R6	21'	7.5	0.0	102
R7	23'	6.7	0.0	101
R8	10'	14.0	0.0	108
R9	106'	-6.5	0.0	87
R10	118'	-7.5	0.0	87
R11	218'	-12.8	0.0	81
R12	143'	-9.1	0.0	85
R13	384'	-17.7	0.0	76

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8-hour workday.
[4] Distance from the nearest pile location to the nearest receiver.
[5] Point (stationary) source drop off rate of 6.0 dBA per doubling of distance.

Given the high construction noise levels generated by impact pile driving equipment, Table 7-11 presents the Project construction noise levels due to pile driving with alternative equipment (e.g., drilling or non-impact alternative) at the nearby sensitive receiver locations. As shown on Table 7-11, pile driving (e.g., drilling or non-impact alternative) equipment noise levels will range from 59 to 91 dBA L_{eq} at the nearby sensitive receiver locations.

TABLE 7-11: PILE DRIVING (DRILLING) EQUIPMENT NOISE LEVELS

Equipment Type[1]	Quantity	Usage Factor[2]	Hours Of Operation[3]	Reference Noise Level @ 50 Feet (dBA L_{max})	Noise Level @ 50 Feet (dBA L_{eq})
Auger Drill Rig	1	20%	1.6	84.0	77
Hourly Noise Levels 50 Feet (dBA L_{eq})					77

Construction Noise Reference Distance	Distance To Closest Pile Driving Activity (Feet)[4]	Distance Attenuation (dBA L_{eq})[5]	Estimated Noise Barrier Attenuation (dBA L_{eq})	Construction Noise Level (dBA L_{eq})
R1	13'	11.7	0.0	89
R2	46'	0.7	0.0	78
R3	10'	14.0	0.0	91
R4	38'	2.4	0.0	79
R5	18'	8.9	0.0	86
R6	21'	7.5	0.0	85
R7	23'	6.7	0.0	84
R8	10'	14.0	0.0	91
R9	106'	-6.5	0.0	71
R10	118'	-7.5	0.0	70
R11	218'	-12.8	0.0	64
R12	143'	-9.1	0.0	68
R13	384'	-17.7	0.0	59

[1] Source: FHWA's Roadway Construction Noise Model, January 2006.
[2] Estimates the fraction of time each piece of equipment is operating at full power during a construction operation.
[3] Represents the actual hours of peak construction equipment activity out of a typical 8-hour workday.
[4] Distance from the nearest pile location to the nearest receiver.
[5] Point (stationary) source drop off rate of 6.0 dBA per doubling of distance.

7.5 PILE DRIVING CONSTRUCTION NOISE LEVEL COMPLIANCE

The pile driving construction noise analysis shows that the highest construction noise levels will occur if impact pile driving equipment is used at the closest point from the edge of primary construction activity to each of the nearby receiver locations. As shown on Table 7-12, the impact pile driving equipment noise levels, ranging from 76 to 108 dBA L_{eq} will exceed the 85 dBA L_{eq} construction noise level threshold at 10 of the 13 receiver locations: R1 to R10, if occupied. The pile driving equipment noise levels with alternative drilling equipment are shown to range from 59 to 91 dBA L_{eq} and will exceed the 85 dBA L_{eq} construction noise level threshold at four of the 13 receiver locations: R1, R3, R5, and R8. Therefore, both the unmitigated impact and drilling pile driving equipment noise levels represent *potentially significant* noise impacts.

TABLE 7-12: UNMITIGATED PILE DRIVING EQUIPMENT NOISE LEVEL COMPLIANCE

Receiver Location[1]	Noise Levels (dBA L_{eq})		Threshold[3]	Threshold Exceeded?[4]	
	Pile Driver (Impact) Noise Levels[2]	Pile Driver (Drilling) Noise Levels		Pile Driver (Impact)	Pile Driver (Drilling)
R1	106	89	85	Yes	Yes
R2	95	78	85	Yes	No
R3	108	91	85	Yes	Yes
R4	96	79	85	Yes	No
R5	103	86	85	Yes	Yes
R6	102	85	85	Yes	No
R7	101	84	85	Yes	No
R8	108	91	85	Yes	Yes
R9	87	70	85	Yes	No
R10	87	70	85	Yes	No
R11	81	64	85	No	No
R12	85	68	85	No	No
R13	76	59	85	No	No

[1] Noise-sensitive receiver locations are shown on Exhibit 7-A.
[2] Estimated construction noise levels during peak operating conditions, as shown on Tables 7-10 and 7-11, respectively.
[3] Construction noise level threshold as shown on Table 4-1.
[4] Do the estimated Project construction noise levels exceed the construction noise level threshold?

Construction noise mitigation measures are therefore required to reduce the impacts at the nearby, occupied sensitive receiver locations. Non-impact pile driving equipment (e.g., drilling or other non-impact alternatives) shall be required to reduce the pile driving equipment noise levels at adjacent receiver locations. Further construction noise mitigation measures are outlined in the Construction Mitigation Plan and Executive Summary.

As shown on Table 7-13, the previously identified temporary construction noise barrier mitigation for typical construction noise levels will also reduce the pile driving (e.g., drilling or non-impact alternative) equipment noise levels at the potentially impacted receiver locations to range from 75 to 79 dBA L_{eq} and will satisfy the 85 dBA L_{eq} threshold for noise-sensitive receiver locations. Therefore, the noise impact due to typical Project construction activities is considered a *less than significant* impact with mitigation for receiver locations R1, R3, R5, and R8.

TABLE 7-13: MITIGATED PILE DRIVING EQUIPMENT NOISE LEVEL COMPLIANCE

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})				
	Highest Pile Driving (Drilling) Levels[2]	10' Temporary Noise Barrier Attenuation	Mitigated Construction Noise Levels	Threshold[3]	Threshold Exceeded?[4]
R1	89	-11	78	85	No
R3	91	-12	79	85	No
R5	86	-11	75	85	No
R8	91	-12	79	85	No

[1] Noise-sensitive receiver locations are shown on Exhibit 7-A.
[2] Estimated construction noise levels during peak operating conditions, as shown on Tables 7-10 and 7-11, respectively.
[3] Construction noise level threshold as shown on Table 4-1.
[4] Do the mitigated Project construction noise levels exceed the construction noise level threshold?

7.6 CONSTRUCTION VIBRATION IMPACTS

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used, distance to the affected structures and soil type.

7.6.1 CONSTRUCTION VIBRATION ASSESSMENT METHODOLOGY

This analysis focuses on the potential ground-borne vibration associated with construction activities. Ground-borne vibration levels associated with several types of construction equipment are summarized on Table 7-14. Based on the representative vibration levels presented for various construction equipment types, it is possible to estimate the human response (annoyance) using the vibration thresholds identified by Caltrans. To describe the potential vibration impacts the FTA provides the following equation and reference vibration levels on Table 7-14: $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$

TABLE 7-14: VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	PPV (in/sec) at 25 feet
Small bulldozer	0.003
Jackhammer	0.035
Loaded Trucks	0.076
Large bulldozer	0.089
Pile Driver (Drilling)	0.089
Pile Driver (Impact)	0.644

7.6.2 CONSTRUCTION VIBRATION LEVELS

Ground-borne vibration levels resulting from construction activities occurring within the Project site were estimated by data published by the Federal Transit Administration (FTA). Using the vibration source level of construction equipment provided on Table 7-14 and the construction vibration assessment methodology published by the FTA, it is possible to estimate the Project vibration impacts. Table 7-15 presents the expected Project related vibration levels at distances ranging from 10 to 73 feet from construction activity.

Typical Construction Activity Vibration Levels

At distances ranging from 10 to 73 feet from the Project site, typical construction activity vibration velocity levels are expected to range from 0.018 to 0.352 in/sec PPV, as shown on Table 7-15. Table 7-15 shows that the Project construction vibration levels will exceed the human annoyance threshold of 0.2 in/sec PPV at receiver locations R1, R3 and R8. In addition, construction vibration levels are shown to exceed the building damage threshold of 0.3 in/sec PPV at receiver locations R3 and R8. Therefore, the unmitigated temporary construction-related vibration levels are considered a *potentially significant* impact.

Temporary construction vibration mitigation measures are required to reduce the impacts at nearby sensitive receiver locations. The Construction Mitigation Plan outlined in this report identifies the measures required to satisfy the 0.3 in/sec PPV building damage vibration threshold at nearby sensitive receiver locations to *less than significant* impacts after mitigation. Mitigation includes ground-borne vibration monitoring of nearby residential structures, represented by receiver locationsR3 and R8 adjacent to the channel between Old Greenspot Road and Merris Street, shall be required for the duration of Project construction between Old Greenspot Road and Merris Street. The monitoring shall be based on the Caltrans residential building damage threshold of 0.3 in/sec PPV. Though Caltrans identifies a residential building damage threshold of 0.3 in/sec PPV, the County of San Bernardino may require that vibration levels do not exceed a more conservative threshold (e.g., lower) at their discretion.

However, vibration levels will still exceed the human annoyance threshold of 0.2 in/sec PPV at receiver locations R1, R3, and R8, and therefore, Project typical construction vibration levels represent a *potentially significant* impact at occupied residential homes in relation to human annoyance with mitigation. The Construction Mitigation Plan outlined in this report identifies the measures required to satisfy the 0.2 in/sec PPV human annoyance vibration threshold at nearby sensitive receiver locations to *less than significant* impacts after mitigation. If monitored vibration levels exceed the 0.2 in/sec PPV annoyance threshold then relocation of residents, and/or hours restrictions to day(s)/time(s) when the impacted receiver(s) are unoccupied, shall be provided for the duration of activities within 25 feet of the affected receiver location(s).

Further, vibration levels at the site of the closest sensitive receiver are unlikely to be sustained during the entire construction period but will occur rather only during the times that heavy construction equipment is operating adjacent to the Project site perimeter. Moreover, construction at the Project site will be restricted to daytime hours consistent with City

requirements thereby eliminating potential vibration impacts during the sensitive nighttime hours.

Pile Driving Construction Vibration Levels

At distances ranging from 10 to 384 feet from pile driving (impact) activities, vibration velocity levels are expected to range from 0.011 to 2.530 in/sec PPV, as shown on Table 7-15. Table 7-15 shows that the Project construction vibration levels will exceed the County's human annoyance threshold of 0.2 in/sec PPV at receiver locations R1 to R8. In addition, pile driving (impact) vibration levels are shown to exceed the building damage threshold of 0.3 in/sec PPV at receiver locations R1, and R3 to R8. Therefore, the unmitigated temporary impact pile driving-related vibration levels are considered a *potentially significant* impact.

Temporary construction vibration mitigation measures are required to reduce the impacts at nearby sensitive receiver locations during pile driving activities. Consistent with the pile driving measures identified in this report to reduce impact pile driving noise levels, the use of alternative pile driving equipment (e.g., drilling or non-impact alternative) shall be required instead of impact devices. The mitigated pile driving vibration levels with alternative equipment (e.g., drilling or non-impact alternative) will be reduced to range from 0.001 to 0.352 in/sec PPV, and will still exceed the Caltrans 0.3 in/sec PPV building damage threshold for older residential structures at receiver locations R3 and R8, as shown on Table 7-16. Therefore, the vibration monitoring as part of the Construction Mitigation Plan identified in this noise study shall be required to reduce impacts to *less than significant* levels.

In addition, pile driving (e.g., drilling or non-impact alternative) equipment vibration levels will potentially exceed the human annoyance threshold of 0.2 in/sec PPV at receiver locations R1, R3, and R8, and therefore, Project pile driving (e.g., drilling or non-impact alternative) vibration levels represent a *potentially significant* impact at occupied residential homes in relation to human annoyance with mitigation. However, the Construction Mitigation Plan outlined in this report identifies the measures required to satisfy the 0.2 in/sec PPV human annoyance vibration threshold at nearby sensitive receiver locations to *less than significant* impacts after mitigation.

TABLE 7-15: UNMITIGATED CONSTRUCTION EQUIPMENT VIBRATION LEVELS

Receiver[1]	Distance to Const. Activity (Feet)	Typical Construction PPV Levels (in/sec)[2]					Pile Driving (PPV)[2]		Thresholds (in/sec PPV)		Threshold Exceeded?[3]			
											Typical Construction		Pile Driving Impact	
		Small Bulldozer (< 80k lbs)	Jack-hammer	Loaded Trucks	Large Bulldozer (> 80k lbs)	Highest Vibration Level	Distance to Pile Driving (Feet)	Pile Driver (Impact)	Human Annoyance	Building Damage	Human Annoyance	Building Damage	Human Annoyance	Building Damage
R1	13'	0.008	0.093	0.203	0.237	0.237	13'	1.707	0.2	0.3	**Yes**	No	**Yes**	**Yes**
R2	15'	0.006	0.075	0.164	0.191	0.191	46'	0.256	0.2	0.3	No	No	**Yes**	No
R3	10'	0.012	0.138	0.300	0.352	0.352	10'	2.530	0.2	0.3	**Yes**	**Yes**	**Yes**	**Yes**
R4	38'	0.002	0.019	0.041	0.047	0.047	38'	0.342	0.2	0.3	No	No	**Yes**	**Yes**
R5	18'	0.005	0.057	0.124	0.146	0.146	18'	1.048	0.2	0.3	No	No	**Yes**	**Yes**
R6	21'	0.004	0.045	0.099	0.116	0.116	21'	0.831	0.2	0.3	No	No	**Yes**	**Yes**
R7	23'	0.003	0.040	0.086	0.101	0.101	23'	0.725	0.2	0.3	No	No	**Yes**	**Yes**
R8	10'	0.012	0.138	0.300	0.352	0.352	10'	2.530	0.2	0.3	**Yes**	**Yes**	**Yes**	**Yes**
R9	21'	0.004	0.045	0.099	0.116	0.116	106'	0.073	0.2	0.3	No	No	No	No
R10	73'	0.001	0.007	0.015	0.018	0.018	118'	0.062	0.2	0.3	No	No	No	No
R11	24'	0.003	0.037	0.081	0.095	0.095	218'	0.025	0.2	0.3	No	No	No	No
R12	26'	0.003	0.033	0.072	0.084	0.084	143'	0.047	0.2	0.3	No	No	No	No
R13	69'	0.001	0.008	0.017	0.019	0.019	384'	0.011	0.2	0.3	No	No	No	No

[1] Receiver locations are shown on Exhibit 7-A.
[2] Based on the Vibration Source Levels of Construction Equipment included on Table 7-14.
[3] Does the peak vibration exceed the acceptable vibration thresholds?
"PPV" = Peak Particle Velocity

TABLE 7-16: ALTERNATIVE PILE DRIVING CONSTRUCTION EQUIPMENT VIBRATION LEVELS

Receiver[1]	Distance to Const. Activity (Feet)	Pile Drilling (PPV)		Thresholds (in/sec PPV)		Threshold Exceeded?	
		Distance to Pile Driving (Feet)	Pile Driver (Drill)	Human Annoyance	Building Damage	Human Annoyance	Building Damage
R1	13'	13'	0.237	0.2	0.3	Yes	No
R2	15'	46'	0.036	0.2	0.3	No	No
R3	10'	10'	0.352	0.2	0.3	Yes	Yes
R4	38'	38'	0.047	0.2	0.3	No	No
R5	18'	18'	0.146	0.2	0.3	No	No
R6	21'	21'	0.116	0.2	0.3	No	No
R7	23'	23'	0.101	0.2	0.3	No	No
R8	10'	10'	0.352	0.2	0.3	Yes	Yes
R9	21'	106'	0.010	0.2	0.3	No	No
R10	73'	118'	0.009	0.2	0.3	No	No
R11	24'	218'	0.003	0.2	0.3	No	No
R12	26'	143'	0.007	0.2	0.3	No	No
R13	69'	384'	0.001	0.2	0.3	No	No

[1] Receiver locations are shown on Exhibit 7-A.
[2] Based on the Vibration Source Levels of Construction Equipment included on Table 7-14.
[3] Does the mitigated vibration exceed the acceptable vibration thresholds?
"PPV" = Peak Particle Velocity

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8 REFERENCES

1. **State of California.** *California Environmental Quality Act, Appendix G.* 2018.
2. **California Department of Transportation Environmental Program.** *Technical Noise Supplement - A Technical Supplement to the Traffic Noise Analysis Protocol.* Sacramento, CA : s.n., September 2013.
3. **Environmental Protection Agency Office of Noise Abatement and Control.** *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* March 1974. EPA/ONAC 550/9/74-004.
4. **U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch.** *Highway Traffic Noise Analysis and Abatement Policy and Guidance.* June, 1995.
5. **U.S. Department of Transportation, Federal Highway Administration.** *Highway Traffic Noise in the United States, Problem and Response.* April 2000. p. 3.
6. **U.S. Environmental Protection Agency Office of Noise Abatement and Control.** *Noise Effects Handbook-A Desk Reference to Health and Welfare Effects of Noise.* October 1979 (revised July 1981). EPA 550/9/82/106.
7. **Occupational Safety and Health Administration.** *Standard 29 CRF, Part 1910.*
8. **Center for Disease Control and Prevention.** About Hearing Loss. [Online] [Cited: 04 15, 2016.] http://www.cdc.gov/healthyschools/noise/signs.htm.
9. **U.S. Department of Transportation, Federal Transit Administration.** *Transit Noise and Vibration Impact Assessment.* September 2018.
10. **Office of Planning and Research.** *State of California General Plan Guidlines 2003.* October 2003.
11. **City of Highland.** *General Plan, Noise Element.* March 2006.
12. **National Institute for Occupational Safety and Health.** *Criteria for Recommended Standard: Occupational Noise Exposure.* June 1998.
13. **California Department of Transportation.** *Transportation and Construction Vibration Guidance Manual.* September 2013.
14. **County of San Bernardino.** *Development Code, Chapter 83.01.*
15. **American National Standards Institute (ANSI).** *Specification for Sound Level Meters ANSI S1.4-2014/IEC 61672-1:2013.*
16. **U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning.** *FHWA Roadway Construction Noise Model.* January, 2006.
17. **San Bernardino County Flood Control District.** *Elder Creek Construction Schedule.* May 2018.

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9 CERTIFICATION

The contents of this noise study report represent an accurate depiction of the noise environment and impacts associated with the proposed Elder Creek Channel Improvements Project. The information contained in this noise study report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at (949) 336-5979.

Bill Lawson, P.E., INCE
Principal
URBAN CROSSROADS, INC.
260 E. Baker Street, Suite 200
Costa Mesa, CA 92626
(949) 336-5979
blawson@urbanxroads.com

EDUCATION

Master of Science in Civil and Environmental Engineering
California Polytechnic State University, San Luis Obispo • December, 1993

Bachelor of Science in City and Regional Planning
California Polytechnic State University, San Luis Obispo • June, 1992

PROFESSIONAL REGISTRATIONS

PE – Registered Professional Traffic Engineer – TR 2537 • January, 2009
AICP – American Institute of Certified Planners – 013011 • June, 1997–January 1, 2012
PTP – Professional Transportation Planner • May, 2007 – May, 2013
INCE – Institute of Noise Control Engineering • March, 2004

PROFESSIONAL AFFILIATIONS

ASA – Acoustical Society of America
ITE – Institute of Transportation Engineers

PROFESSIONAL CERTIFICATIONS

Certified Acoustical Consultant – County of Orange • February, 2011
FHWA-NHI-142051 Highway Traffic Noise Certificate of Training • February, 2013

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APPENDIX 3.1:

CITY OF HIGHLAND MUNICIPAL CODE

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Chapter 8.50
NOISE CONTROL

Sections:

8.50.010 Findings and purpose.

A. It is the purpose of these regulations to implement the goals and objectives of the noise element of the city's general plan, to establish community-wide noise standards and to serve as a reference for locating other city regulations relating to noise in the community. It is further the purpose of these regulations to recognize that the existence of excessive noise within the city is a condition which is detrimental to the health, safety, welfare and quality of life of the citizens which should be regulated in the public interest.

B. In furtherance of the foregoing purpose, the city council finds and declares as follows:

1. The making, creation or maintenance of such loud, unnecessary, unnatural or unusual noises or vibrations that are prolonged, unusual, annoying, disturbing and unnatural in their time, place and use are a detriment to the public health, comfort, convenience, safety, general welfare and the peace and quiet of the city and its inhabitants; and

2. The public interest necessity for the provisions and prohibitions hereinafter contained and enacted is declared as a matter of legislative determination and public policy, and it is further declared that the provisions and prohibitions hereinafter contained and enacted are in pursuit of and for the purpose of securing and promoting the public health, comfort, convenience, safety, general welfare and property and the peace and quiet of the city and its inhabitants. (Ord. 324 § 2, 2008)

8.50.020 Definitions.

For the purposes of this chapter, the following terms shall have the meanings given:

"Construction equipment" means tools, machinery or equipment used in connection with construction operations, including all types of "special construction" equipment as defined in the pertinent sections of the California Vehicle Code when used in the construction process on any construction site, home improvement site or property maintenance site, regardless of whether such site be located on highway or off highway.

"Enforcement officer" means a city code enforcement officer or peace officer authorized to enforce the provisions and prohibitions of this chapter pursuant to HMC 8.50.070.

“Plainly audible” means any sound that can be detected by a person using his or her unaided hearing faculties. As an example, if the sound source under investigation is a portable or personal vehicular sound amplification or reproduction device, the investigating enforcement officer need not determine the title of any music, specific words, or the artist performing the music. The detection of the vibration from the rhythmic bass component of the music is sufficient to constitute a plainly audible sound.

“Public right-of-way” means any street, avenue, boulevard, highway, sidewalk, alley or similar place, owned or controlled by a government entity.

“Public space” means any real property or structure(s) on real property, owned by a government entity and normally accessible to the public, including but not limited to parks and other recreation areas.

“Responsible person” means (1) any person who owns, leases or is lawfully in charge of the property or motor vehicle where the noise violation takes place or (2) any person who owns or controls the source of the noise or violation. If the responsible person is a minor, then the parent or guardian who has custody of the child at the time of the violation shall be the responsible person who is liable under this chapter. (Ord. 324 § 2, 2008)

8.50.030 Prohibited acts.

A. It shall be unlawful for any person to engage in the following activities:

1. Sounding any horn or signal device on any automobile, motorcycle, bus or other motor vehicle in any other manner or circumstance(s) or for any other purpose than required or permitted by the Vehicle Code or other state laws.

2. Racing the engine of any motor vehicle while the vehicle is not in motion, except when necessary to do so in the course of repairing, adjusting or testing the same.

3. Operating or permitting the use of any motor vehicle on any public right-of-way or public place or on private property within a residential zone for which the exhaust muffler, intake muffler or any other noise abatement device has been modified or changed in a manner such that the noise emitted by the motor vehicle is increased above that emitted by the vehicle as originally manufactured.

4. Operating or permitting the use or operation of personal or commercial music or sound amplification or production equipment that is:

a. Plainly audible across property boundaries;

b. Plainly audible through partitions common to two residences within a building;

c. Plainly audible at a distance of 50 feet in any direction from the source of music or sound, between the hours of 7:00 a.m. and 10:00 p.m.; or

d. Plainly audible at a distance of 25 feet in any direction from the source of music or sound, between the hours of 10:00 p.m. and 7:00 a.m.

5. The intentional sounding or permitting the sounding outdoors of any fire, burglar, or civil defense alarm, siren, whistle, or any motor vehicle burglar alarm, except for emergency purposes or for testing, unless such alarm is terminated within 15 minutes of activation.

6. Creating excessive noise adjacent to any school, church, court or library while the same is in use, or adjacent to any hospital or care facility, which unreasonably interferes with the workings of such institution, or which disturbs or unduly annoys patients in the hospital, provided conspicuous signs are displayed,

clearly visible to the motoring public, indicating the presence of a school, institution of learning, church, court or hospital.

7. Making or knowingly and unreasonably permitting to be made any unreasonably loud, unnecessary or unusual noise that disturbs the comfort, repose, health, peace and quiet or which causes discomfort or annoyance to any reasonable person of normal sensitivity. The characteristics and conditions that may be considered in determining whether this section has been violated include, but are not limited to, the following:

a. The level of noise;

b. Whether the nature of the noise is usual or unusual;

c. Whether the origin of the noise is natural or unnatural;

d. The level of the background noise;

e. The proximity of the noise to sleeping facilities;

f. The nature and zoning of the area(s) within which the noise emanates;

g. The density of the inhabitation of the area within which the noise emanates;

h. The time of day or night the noise occurs;

i. The duration of the noise; and

j. Whether the noise is produced by a commercial or noncommercial activity.

B. A violation of this section is a public nuisance.

C. A violation of this section may result in the following:

1. Issuance of an administrative citation, where the fines and penalties shall be assessed as infractions in accordance with HMC 2.56.110;

2. Issuance of a notice of public nuisance and abatement pursuant to Chapter 8.28 HMC;

3. Imposition of criminal and civil penalties, including those in Chapter 1.24 HMC; and

4. Confiscation and impoundment as evidence of the components that are amplifying or transmitting the prohibited noise.

D. An enforcement officer who encounters a violation of this section may issue a written notice to the responsible person demanding immediate abatement of the violation (written notice). The written notice shall inform the recipient that a second violation of the same provision within a 72-hour period may result in the issuance of a criminal citation and/or notice of public nuisance, the imposition of criminal and civil penalties, and confiscation and impoundment as evidence of the components that are amplifying or transmitting the prohibited noise.

E. Any peace officer who encounters a second violation of this section within a 72-hour period following issuance of a written notice is empowered to confiscate and impound as evidence any or all of the components amplifying or transmitting the sound.

F. Any person claiming legal ownership of the items confiscated and impounded under this section may request the return of the item by filing a written request with the police department within seven calendar days of the

confiscation. Such requests shall be processed in accordance with the procedures adopted by the police department. (Ord. 370 § 27, 2012; Ord. 324 § 2, 2008)

8.50.040 Excessive noise and vibration emanating from a motor vehicle.

A. No person shall operate or occupy a motor vehicle on any public right-of-way, public place or private property, while operating or permitting the use or operation of any radio, stereo receiver, musical instrument, television, computer, compact disc player, tape recorder, cassette player or any other device for the production or reproduction of sound from within the motor vehicle, so that the sound is plainly audible at a distance of 50 feet from such vehicle, or in the case of a motor vehicle on private property, beyond the property line.

B. A violation of this section is a public nuisance.

C. A violation of this section may result in the following:

1. Issuance of an administrative citation, where the fines and penalties shall be assessed as infractions in accordance with HMC 2.56.110;

2. Issuance of a notice of public nuisance and abatement pursuant to Chapter 8.28 HMC;

3. Imposition of criminal and civil penalties, including those in Chapter 1.24 HMC; and

4. Immediate confiscation and impoundment as evidence of the components that are amplifying or transmitting the prohibited noises or the immediate confiscation and impoundment of the motor vehicle to which the component is attached if the same may not be removed without causing harm to the vehicle or the component.

D. Any person claiming legal ownership of a motor vehicle confiscated and impounded under this section may request the return of the vehicle by filing a written request with the police department within seven calendar days of the confiscation. Such requests shall be processed in accordance with procedures adopted by the police department.

E. Any person claiming legal ownership of the items confiscated and impounded under this section, other than a motor vehicle, may request the return of the item by filing a written request with the police department, which shall be processed in accordance with procedures adopted by the police department. (Ord. 370 § 28, 2012; Ord. 324 § 2, 2008)

8.50.050 Controlled hours of operation.

It shall be unlawful for any person to engage in the following activities at a time other than between the hours of 5:00 a.m. and 10:00 p.m. on any day in the industrial (I) zone, and between the hours of 7:00 a.m. and 10:00 p.m. on any day in all other zones:

A. Operate or permit the use of powered model vehicles and planes.

B. Load or unload any vehicle, or operate or permit the use of dollies, carts, forklifts, or other wheeled equipment that causes any impulsive sound, raucous or unnecessary noise within 1,000 feet of a residence.

C. Operate or permit the use of domestic power tools, machinery, or any other equipment or tool in any garage, workshop, house or any other structure.

D. Operate or permit the use of gasoline or electric-powered leaf blowers such as commonly used by gardeners and other persons for cleaning lawns, yards, driveways, gutters and other property.

E. Operate or permit the use of privately operated street/parking lot sweepers or vacuums, except that emergency work and/or work necessitated by unusual conditions may be performed with the written consent of the code enforcement officer.

F. Operate or permit the use of electrically operated compressor(s), fan(s) and other similar device(s).

G. Operate or permit the use of pile driver(s), steam or gasoline shovel(s), pneumatic hammer(s), steam or electric hoist(s) or other similar device(s).

H. Perform ground maintenance on golf course grounds and tennis courts contiguous to golf courses that creates a noise disturbance across a residential or commercial property line.

I. Operate or permit the use of any motor vehicle with a gross vehicle weight rating in excess of 10,000 pounds, or of any auxiliary equipment attached to such a vehicle, including but not limited to refrigerated truck compressors, for a period longer than 15 minutes in any hour while the vehicle is stationary and on a public right-of-way or public space, except when movement of said vehicle is restricted by other traffic.

J. Repair, rebuild, reconstruct or dismantle any motor vehicle or other mechanical equipment or device(s) in a manner so as to be plainly audible across property lines.

K. Load, unload, open, close or otherwise handle garbage cans, recycling bins or other similar objects between the hours of 10:00 p.m. and 7:00 a.m. the following morning, except city-permitted trash collection. (Ord. 352 § 1, 2010; Ord. 324 § 2, 2008)

8.50.060 Exemptions.

The following activities and noise sources shall not be subject to the provisions of this chapter:

A. Those noise events in the community (e.g., airport noise, arterial traffic noise, railroad noise) that are more accurately measured by application of the general plan noise element policy, utilizing the community noise equivalent level (CNEL) method.

B. Activities conducted on the grounds of any public or private school during regular hours of operation.

C. Outdoor gatherings, public dances, shows and sporting and entertainment events, provided said events are authorized by the city.

D. Legally permitted activities conducted at public places during regular hours of operation.

E. Any mechanical device, apparatus, or equipment used, related to or connected with emergency machinery, vehicle or work.

F. All mechanical devices, apparatus, or equipment which are utilized for the protection or salvage of agricultural crops during periods of potential or actual frost damage or other adverse weather conditions.

G. Mobile noise sounds associated with agricultural operations, provided such operations do not take place between the hours of 10:00 p.m. and 7:00 a.m. on weekdays, including Saturdays, or at any time on Sunday or a state holiday.

H. Mobile noise sources associated with agricultural pest control through pesticide application.

I. Warning devices necessary for the protection of the public safety, including, but not limited to, police, fire and ambulance sirens and train horns and sounds for the purpose of alerting persons to the existence of an emergency.

J. Construction, repair or excavation necessary for the immediate preservation of life or property.

K. Construction, operation, maintenance and repair of equipment, apparatus or facilities of the park and recreation department, public work projects or essential public services and facilities, including trash collection and those of public utilities subject to the regulatory jurisdiction of the Public Utilities Commission.

L. Construction, repair or excavation work performed pursuant to a valid written agreement with the city or any of its political subdivisions, which agreement provides for noise mitigation measures.

M. Any activity, to the extent regulation thereof has been preempted by state or federal law.

N. Any specific activity or noise source governed elsewhere in this code. Such activities include, but are not limited to:

1. Security alarm systems (Chapter 8.04 HMC);

2. Animal noise (Chapter 6.04 HMC);

3. Loud, unruly or disorderly private parties or assemblies (Chapter 9.17 HMC). (Ord. 324 § 2, 2008)

8.50.070 Enforcement and administration.

The city manager, chief of police and/or their designees shall be responsible for administering and enforcing the provisions of this chapter. (Ord. 324 § 2, 2008)

8.50.080 Enforcement – Interference.

No person shall interfere with, oppose, or resist any authorized person charged with the enforcement of this chapter while such person is engaged in the performance of his duty. (Ord. 324 § 3, 2008; Ord. 283 § 4, 2002. Formerly 8.50.140)

8.50.090 Violations – Notices – Abatement.

Violations of this chapter shall be prosecuted in the same manner as other violations of this code; provided, however, in the event of an initial violation of the provisions of this chapter, a written notice shall be given the alleged violator which specifies the time by which the condition shall be corrected or, where applicable, an application for a permit shall be received by the planning division. No complaint or further action shall be taken in the event the cause of the violation has been removed or the condition abated or fully corrected within the time period specified in the written notice. (Ord. 370 § 29, 2012; Ord. 324 § 3, 2008; Ord. 283 § 4, 2002. Formerly 8.50.150)

8.50.100 Violations – Penalties.

Repealed by Ord. 370. (Ord. 324 § 3, 2008; Ord. 283 § 4, 2002. Formerly 8.50.160)

8.50.110 Violations – Notices – Service – Effect.

In the event the alleged violator cannot be located in order to serve the violation of intention to prosecute, such notice shall be deemed to be given upon mailing such notice by registered or certified mail to the alleged violator at his last known address or at the place where the violation occurred, in which event the specified time period for abating the violation or applying for a variance shall commence on the date of the day following the mailing of such notice. Subsequent violations of the same offense shall result in the immediate filing of a complaint. (Ord. 370 § 30, 2012; Ord. 324 § 3, 2008; Ord. 283 § 4, 2002. Formerly 8.50.170)

8.50.120 Immediate threats to health and welfare.

A. The city manager may order an immediate halt to any sound which exposes any person, except those excluded pursuant to HMC 8.50.060, to continuous sound levels in excess of those described herein. Within two days following the issuance of any such order, the city shall apply to the appropriate court for an injunction to replace the order.

B. No order pursuant to subsection A of this section shall be issued if the only persons exposed to sound levels in excess of those contained herein are exposed as a result of (1) trespassing; (2) an invitation upon private property by the person causing or permitting the sound; or (3) employment by the person or contractor of the person causing or permitting the sound.

C. Any person subject to an order issued pursuant to subsection A of this section shall comply with such order until (1) the sound is brought into compliance with the order, as determined by the city manager; or (2) a judicial order has superseded the order of the city manager. (Ord. 324 § 3, 2008; Ord. 283 § 4, 2002. Formerly 8.50.180)

8.50.130 Administrative citations and costs of second and subsequent responses.

The city manager or his designee, in his/her sole discretion, may prosecute violations of this chapter through the administrative citation process set forth in Chapter 2.56 HMC, in lieu of the criminal or nuisance abatement process. In the case of second and subsequent violations of this chapter, the city may assess a second response service fee in compliance with HMC 9.17.030 through 9.17.060, inclusive. (Ord. 324 § 4, 2008)

8.50.140 Modification, suspension and/or revocation of validly issued city permit and/or city license.

The violation of this chapter by any city permittee or licensee more than twice in any six-calendar-month period, in the course of operating pursuant to a validly issued city permit and/or license, may be grounds for the modification, suspension or revocation of such license subject to normal city processes, in the discretion of the city manager. (Ord. 324 § 4, 2008)

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APPENDIX 5.1:

STUDY AREA PHOTOS

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L1_E
34, 6' 34.890000", 117, 10' 18.970000"

L1_N
34, 6' 36.330000", 117, 10' 17.780000"

L1_NE
34, 6' 34.890000", 117, 10' 18.970000"

L1_SE
34, 6' 34.890000", 117, 10' 18.970000"

L1_W
34, 6' 34.890000", 117, 10' 18.970000"

L2_N
34, 6' 31.900000", 117, 10' 20.060000"

L2_S
34, 6' 31.900000", 117, 10' 20.060000"

L3_N
34, 6' 31.080000", 117, 10' 20.280000"

L3_S
34, 6' 31.080000", 117, 10' 20.280000"

L3_SW
34, 6' 31.080000", 117, 10' 20.280000"

L5_E
34, 6' 27.000000", 117, 10' 21.830000"

L5_N
34, 6' 27.000000", 117, 10' 21.830000"

L5_S
34, 6' 27.000000", 117, 10' 21.830000"

L5_SE
34, 6' 27.000000", 117, 10' 21.830000"

L5_SW
34, 6' 27.210000", 117, 10' 22.360000"

L6_E
34, 6' 22.600000", 117, 10' 24.850000"

L6_N
34, 6' 21.950000", 117, 10' 20.090000"

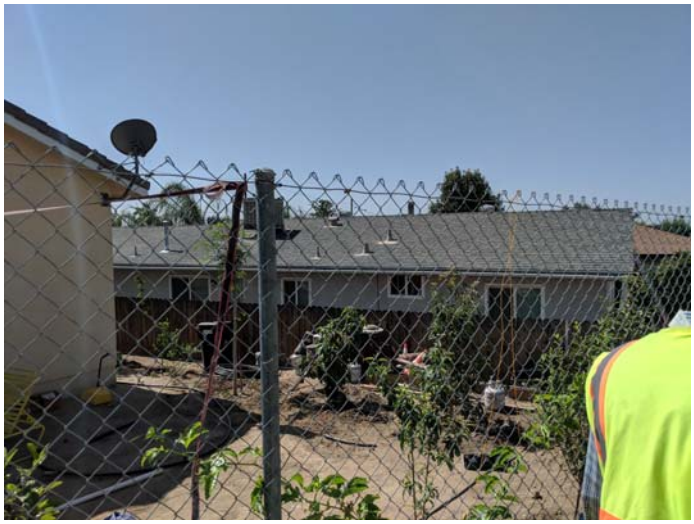
L6_S
34, 6' 21.950000", 117, 10' 20.090000"

L6_SW
34, 6' 21.950000", 117, 10' 20.090000"

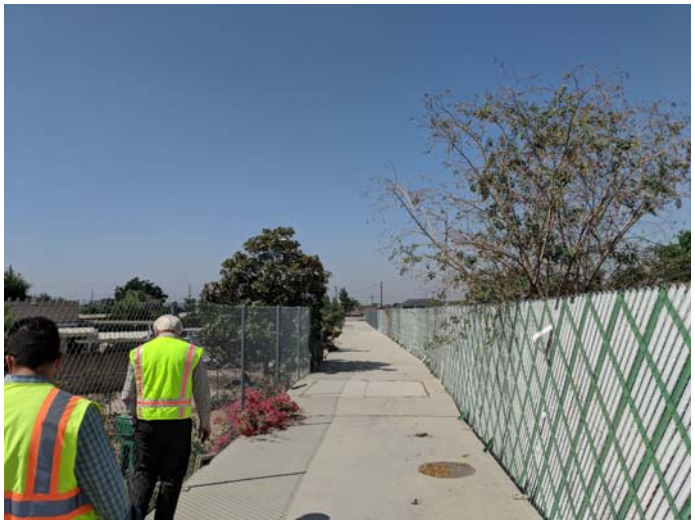
L6_W
34, 6' 21.950000", 117, 10' 20.090000"

Site1
34, 6' 34.720000", 117, 10' 18.300000"

Site2
34, 6' 34.720000", 117, 10' 18.300000"



Site3
34, 6' 33.650000", 117, 10' 18.990000"



Site4
34, 6' 32.880000", 117, 10' 19.540000"

Site5
34, 6' 32.080000", 117, 10' 19.920000"

Site6
34, 6' 30.330000", 117, 10' 20.870000"

Site7
34, 6' 30.330000", 117, 10' 20.870000"

Site8
34, 6' 30.330000", 117, 10' 20.870000"

Site9
34, 6' 30.090000", 117, 10' 21.230000"

Site10
34, 6' 30.120000", 117, 10' 21.170000"

Site11
34, 6' 27.980000", 117, 10' 21.660000"

Site12
34, 6' 27.980000", 117, 10' 21.660000"

Site13
34, 6' 27.980000", 117, 10' 21.660000"

Site14
34, 6' 27.980000", 117, 10' 21.660000"

APPENDIX 5.2:

NOISE LEVEL MEASUREMENT WORKSHEETS

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24-Hour Noise Level Measurement Summary

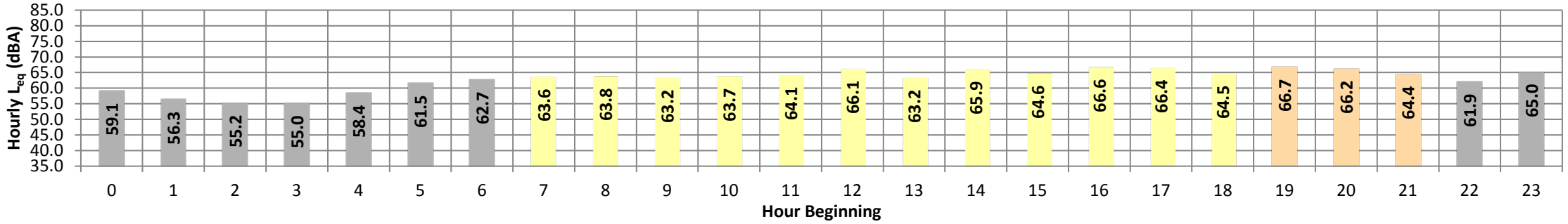
Date: Friday, June 22, 2018
Project: Elder Creek

Location: L1 - Located north of the Project site on Old Greenspot Road near existing residential homes.

Meter: Piccolo I

JN: 11744
Analyst: A. Wolfe

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	59.1	83.5	40.6	69.0	67.0	64.0	63.0	57.0	48.0	42.0	41.0	40.0	59.1	10.0	69.1
	1	56.3	81.2	40.5	68.0	66.0	62.0	58.0	47.0	43.0	40.0	40.0	40.0	56.3	10.0	66.3
	2	55.2	80.9	40.4	67.0	64.0	58.0	55.0	46.0	43.0	40.0	40.0	40.0	55.2	10.0	65.2
	3	55.0	74.9	41.8	66.0	64.0	61.0	59.0	52.0	47.0	43.0	42.0	42.0	55.0	10.0	65.0
	4	58.4	80.4	44.2	68.0	66.0	63.0	61.0	56.0	50.0	46.0	45.0	44.0	58.4	10.0	68.4
	5	61.5	85.0	44.2	72.0	69.0	66.0	65.0	60.0	55.0	48.0	47.0	45.0	61.5	10.0	71.5
	6	62.7	83.5	43.4	72.0	70.0	68.0	66.0	61.0	58.0	51.0	49.0	46.0	62.7	10.0	72.7
Day	7	63.6	85.8	45.9	73.0	71.0	68.0	67.0	62.0	59.0	52.0	50.0	48.0	63.6	0.0	63.6
	8	63.8	91.5	46.3	72.0	70.0	68.0	66.0	61.0	57.0	50.0	49.0	47.0	63.8	0.0	63.8
	9	63.2	84.9	45.2	73.0	70.0	68.0	66.0	62.0	58.0	51.0	49.0	47.0	63.2	0.0	63.2
	10	63.7	81.3	45.4	75.0	72.0	69.0	67.0	62.0	58.0	51.0	50.0	47.0	63.7	0.0	63.7
	11	64.1	82.3	45.2	74.0	73.0	70.0	68.0	63.0	58.0	51.0	49.0	46.0	64.1	0.0	64.1
	12	66.1	89.7	46.4	77.0	74.0	70.0	68.0	63.0	59.0	52.0	50.0	48.0	66.1	0.0	66.1
	13	63.2	82.4	44.4	74.0	71.0	68.0	67.0	62.0	57.0	50.0	48.0	46.0	63.2	0.0	63.2
	14	65.9	90.6	43.7	75.0	72.0	69.0	68.0	63.0	58.0	51.0	49.0	47.0	65.9	0.0	65.9
	15	64.6	83.5	46.4	75.0	73.0	69.0	68.0	64.0	59.0	52.0	51.0	48.0	64.6	0.0	64.6
	16	66.6	91.5	47.0	77.0	74.0	70.0	68.0	64.0	59.0	53.0	51.0	49.0	66.6	0.0	66.6
	17	66.4	89.9	47.2	78.0	74.0	71.0	69.0	64.0	59.0	53.0	52.0	50.0	66.4	0.0	66.4
	18	64.5	91.9	46.4	73.0	70.0	67.0	66.0	63.0	58.0	52.0	51.0	49.0	64.5	0.0	64.5
Evening	19	66.7	95.9	46.6	74.0	72.0	68.0	67.0	62.0	58.0	51.0	50.0	48.0	66.7	5.0	71.7
	20	66.2	90.3	44.3	76.0	73.0	69.0	67.0	63.0	59.0	51.0	50.0	47.0	66.2	5.0	71.2
	21	64.4	87.7	44.3	74.0	72.0	69.0	68.0	63.0	57.0	49.0	47.0	45.0	64.4	5.0	69.4
Night	22	61.9	85.5	41.9	71.0	69.0	67.0	65.0	59.0	53.0	45.0	44.0	43.0	61.9	10.0	71.9
	23	65.0	97.0	40.6	72.0	69.0	66.0	64.0	58.0	50.0	43.0	42.0	41.0	65.0	10.0	75.0

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	63.2	81.3	43.7	72.0	70.0	67.0	66.0	61.0	57.0	50.0	48.0	46.0
	Max	66.6	91.9	47.2	78.0	74.0	71.0	69.0	64.0	59.0	53.0	52.0	50.0
Energy Average		64.8	Average:		74.7	72.0	68.9	67.3	62.8	58.3	51.5	49.9	47.7
Evening	Min	64.4	87.7	44.3	74.0	72.0	68.0	67.0	62.0	57.0	49.0	47.0	45.0
	Max	66.7	95.9	46.6	76.0	73.0	69.0	68.0	63.0	59.0	51.0	50.0	48.0
Energy Average		65.9	Average:		74.7	72.3	68.7	67.3	62.7	58.0	50.3	49.0	46.7
Night	Min	55.0	74.9	40.4	66.0	64.0	58.0	55.0	46.0	43.0	40.0	40.0	40.0
	Max	65.0	97.0	44.2	72.0	70.0	68.0	66.0	61.0	58.0	51.0	49.0	46.0
Energy Average		60.7	Average:		69.4	67.1	63.9	61.8	55.1	49.7	44.2	43.3	42.3

24-Hour L_{eq} (dBA)

63.9

24-Hour CNEL (dBA)

68.7

24-Hour Noise Level Measurement Summary

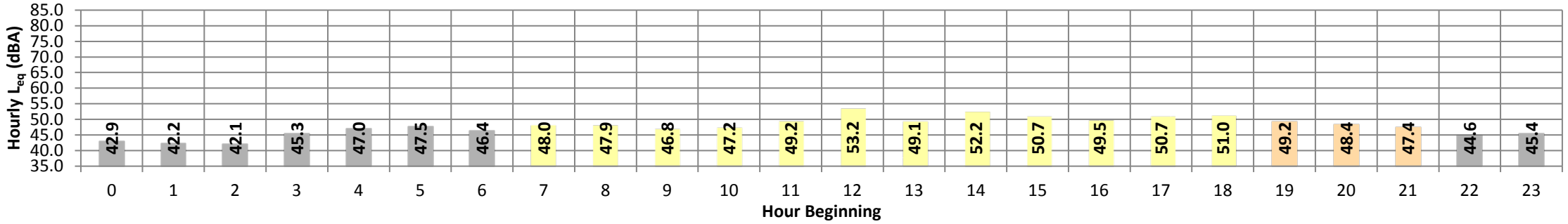
Date: Friday, June 22, 2018
Project: Elder Creek

Location: L2 - Located at the eastern Project site boundary adjacent to existing residential homes on Tyler Street.

Meter: Piccolo I

JN: 11744
Analyst: A. Wolfe

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	42.9	58.2	39.4	48.0	47.0	45.0	44.0	43.0	41.0	40.0	39.0	39.0	42.9	10.0	52.9
	1	42.2	58.5	39.4	49.0	46.0	44.0	44.0	42.0	41.0	39.0	39.0	39.0	42.2	10.0	52.2
	2	42.1	61.3	39.3	48.0	45.0	44.0	43.0	41.0	41.0	39.0	39.0	39.0	42.1	10.0	52.1
	3	45.3	58.6	40.6	51.0	50.0	48.0	48.0	46.0	44.0	41.0	41.0	41.0	45.3	10.0	55.3
	4	47.0	56.7	42.5	52.0	51.0	50.0	49.0	47.0	46.0	44.0	43.0	43.0	47.0	10.0	57.0
	5	47.5	60.4	41.8	53.0	51.0	50.0	49.0	48.0	46.0	44.0	43.0	42.0	47.5	10.0	57.5
	6	46.4	63.1	41.1	52.0	51.0	49.0	48.0	47.0	45.0	43.0	42.0	41.0	46.4	10.0	56.4
Day	7	48.0	71.2	43.3	54.0	52.0	50.0	49.0	47.0	46.0	45.0	44.0	44.0	48.0	0.0	48.0
	8	47.9	63.7	42.5	56.0	54.0	52.0	50.0	47.0	45.0	44.0	43.0	43.0	47.9	0.0	47.9
	9	46.8	60.8	41.1	54.0	52.0	50.0	49.0	46.0	45.0	43.0	42.0	42.0	46.8	0.0	46.8
	10	47.2	64.5	39.4	57.0	54.0	51.0	49.0	46.0	44.0	42.0	41.0	39.0	47.2	0.0	47.2
	11	49.2	70.3	40.4	59.0	57.0	53.0	51.0	47.0	45.0	42.0	41.0	41.0	49.2	0.0	49.2
	12	53.2	74.8	41.3	64.0	61.0	56.0	54.0	50.0	48.0	46.0	45.0	42.0	53.2	0.0	53.2
	13	49.1	62.6	44.5	56.0	55.0	52.0	51.0	49.0	47.0	46.0	46.0	45.0	49.1	0.0	49.1
	14	52.2	74.7	44.8	59.0	56.0	52.0	51.0	49.0	48.0	46.0	46.0	45.0	52.2	0.0	52.2
	15	50.7	63.7	42.2	57.0	56.0	55.0	54.0	51.0	49.0	46.0	46.0	45.0	50.7	0.0	50.7
	16	49.5	64.1	41.1	58.0	56.0	53.0	52.0	49.0	47.0	44.0	43.0	42.0	49.5	0.0	49.5
	17	50.7	63.2	43.3	57.0	56.0	54.0	53.0	51.0	49.0	46.0	46.0	44.0	50.7	0.0	50.7
	18	51.0	63.5	43.1	59.0	57.0	55.0	54.0	51.0	49.0	46.0	46.0	44.0	51.0	0.0	51.0
Evening	19	49.2	65.6	41.1	56.0	54.0	52.0	51.0	49.0	48.0	44.0	44.0	42.0	49.2	5.0	54.2
	20	48.4	65.6	39.4	57.0	55.0	52.0	51.0	48.0	46.0	43.0	42.0	41.0	48.4	5.0	53.4
	21	47.4	60.3	39.1	56.0	54.0	51.0	50.0	47.0	45.0	42.0	41.0	40.0	47.4	5.0	52.4
Night	22	44.6	61.0	38.7	53.0	51.0	48.0	47.0	44.0	42.0	40.0	39.0	39.0	44.6	10.0	54.6
	23	45.4	65.9	39.4	53.0	51.0	49.0	47.0	44.0	42.0	41.0	39.0	39.0	45.4	10.0	55.4

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	46.8	60.8	39.4	54.0	52.0	50.0	49.0	46.0	44.0	42.0	41.0	39.0
	Max	53.2	74.8	44.8	64.0	61.0	56.0	54.0	51.0	49.0	46.0	46.0	45.0
Energy Average		50.1	Average:		57.5	55.5	52.8	51.4	48.6	46.8	44.7	44.1	43.0
Evening	Min	47.4	60.3	39.1	56.0	54.0	51.0	50.0	47.0	45.0	42.0	41.0	40.0
	Max	49.2	65.6	41.1	57.0	55.0	52.0	51.0	49.0	48.0	44.0	44.0	42.0
Energy Average		48.4	Average:		56.3	54.3	51.7	50.7	48.0	46.3	43.0	42.3	41.0
Night	Min	42.1	56.7	38.7	48.0	45.0	44.0	43.0	41.0	41.0	39.0	39.0	39.0
	Max	47.5	65.9	42.5	53.0	51.0	50.0	49.0	48.0	46.0	44.0	43.0	43.0
Energy Average		45.2	Average:		51.0	49.2	47.4	46.6	44.7	43.1	41.2	40.4	40.2

24-Hour L_{eq} (dBA)

48.6

24-Hour CNEL (dBA)

53.1

24-Hour Noise Level Measurement Summary

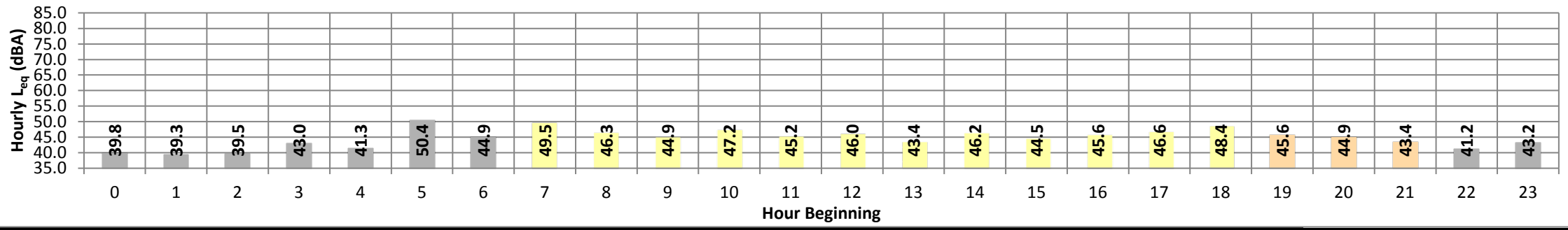
Date: Friday, June 22, 2018
Project: Elder Creek

Location: L3 - Located at the eastern Project site boundary adjacent to existing residential homes on Tyler Street.

Meter: Piccolo I

JN: 11744
Analyst: A. Wolfe

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	39.8	58.0	36.3	46.0	44.0	42.0	41.0	39.0	38.0	36.0	36.0	36.0	39.8	10.0	49.8
	1	39.3	54.4	36.3	46.0	43.0	42.0	41.0	39.0	38.0	36.0	36.0	36.0	39.3	10.0	49.3
	2	39.5	57.9	36.2	47.0	44.0	42.0	40.0	39.0	38.0	36.0	36.0	36.0	39.5	10.0	49.5
	3	43.0	57.7	37.8	48.0	47.0	46.0	45.0	43.0	42.0	39.0	38.0	38.0	43.0	10.0	53.0
	4	41.3	56.3	36.3	50.0	47.0	44.0	43.0	41.0	39.0	38.0	38.0	36.0	41.3	10.0	51.3
	5	50.4	67.2	39.1	61.0	59.0	57.0	56.0	46.0	44.0	41.0	41.0	40.0	50.4	10.0	60.4
	6	44.9	64.1	38.1	55.0	52.0	47.0	46.0	44.0	42.0	40.0	39.0	39.0	44.9	10.0	54.9
Day	7	49.5	69.9	41.4	61.0	58.0	54.0	52.0	47.0	44.0	43.0	43.0	42.0	49.5	0.0	49.5
	8	46.3	68.4	40.1	56.0	53.0	49.0	48.0	44.0	43.0	41.0	41.0	41.0	46.3	0.0	46.3
	9	44.9	61.9	38.9	54.0	51.0	48.0	46.0	44.0	42.0	41.0	40.0	39.0	44.9	0.0	44.9
	10	47.2	66.3	37.7	60.0	58.0	50.0	48.0	43.0	41.0	39.0	39.0	38.0	47.2	0.0	47.2
	11	45.2	65.9	37.9	55.0	51.0	48.0	47.0	43.0	41.0	39.0	39.0	38.0	45.2	0.0	45.2
	12	46.0	61.8	38.1	55.0	54.0	51.0	49.0	45.0	42.0	40.0	39.0	39.0	46.0	0.0	46.0
	13	43.4	60.4	37.6	52.0	50.0	47.0	46.0	42.0	41.0	39.0	39.0	38.0	43.4	0.0	43.4
	14	46.2	68.0	37.9	56.0	52.0	48.0	46.0	43.0	41.0	39.0	39.0	38.0	46.2	0.0	46.2
	15	44.5	57.2	37.9	51.0	50.0	49.0	48.0	45.0	42.0	39.0	38.0	38.0	44.5	0.0	44.5
	16	45.6	60.5	38.1	55.0	54.0	50.0	49.0	44.0	42.0	40.0	39.0	39.0	45.6	0.0	45.6
	17	46.6	61.1	39.8	55.0	53.0	51.0	49.0	46.0	44.0	42.0	42.0	41.0	46.6	0.0	46.6
	18	48.4	73.5	40.8	56.0	55.0	53.0	51.0	47.0	45.0	43.0	42.0	41.0	48.4	0.0	48.4
Evening	19	45.6	63.8	38.5	53.0	52.0	49.0	48.0	45.0	44.0	41.0	40.0	40.0	45.6	5.0	50.6
	20	44.9	63.5	38.0	53.0	51.0	49.0	47.0	44.0	42.0	39.0	39.0	38.0	44.9	5.0	49.9
	21	43.4	58.0	36.3	52.0	50.0	48.0	46.0	42.0	41.0	39.0	38.0	38.0	43.4	5.0	48.4
Night	22	41.2	59.9	36.3	49.0	46.0	44.0	43.0	41.0	39.0	38.0	37.0	36.0	41.2	10.0	51.2
	23	43.2	70.5	36.3	51.0	48.0	44.0	43.0	40.0	39.0	37.0	36.0	36.0	43.2	10.0	53.2

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	43.4	57.2	37.6	51.0	50.0	47.0	46.0	42.0	41.0	39.0	38.0	38.0
	Max	49.5	73.5	41.4	61.0	58.0	54.0	52.0	47.0	45.0	43.0	43.0	42.0
Energy Average		46.5	Average:		55.5	53.3	49.8	48.3	44.4	42.3	40.4	40.0	39.3
Evening	Min	43.4	58.0	36.3	52.0	50.0	48.0	46.0	42.0	41.0	39.0	38.0	38.0
	Max	45.6	63.8	38.5	53.0	52.0	49.0	48.0	45.0	44.0	41.0	40.0	40.0
Energy Average		44.7	Average:		52.7	51.0	48.7	47.0	43.7	42.3	39.7	39.0	38.7
Night	Min	39.3	54.4	36.2	46.0	43.0	42.0	40.0	39.0	38.0	36.0	36.0	36.0
	Max	50.4	70.5	39.1	61.0	59.0	57.0	56.0	46.0	44.0	41.0	41.0	40.0
Energy Average		44.2	Average:		50.3	47.8	45.3	44.2	41.3	39.9	37.9	37.4	37.0

24-Hour L_{eq} (dBA)

45.5

24-Hour CNEL (dBA)

51.2

24-Hour Noise Level Measurement Summary

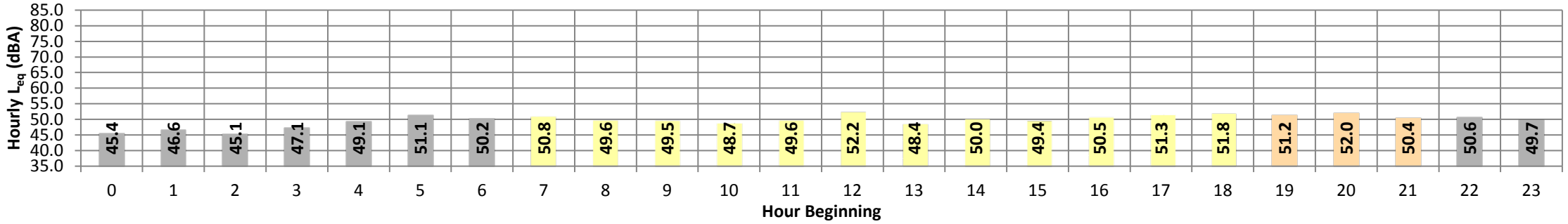
Date: Friday, June 22, 2018
Project: Elder Creek

Location: L4 - Located west of the Project site on Church Street near vacant land and existing residential homes.

Meter: Piccolo I

JN: 11744
Analyst: A. Wolfe

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	45.4	65.8	39.1	53.0	51.0	48.0	47.0	45.0	42.0	40.0	39.0	39.0	45.4	10.0	55.4
	1	46.6	66.9	39.1	58.0	56.0	50.0	47.0	44.0	42.0	39.0	39.0	39.0	46.6	10.0	56.6
	2	45.1	66.4	39.1	55.0	51.0	48.0	47.0	44.0	42.0	40.0	39.0	39.0	45.1	10.0	55.1
	3	47.1	61.4	41.0	54.0	52.0	50.0	49.0	47.0	46.0	43.0	42.0	42.0	47.1	10.0	57.1
	4	49.1	58.6	43.9	54.0	54.0	52.0	51.0	49.0	48.0	45.0	45.0	44.0	49.1	10.0	59.1
	5	51.1	68.3	41.0	59.0	57.0	54.0	53.0	50.0	49.0	46.0	45.0	44.0	51.1	10.0	61.1
	6	50.2	63.8	43.0	58.0	56.0	54.0	52.0	50.0	48.0	45.0	44.0	43.0	50.2	10.0	60.2
Day	7	50.8	65.4	46.2	59.0	56.0	53.0	52.0	50.0	49.0	47.0	47.0	46.0	50.8	0.0	50.8
	8	49.6	61.6	44.6	56.0	55.0	52.0	51.0	49.0	48.0	46.0	46.0	45.0	49.6	0.0	49.6
	9	49.5	65.9	42.6	58.0	55.0	52.0	51.0	49.0	48.0	45.0	45.0	43.0	49.5	0.0	49.5
	10	48.7	64.9	40.9	56.0	55.0	52.0	51.0	48.0	47.0	44.0	43.0	42.0	48.7	0.0	48.7
	11	49.6	67.9	40.6	58.0	56.0	53.0	52.0	49.0	47.0	44.0	43.0	42.0	49.6	0.0	49.6
	12	52.2	71.8	40.8	62.0	59.0	56.0	54.0	50.0	48.0	44.0	44.0	42.0	52.2	0.0	52.2
	13	48.4	64.0	39.2	56.0	54.0	51.0	51.0	48.0	46.0	43.0	42.0	41.0	48.4	0.0	48.4
	14	50.0	68.8	40.9	58.0	56.0	54.0	52.0	49.0	47.0	44.0	43.0	42.0	50.0	0.0	50.0
	15	49.4	66.2	40.8	57.0	55.0	53.0	52.0	49.0	47.0	44.0	43.0	42.0	49.4	0.0	49.4
	16	50.5	62.7	42.2	57.0	56.0	54.0	53.0	50.0	49.0	46.0	45.0	44.0	50.5	0.0	50.5
	17	51.3	67.3	43.2	59.0	57.0	54.0	53.0	51.0	49.0	47.0	46.0	44.0	51.3	0.0	51.3
	18	51.8	64.9	43.7	60.0	59.0	56.0	55.0	51.0	50.0	47.0	46.0	45.0	51.8	0.0	51.8
Evening	19	51.2	68.6	41.7	60.0	58.0	55.0	53.0	51.0	49.0	45.0	45.0	43.0	51.2	5.0	56.2
	20	52.0	70.5	42.0	62.0	59.0	56.0	54.0	51.0	48.0	45.0	44.0	43.0	52.0	5.0	57.0
	21	50.4	68.7	40.8	60.0	58.0	55.0	53.0	50.0	47.0	44.0	43.0	42.0	50.4	5.0	55.4
Night	22	50.6	68.0	39.2	62.0	60.0	56.0	53.0	48.0	45.0	42.0	41.0	39.0	50.6	10.0	60.6
	23	49.7	69.3	38.8	62.0	59.0	54.0	51.0	47.0	44.0	40.0	39.0	39.0	49.7	10.0	59.7

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	48.4	61.6	39.2	56.0	54.0	51.0	51.0	48.0	46.0	43.0	42.0	41.0
	Max	52.2	71.8	46.2	62.0	59.0	56.0	55.0	51.0	50.0	47.0	47.0	46.0
Energy Average		50.3	Average:		58.0	56.1	53.3	52.3	49.4	47.9	45.1	44.4	43.2
Evening	Min	50.4	68.6	40.8	60.0	58.0	55.0	53.0	50.0	47.0	44.0	43.0	42.0
	Max	52.0	70.5	42.0	62.0	59.0	56.0	54.0	51.0	49.0	45.0	45.0	43.0
Energy Average		51.2	Average:		60.7	58.3	55.3	53.3	50.7	48.0	44.7	44.0	42.7
Night	Min	45.1	58.6	38.8	53.0	51.0	48.0	47.0	44.0	42.0	39.0	39.0	39.0
	Max	51.1	69.3	43.9	62.0	60.0	56.0	53.0	50.0	49.0	46.0	45.0	44.0
Energy Average		48.8	Average:		57.2	55.1	51.8	50.0	47.1	45.1	42.2	41.4	40.9

24-Hour L_{eq} (dBA)

50.0

24-Hour CNEL (dBA)

55.9

24-Hour Noise Level Measurement Summary

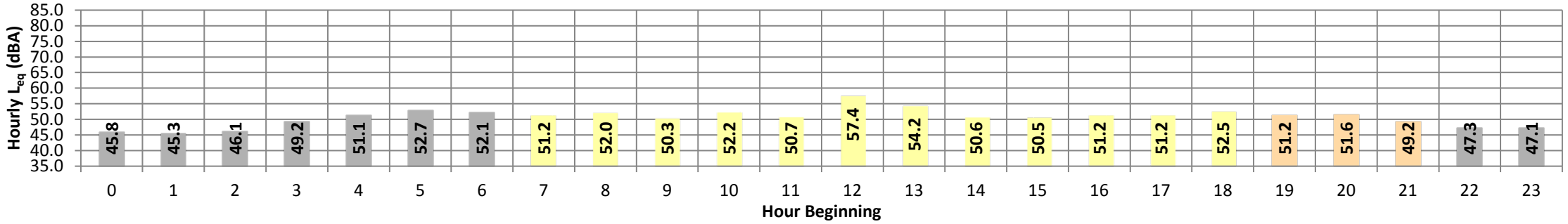
Date: Friday, June 22, 2018
Project: Elder Creek

Location: L5 - Located on Merris Street within the Project site boundaries adjacent to existing residential homes and commercial uses.

Meter: Piccolo I

JN: 11744
Analyst: A. Wolfe

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	45.8	58.8	43.0	51.0	49.0	47.0	47.0	45.0	45.0	44.0	43.0	43.0	45.8	10.0	55.8
	1	45.3	56.2	42.8	50.0	49.0	47.0	46.0	45.0	44.0	43.0	43.0	43.0	45.3	10.0	55.3
	2	46.1	62.5	42.7	50.0	49.0	48.0	47.0	46.0	45.0	44.0	43.0	43.0	46.1	10.0	56.1
	3	49.2	62.0	44.7	55.0	53.0	52.0	51.0	49.0	48.0	46.0	45.0	45.0	49.2	10.0	59.2
	4	51.1	62.3	46.0	56.0	55.0	53.0	53.0	51.0	50.0	48.0	48.0	47.0	51.1	10.0	61.1
	5	52.7	70.7	44.4	61.0	58.0	56.0	55.0	52.0	50.0	47.0	46.0	45.0	52.7	10.0	62.7
	6	52.1	73.3	44.0	62.0	59.0	55.0	54.0	50.0	48.0	46.0	46.0	45.0	52.1	10.0	62.1
Day	7	51.2	69.0	46.4	58.0	55.0	53.0	52.0	50.0	49.0	48.0	48.0	47.0	51.2	0.0	51.2
	8	52.0	74.0	45.3	61.0	58.0	55.0	53.0	50.0	49.0	47.0	46.0	46.0	52.0	0.0	52.0
	9	50.3	70.4	43.1	58.0	56.0	54.0	53.0	49.0	47.0	45.0	45.0	44.0	50.3	0.0	50.3
	10	52.2	72.8	41.3	64.0	60.0	54.0	52.0	49.0	46.0	44.0	43.0	42.0	52.2	0.0	52.2
	11	50.7	68.8	41.9	61.0	58.0	54.0	53.0	49.0	46.0	44.0	43.0	43.0	50.7	0.0	50.7
	12	57.4	81.5	40.8	68.0	65.0	59.0	56.0	49.0	47.0	44.0	43.0	42.0	57.4	0.0	57.4
	13	54.2	79.2	40.8	66.0	63.0	58.0	56.0	50.0	46.0	43.0	42.0	41.0	54.2	0.0	54.2
	14	50.6	73.2	40.9	61.0	58.0	54.0	51.0	48.0	46.0	43.0	42.0	42.0	50.6	0.0	50.6
	15	50.5	73.0	41.4	60.0	56.0	52.0	51.0	48.0	46.0	43.0	43.0	42.0	50.5	0.0	50.5
	16	51.2	75.7	41.9	61.0	59.0	54.0	52.0	49.0	48.0	45.0	44.0	43.0	51.2	0.0	51.2
	17	51.2	69.0	44.9	58.0	56.0	54.0	53.0	51.0	49.0	47.0	46.0	46.0	51.2	0.0	51.2
	18	52.5	68.0	44.9	62.0	59.0	56.0	54.0	51.0	50.0	48.0	47.0	46.0	52.5	0.0	52.5
Evening	19	51.2	71.8	44.0	59.0	57.0	55.0	53.0	50.0	49.0	46.0	46.0	45.0	51.2	5.0	56.2
	20	51.6	67.2	44.4	59.0	58.0	56.0	55.0	51.0	49.0	46.0	45.0	45.0	51.6	5.0	56.6
	21	49.2	66.9	43.4	57.0	55.0	53.0	51.0	48.0	46.0	45.0	44.0	44.0	49.2	5.0	54.2
Night	22	47.3	60.1	42.7	55.0	53.0	51.0	49.0	47.0	45.0	44.0	44.0	43.0	47.3	10.0	57.3
	23	47.1	63.6	42.1	55.0	54.0	51.0	49.0	46.0	45.0	43.0	43.0	42.0	47.1	10.0	57.1

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	50.3	68.0	40.8	58.0	55.0	52.0	51.0	48.0	46.0	43.0	42.0	41.0
	Max	57.4	81.5	46.4	68.0	65.0	59.0	56.0	51.0	50.0	48.0	48.0	47.0
Energy Average		52.6	Average:		61.5	58.6	54.8	53.0	49.4	47.4	45.1	44.3	43.7
Evening	Min	49.2	66.9	43.4	57.0	55.0	53.0	51.0	48.0	46.0	45.0	44.0	44.0
	Max	51.6	71.8	44.4	59.0	58.0	56.0	55.0	51.0	49.0	46.0	46.0	45.0
Energy Average		50.8	Average:		58.3	56.7	54.7	53.0	49.7	48.0	45.7	45.0	44.7
Night	Min	45.3	56.2	42.1	50.0	49.0	47.0	46.0	45.0	44.0	43.0	43.0	42.0
	Max	52.7	73.3	46.0	62.0	59.0	56.0	55.0	52.0	50.0	48.0	48.0	47.0
Energy Average		49.4	Average:		55.0	53.2	51.1	50.1	47.9	46.7	45.0	44.6	44.0

24-Hour L_{eq} (dBA)

51.4

24-Hour CNEL (dBA)

56.6

24-Hour Noise Level Measurement Summary

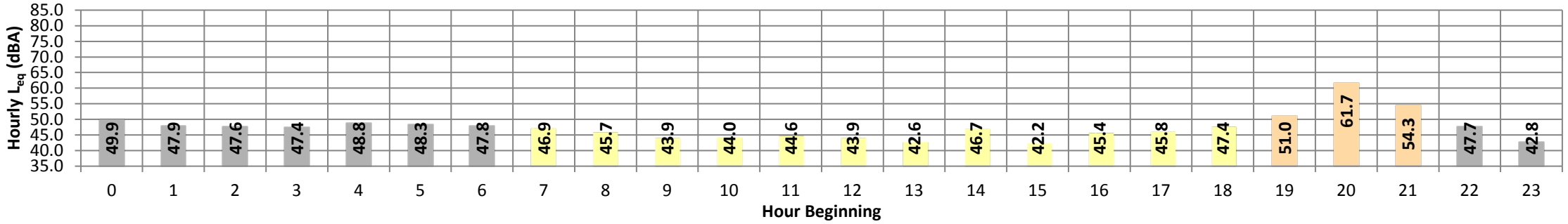
Date: Friday, June 22, 2018
Project: Elder Creek

Location: L6 - Located on Abbey Way adjacent to the Project site near existing vacant land.

Meter: Piccolo I

JN: 11744
Analyst: A. Wolfe

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	49.9	61.6	39.9	59.0	58.0	56.0	56.0	45.0	42.0	40.0	40.0	40.0	49.9	10.0	59.9
	1	47.9	55.7	40.8	51.0	50.0	50.0	49.0	48.0	47.0	45.0	44.0	42.0	47.9	10.0	57.9
	2	47.6	56.7	43.6	53.0	52.0	51.0	50.0	47.0	46.0	44.0	44.0	43.0	47.6	10.0	57.6
	3	47.4	55.0	43.6	52.0	51.0	50.0	49.0	47.0	46.0	45.0	44.0	43.0	47.4	10.0	57.4
	4	48.8	58.3	43.6	54.0	53.0	52.0	51.0	49.0	47.0	45.0	44.0	43.0	48.8	10.0	58.8
	5	48.3	61.2	43.5	53.0	52.0	51.0	50.0	49.0	47.0	44.0	44.0	43.0	48.3	10.0	58.3
	6	47.8	66.9	43.5	54.0	52.0	51.0	50.0	47.0	46.0	45.0	45.0	44.0	47.8	10.0	57.8
Day	7	46.9	61.0	42.4	54.0	52.0	51.0	50.0	46.0	44.0	43.0	43.0	43.0	46.9	0.0	46.9
	8	45.7	65.2	42.2	53.0	51.0	48.0	46.0	45.0	44.0	42.0	42.0	42.0	45.7	0.0	45.7
	9	43.9	58.1	40.6	49.0	48.0	46.0	45.0	44.0	43.0	41.0	40.0	40.0	43.9	0.0	43.9
	10	44.0	68.4	38.1	50.0	48.0	45.0	44.0	42.0	41.0	40.0	40.0	40.0	44.0	0.0	44.0
	11	44.6	64.2	38.0	55.0	50.0	46.0	45.0	43.0	42.0	40.0	40.0	40.0	44.6	0.0	44.6
	12	43.9	61.0	37.8	52.0	50.0	47.0	46.0	43.0	42.0	40.0	40.0	40.0	43.9	0.0	43.9
	13	42.6	63.5	37.8	50.0	47.0	45.0	43.0	41.0	40.0	37.0	37.0	37.0	42.6	0.0	42.6
	14	46.7	71.5	37.8	56.0	53.0	48.0	46.0	42.0	41.0	40.0	38.0	37.0	46.7	0.0	46.7
	15	42.2	56.7	37.8	49.0	46.0	45.0	44.0	42.0	40.0	40.0	38.0	37.0	42.2	0.0	42.2
	16	45.4	60.8	37.8	55.0	53.0	49.0	47.0	44.0	43.0	40.0	40.0	40.0	45.4	0.0	45.4
	17	45.8	62.3	40.7	52.0	51.0	49.0	47.0	45.0	44.0	42.0	42.0	41.0	45.8	0.0	45.8
	18	47.4	63.5	40.7	55.0	54.0	50.0	49.0	46.0	45.0	43.0	42.0	41.0	47.4	0.0	47.4
Evening	19	51.0	65.7	40.6	63.0	63.0	55.0	52.0	47.0	45.0	42.0	41.0	40.0	51.0	5.0	56.0
	20	61.7	71.7	42.4	70.0	70.0	69.0	67.0	60.0	52.0	47.0	46.0	44.0	61.7	5.0	66.7
	21	54.3	62.4	41.0	60.0	60.0	59.0	58.0	54.0	53.0	51.0	47.0	44.0	54.3	5.0	59.3
Night	22	47.7	60.2	40.7	56.0	55.0	54.0	51.0	47.0	44.0	42.0	42.0	40.0	47.7	10.0	57.7
	23	42.8	54.4	39.3	47.0	45.0	44.0	44.0	43.0	42.0	40.0	40.0	40.0	42.8	10.0	52.8

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	42.2	56.7	37.8	49.0	46.0	45.0	43.0	41.0	40.0	37.0	37.0	37.0
	Max	47.4	71.5	42.4	56.0	54.0	51.0	50.0	46.0	45.0	43.0	43.0	43.0
Energy Average		45.2	Average:		52.5	50.3	47.4	46.0	43.6	42.4	40.7	40.2	39.8
Evening	Min	51.0	62.4	40.6	60.0	60.0	55.0	52.0	47.0	45.0	42.0	41.0	40.0
	Max	61.7	71.7	42.4	70.0	70.0	69.0	67.0	60.0	53.0	51.0	47.0	44.0
Energy Average		58.0	Average:		64.3	64.3	61.0	59.0	53.7	50.0	46.7	44.7	42.7
Night	Min	42.8	54.4	39.3	47.0	45.0	44.0	44.0	43.0	42.0	40.0	40.0	40.0
	Max	49.9	66.9	43.6	59.0	58.0	56.0	56.0	49.0	47.0	45.0	45.0	44.0
Energy Average		47.9	Average:		53.2	52.0	51.0	50.0	46.9	45.2	43.3	43.0	42.0

24-Hour L_{eq} (dBA)

50.7

24-Hour CNEL (dBA)

56.9

APPENDIX 7.1:

RCNM EQUIPMENT DATABASE

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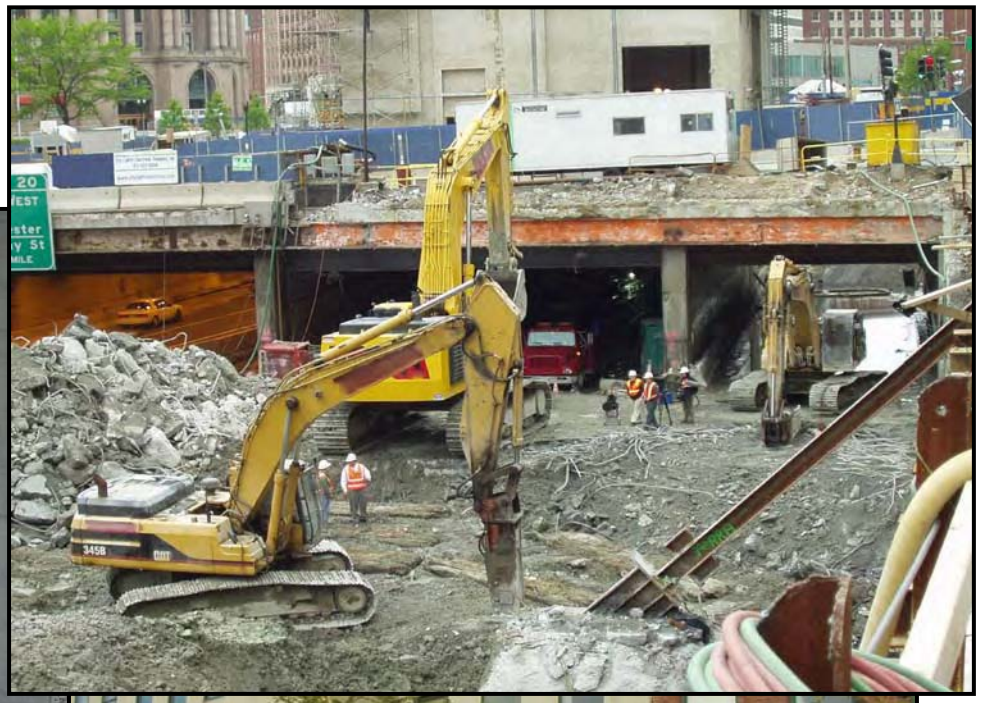
U.S. Department
of Transportation

Federal Highway Administration

FHWA
Roadway Construction Noise Model User's Guide

FHWA-HEP-05-054
DOT-VNTSC-FHWA-05-01

Final Report
January 2006



Prepared for
U.S. Department of Transportation
Federal Highway Administration
Office of Natural and Human Environment
Washington, DC 20590

Prepared by
U.S. Department of Transportation
Research and Innovative Technology Administration
John A. Volpe National Transportation Systems Center
Acoustics Facility
Cambridge, MA 02142

Table 1. CA/T equipment noise emissions and acoustical usage factors database.

CA/T Noise Emission Reference Levels and Usage Factors					
filename: EQUIPLST.xls					
revised: 7/26/05		Acoustical	Spec 721.560	Actual Measured	No. of Actual
	Impact	Use Factor	Lmax @ 50ft	Lmax @ 50ft	Data Samples
Equipment Description	Device ?	(%)	(dBA, slow)	(dBA, slow)	(Count)
				(samples averaged)	
All Other Equipment > 5 HP	No	50	85	-- N/A --	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	-- N/A --	0
Blasting	Yes	-- N/A --	94	-- N/A --	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	-- N/A --	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	-- N/A --	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydr. Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	-- N/A --	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarafier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/chipping gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (Single Nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Shears (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	-- N/A --	0
Tractor	No	40	84	-- N/A --	0
Vacuum Excavator (Vac-truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44
Warning Horn	No	5	85	83	12
Welder / Torch	No	40	73	74	5

APPENDIX 7.2:

TEMPORARY NOISE BARRIER ATTENUATION CALCULATIONS

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STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R1**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	13.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	11.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	13.0	11.7	11.7	11.7	11.7	11.7	11.7
Shielding (Barrier Attenuation)	2.0	-11.4	-11.4	-11.4	-11.4	-11.4	-11.4

STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R3**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	10.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	8.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	10.0	14.0	14.0	14.0	14.0	14.0	14.0
Shielding (Barrier Attenuation)	2.0	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9

STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R5**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	18.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	16.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	18.0	8.9	8.9	8.9	8.9	8.9	8.9
Shielding (Barrier Attenuation)	2.0	-10.9	-10.9	-10.9	-10.9	-10.9	-10.9

STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R6**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	21.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	19.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	21.0	7.5	7.5	7.5	7.5	7.5	7.5
Shielding (Barrier Attenuation)	2.0	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8

STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R8**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	10.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	8.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	10.0	14.0	14.0	14.0	14.0	14.0	14.0
Shielding (Barrier Attenuation)	2.0	-11.9	-11.9	-11.9	-11.9	-11.9	-11.9

STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R9**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	21.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	19.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	21.0	7.5	7.5	7.5	7.5	7.5	7.5
Shielding (Barrier Attenuation)	2.0	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8

STATIONARY SOURCE NOISE PREDICTION MODEL

11/4/2019

Observer Location: **R2**
Source: Highest Construction Noise Level at 50 F
Condition: Construction Mitigation

Project Name: Elder Creek
Job Number: 11744
Analyst: A. Wolfe

NOISE MODEL INPUTS

Noise Distance to Observer	15.0 feet	***Barrier Height:***	**10.0 feet**
Noise Distance to Barrier:	2.0 feet	*Noise Source Height:*	8.0 feet
Barrier Distance to Observer:	13.0 feet	*Observer Height:*	5.0 feet
Observer Elevation:	0.0 feet	*Barrier Type (0-Wall, 1-Berm):*	0
Noise Source Elevation:	0.0 feet	*Drop Off Coefficient:*	20.0
Barrier Elevation:	0.0 feet		

20 = 6 dBA per doubling of distance
15 = 4.5 dBA per doubling of distance

NOISE MODEL PROJECTIONS

Noise Level	*Distance (feet)*	*Leq*	*L50*	*L25*	*L8*	*L2*	*Lmax*
Reference (Sample)	50.0	78.0	0.0	0.0	0.0	0.0	0.0
Distance Attenuation	15.0	10.5	10.5	10.5	10.5	10.5	10.5
Shielding (Barrier Attenuation)	2.0	-11.2	-11.2	-11.2	-11.2	-11.2	-11.2

APPENDIX 7.3:

SAMPLE TEMPORARY CONSTRUCTION NOISE BARRIER PHOTOS

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Temporary Construction Noise Barrier Examples

I-Beam & Acoustic Material 01

I-Beam & Acoustic Material 02

I-Beam & Acoustic Material 03

K-Rail Plywood & Acoustic Material

K-Rail Temporary Fence & Acoustic Material

K-Rail-Mounted Acoustic Material 01

Temporary Construction Noise Barrier Examples

Pillar & Acoustic Material

Straw Bales 01

Straw Bales 02

Temporary Fence & Acoustic Material 01

Temporary Fence & Acoustic Material 02