Antioch L Street Pathways to Transit Phase 2 Project



Noise Study Report

CITY OF ANTIOCH, CONTRA COSTA COUNTY, CALIFORNIA

FEDERAL PROJECT NUMBER SS4AL-6072 (042)

December 2025

Caltrans

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Summary

The Contra Costa Transportation Authority (CCTA), in cooperation with the City of Antioch, proposes to enhance pedestrian and bicyclist infrastructure along L Street, between 9th Street and Sycamore Drive, connecting to multimodal improvements from a previous phase. The project will involve widening the roadway between 10th Street and Sycamore Drive, re-striping to accommodate multimodal facilities, and constructing retaining walls to minimize impacts to Union Pacific Railroad (UPRR) structures and Contra Costa County Fairgrounds property.

The project will include roadway widening along the corridor between 10th Street to 18th Street primarily to close gaps in the sidewalk and bicycle lane network in both northbound (NB) and southbound (SB) directions and will accommodate the addition of one SB and one NB travel lane between 10th Street and 18th Street. The additional travel lanes are being added to address an existing bottleneck between 10th Street to 18th Street (approximately 2,000 feet in length).

The project will close pedestrian and bicycle gaps to improve access by constructing sidewalks, providing continuous bicycle facilities from 9th Street to Sycamore Drive, and installing American with Disabilities Act (ADA)-compliant curb ramps. Additionally, the project includes treating stormwater runoff per local Municipal Regional Permit (MRP) requirements and traffic signal modifications at the intersections of 10th Street, 18th Street, and Sycamore Drive. These improvements are intended to increase multimodal safety, corridor operations, and further provide intersection enhancements. Other improvements include new bus stops and shelters within the project area for the Tri-Delta Transit bus route serving downtown Antioch.

This Noise Study Report (NSR) summarizes the evaluation of noise impacts and abatement under the requirements of Title 23, Part 772 of the Code of Federal Regulations (23 CFR 772) "Procedures for Abatement of Highway Traffic Noise." According to 23 CFR 772, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with Federal Highway Administration (FHWA) noise standards.

The Project is a Type I project because it would involve the addition of a through lane in both the northbound and southbound directions along L Street between W. 10th Street and 18th Street and would be eligible to receive federal funding from the FHWA, administered through Caltrans. Therefore, the Project requires noise abatement to be considered for

impacted receptors. Compliance with 23 CFR 772 provides compliance with the noise impact assessment requirements of the National Environmental Policy Act (NEPA).

Noise-sensitive Activity Category B (residential), Category C (school), Category E (commercial), and Category G (undeveloped) land uses were identified in the vicinity of the Project. Vehicles traveling along L Street, 10th Street, 18th Street, and Sycamore Drive are the primary sources of noise for receptors located along the Project alignment. The study included noise measurements, calculation of future noise levels with the construction and operation of the Project, and identification of measures to reduce construction noise levels and to abate traffic noise levels at adjacent receptors. The FHWA Traffic Noise Model Version 2.5 (TNM 2.5) was used to calculate existing and future traffic noise levels, analyze traffic noise impacts, and analyze the feasibility of noise abatement. The model was validated based on measured noise and traffic conditions documented during the field survey. Following validation, noise levels were assessed in TNM 2.5 based on 2050 No Build and 2050 Build Alternative traffic conditions provided by *Kittelson & Associates, Inc*.

The California Department of Transportation (Caltrans) Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) defines a noise increase as substantial when the predicted noise levels with project implementation exceed existing noise levels by 12 dBA or more. Noise levels are calculated to increase by up to 3 dBA over Existing conditions, assuming 2050 No Build conditions. The 2050 Build conditions would result in noise levels within -2 to +2 dBA as compared to 2050 No Build conditions. When compared to Existing conditions, changes in noise levels under 2050 Build conditions would range from -1 to +5 dBA at receptors along the Project alignment. These noise level increases are not considered to be substantial per the Protocol.

The loudest-hour noise levels at representative Category B outdoor use areas are calculated to range from 48 to 64 dBA $L_{eq[h]}$ under Existing conditions, from 49 to 64 dBA $L_{eq[h]}$ under 2050 No Build conditions, and from 49 to 65 dBA $L_{eq[h]}$ under 2050 Build conditions. The 2050 Build traffic noise levels are not predicted to approach or exceed the noise abatement criteria (NAC) at any Category B receptors.

The loudest-hour noise levels at representative Category C outdoor use areas are calculated to range from 54 to 61 dBA $L_{eq[h]}$ under Existing conditions, from 55 to 63 dBA $L_{eq[h]}$ under 2050 No Build conditions, and from 56 to 63 dBA $L_{eq[h]}$ under 2050 Build conditions. The

2050 Build traffic noise levels are not predicted to approach or exceed the NAC at any Category C receptors.

The loudest-hour noise levels at Category E land uses are calculated to reach 63 dBA $L_{eq[h]}$ under Existing conditions, 64 dBA $L_{eq[h]}$ under 2050 No Build conditions, and 65 dBA $L_{eq[h]}$ under 2050 Build conditions. The 2050 Build traffic noise levels are not predicted to approach or exceed the NAC at any Category E receptors.

There is no noise abatement criterion for Activity Category G land uses. Noise levels results are documented for information purposes only.

In accordance with 23 CFR 772, noise abatement is considered where noise impacts are predicted in areas of frequent human use that would benefit from a lowered noise level. Noise impacts were not identified at receptors along the Project alignment; therefore, noise abatement was not considered.

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List of Abbreviated Terms

23CFR772	Title 23, Part 772 of the Code of Federal Regulations
A	Automobiles
ADA	Americans with Disabilities Act
B	Bus
Caltrans	California Department of Transportation
CCTA	Contra Costa Transportation Authority
CEQA	California Environmental Quality Act
City	City of Antioch
CNEL	Community Noise Equivalent Level
dB	Decibel
dBA	A-Weighted Decibel
FHWA	Federal Highway Administration
HT	Heavy Truck
Hz	Hertz
kHz	Kilohertz
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
$L_{eq[h]}$	Equivalent Sound Level over one hour
L_{max}	Maximum Instantaneous Sound Level
LT-#	Long-Term Reference Noise Measurement
mPa	micro-Pascals
mph	miles per hour
MRP	Municipal Regional Permit
MT	Medium Truck
NAC	Noise Abatement Criteria
NADR	Noise Abatement Decision Report
NB	Northbound
NEPA	National Environmental Policy Act
NSR	Noise Study Report
Project	L Street Path to Transit Phase 2
Protocol	Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
PPV	Peak Particle Velocity
RCNM	FHWA Roadway Construction Noise Model v.1.0
SB	Southbound
SLM	Sound Level Meter
SPL	Sound Pressure Level
ST-#	Short-Term Noise Measurement
TeNS	Caltrans' Technical Noise Supplement
TNAP	Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
TNM 2.5	FHWA Traffic Noise Model Version 2.5
UPRR	Union Pacific Railroad
X	Motorcycle

Chapter 1. Introduction

1.1. Purpose of the Noise Study Report

The purpose of this NSR is to evaluate noise impacts and abatement under the requirements of 23 CFR 772 "Procedures for Abatement of Highway Traffic Noise." 23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for Federal and Federal-aid highway projects. According to 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with FHWA noise standards. Compliance with 23 CFR 772 provides compliance with the noise impact assessment requirements of NEPA.

The Protocol (Caltrans 2020) provides Caltrans policy for implementing 23 CFR 772 in California and outlines the requirements for preparing NSRs. The primary objective of the NSR is to identify noise-sensitive receptors where noise levels would approach or exceed the NAC with the Project or receptors that would experience a substantial increase in noise levels as a result of the Project. Noise impacts associated with the project under the California Environmental Quality Act (CEQA) are not evaluated in the NSR. The determination of significant impact and adverse effects are made by the Project Development Team and will be disclosed in the Project's environmental document.

This NSR documents the assessment of existing and future traffic noise levels at noise-sensitive receptors in the vicinity of the proposed Project and identifies whether preliminary noise abatement measures are necessary for the Project to comply with State and Federal noise abatement requirements. The primary objective of this study is to identify noise-sensitive receptors where noise levels would approach or exceed the NAC with the Project or receptors that would experience a substantial increase in noise levels as a result of the Project.

1.2. Project Purpose

The purpose of the Project is:

- Equitably improve safety and connectivity of the L Street corridor for all modes of travel with an emphasis on pedestrians and bicyclists.
- Improve corridor operations for all users.

- Close bicycle and pedestrian gaps by connecting to existing and planned multimodal improvements.

1.3. Project Need

The Project is needed for the following reasons:

- Lack of multimodal connectivity, particularly for bicycle and pedestrian access, along L Street.
- Lack of ADA-compliant curb ramps.
- Vehicle bottleneck constraints between 10th Street and 18th Street cause vehicle queues and delays, which are anticipated to worsen and will cause the L Street intersections with 10th Street and 18th Street to operate at unacceptable conditions by the year 2030.

Chapter 2. Project Description

Project alternatives include the No Build and Preferred Build Alternative, as discussed below.

2.1. No Build Alternative

Under the No Build Alternative, none of the Project features described under the Project would be constructed. The No-Build Alternative would maintain the existing conditions, and no work would be conducted to relieve current traffic conditions.

2.2. Project Build Alternative

Roadway Improvements

The project aims to enhance pedestrian and bicyclist infrastructure along L Street, between 9th Street and Sycamore Drive in the City of Antioch, connecting to multimodal improvements from a previous phase. The project will involve widening the roadway between 10th Street and Sycamore Drive, re-striping to accommodate multimodal facilities, and constructing retaining walls to minimize impacts to UPRR structures and Contra Costa County Fairgrounds property. See Figure 2-1, Figure 2-2, Figure 2-3, Figure 2-4, and Figure 2-5.

The project will include roadway widening along L Street, between 10th Street and Sycamore Drive. The project will include roadway widening along the corridor between 10th Street and 18th Street primarily to close gaps in the sidewalk and bicycle lane network in both NB and SB directions and will accommodate the addition of one SB and one NB travel lane between 10th Street and 18th Street. The additional travel lanes are being added to address an existing bottleneck between 10th Street and 18th Street (approximately 2,000 feet in length).

The City intends to also close pedestrian and bicycle gaps to improve access by constructing sidewalks, providing continuous bicycle facilities from 9th Street to Sycamore Drive, and installing ADA-compliant curb ramps. Additionally, the project includes treating stormwater runoff per local MRP requirements and traffic signal modifications at the intersections of 10th Street, 18th Street, and Sycamore Drive. These improvements are intended to increase multimodal safety, corridor operations, and further provide intersection enhancements. Other improvements include new bus stops and shelters within the project area for the Tri-Delta Transit bus route serving downtown Antioch.

Right-of-Way Requirements

The widening will require one full right-of-way (ROW) acquisition at 1101 W. 10th Street and partial acquisition of the Contra Costa Fairgrounds property (ranging from 7-17 feet in width, for approximately 1,500 feet in length).

Utility Relocations

The project will require the relocation of storm drain lines, a water meter, underground electrical vaults, light poles, and electrical and telecommunication boxes. The project will also extend the storm drain main line to accommodate connections to the proposed bioretention facilities. The length of storm drain lines to be relocated would range in size from approximately two feet to 93 feet.

Signage and Fencing

The project would relocate existing fencing along the Contra Costa Fairgrounds property line to conform to the new parcel line. The entrance and exit gates to the fairgrounds property along L Street would also be relocated to conform to the new parcel line, but would maintain access to the existing driveways. The project would relocate signs throughout the entire corridor, including signs for speed limit, bus stops, traffic light warning, instructional signs for turning and merging, and a sign marking the location of a petroleum pipe.

Retaining Walls

To accommodate the proposed roadway widening, the project would require the use of retaining walls. The project would include an approximately 273-foot long fill wall and a 130-foot long fill wall along the Contra Costa Fairgrounds property south of 14th Street. At the fairgrounds property, the proposed retaining wall would be approximately four feet tall with the exposed sides facing the fairgrounds. On L Street south of West 18th Street to Sycamore Drive, an approximately 436-foot long retaining wall would be constructed on the east side and an approximately 323-foot long retaining wall would be constructed on the west side along the UPRR underpass. In order to construct the proposed sidewalks along the UPRR underpass, approximately 4.5-foot tall retaining walls would be located behind the existing bridge columns and include 3.5-foot tall handrails. Beyond the Kinder Morgan pipeline, the retaining structures along the west side would be limited to retaining curbs along the proposed sidewalks.

Vegetation and Tree Removal

The project would require clearing and grubbing of existing vegetation and tree removal. The project would remove approximately 91 existing trees, all of which would be located on the west side of L Street, between 10th Street and 18th Street. Most of the existing trees to be removed are located on private property that would be acquired as part of the project, including the parcel at 1101 W. 10th Street and the eastern edge of the Contra Costa Fairgrounds property. Replacement trees would be planted in accordance with Article 12 of the City's Code of Ordinances.

Construction Details

Project construction is anticipated to take approximately 18 months to complete. Construction hours shall be limited to 7:00 a.m. through 6:00 p.m. on weekdays, or 8:00 a.m. through 5:00 p.m. where within 300 feet of an occupied dwelling, and between 9:00 a.m. to 5:00 p.m. on weekends and holidays. The maximum excavation depth for the project will be approximately 15 feet for traffic signals, seven feet for storm drain line extensions, 4.5 feet for bioretention areas, and 2.5 feet for the roadway widening. All construction equipment staging would occur within the existing City ROW. No road closures or detours are anticipated to be required during construction. The project would require approximately 150 cubic yards of soil to be exported and approximately 1,500 cubic yards of asphalt and concrete to be poured on-site.

Figure 2-1. Proposed Build Alternative

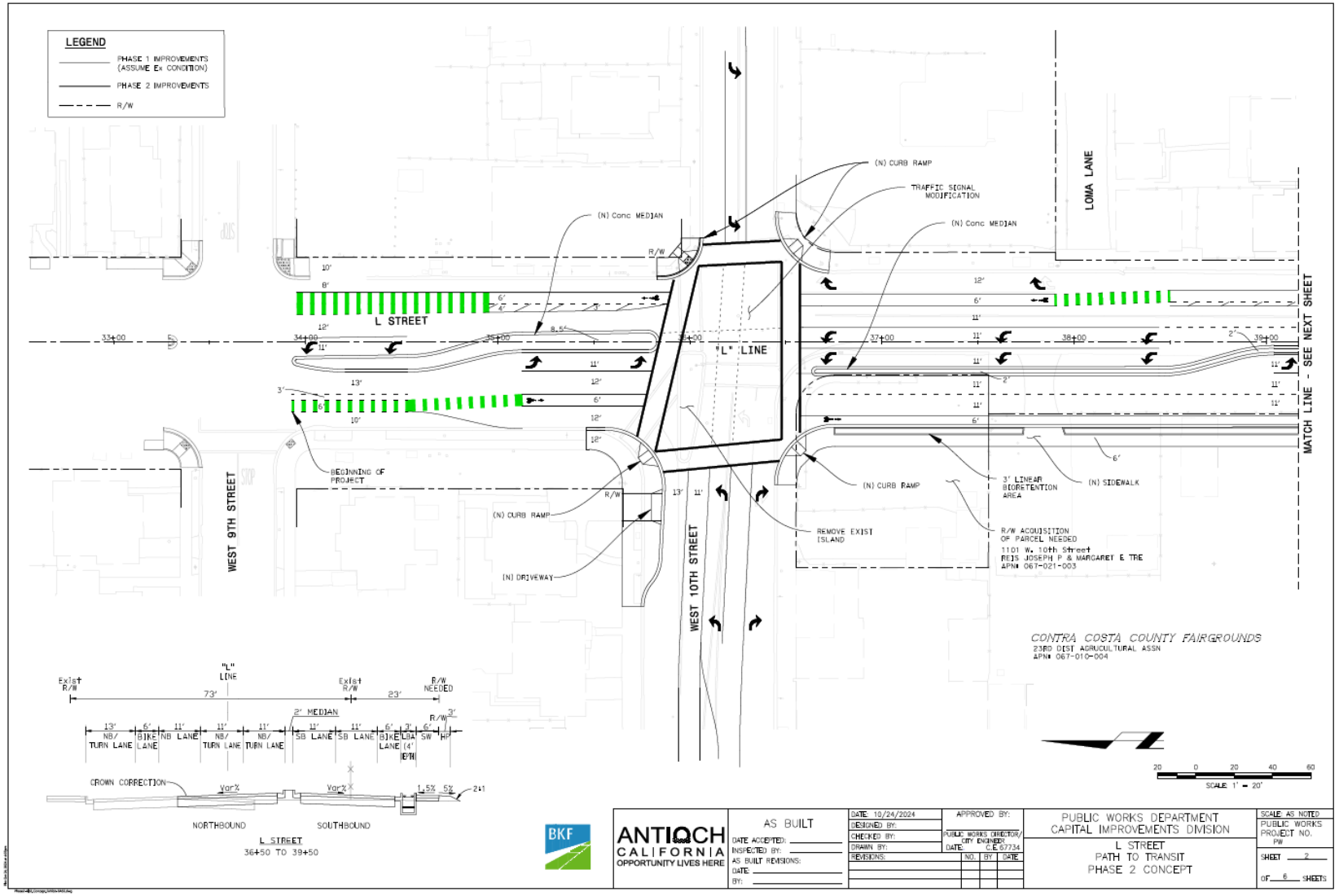


Figure 2-2. Proposed Build Alternative

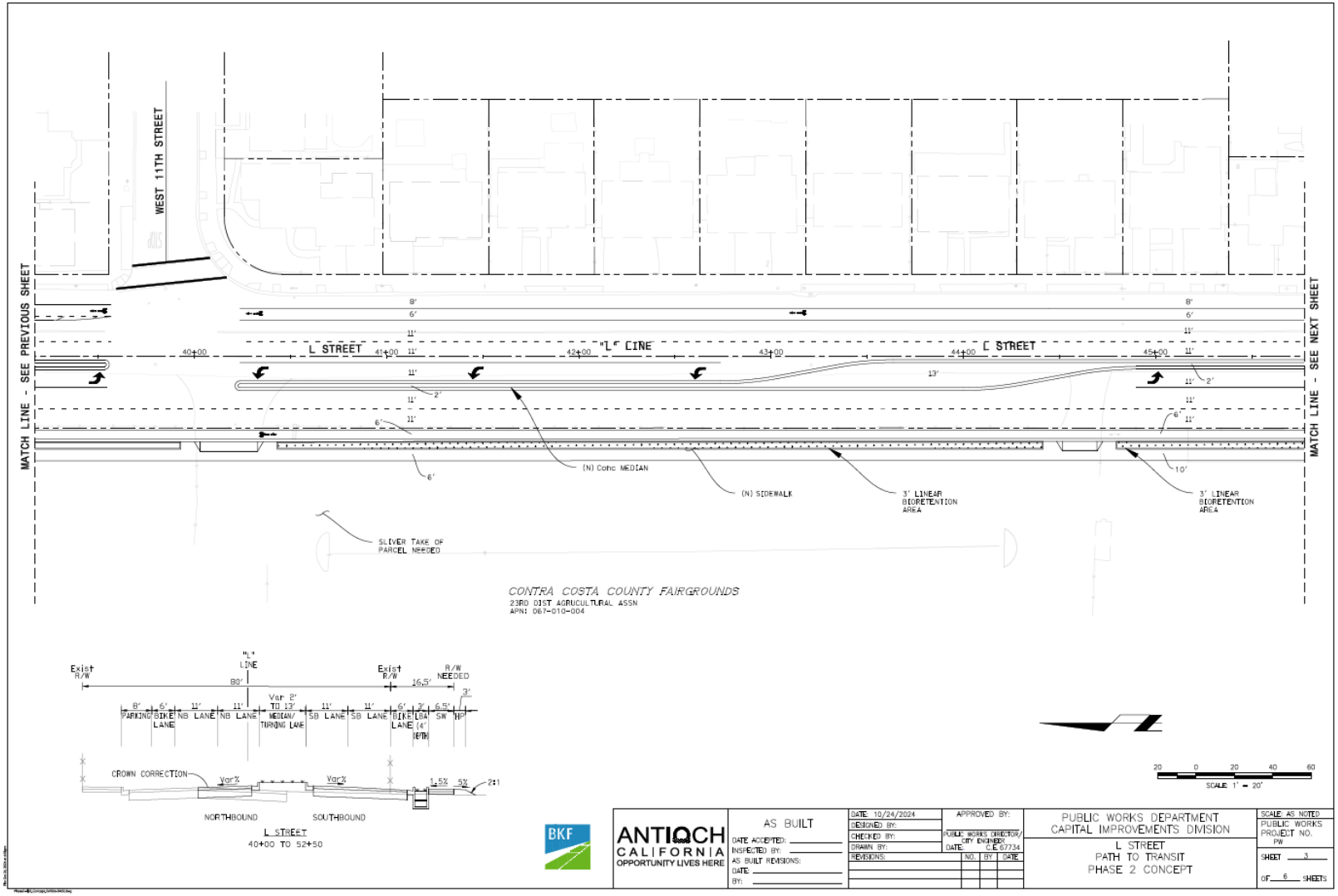


Figure 2-3. Proposed Build Alternative

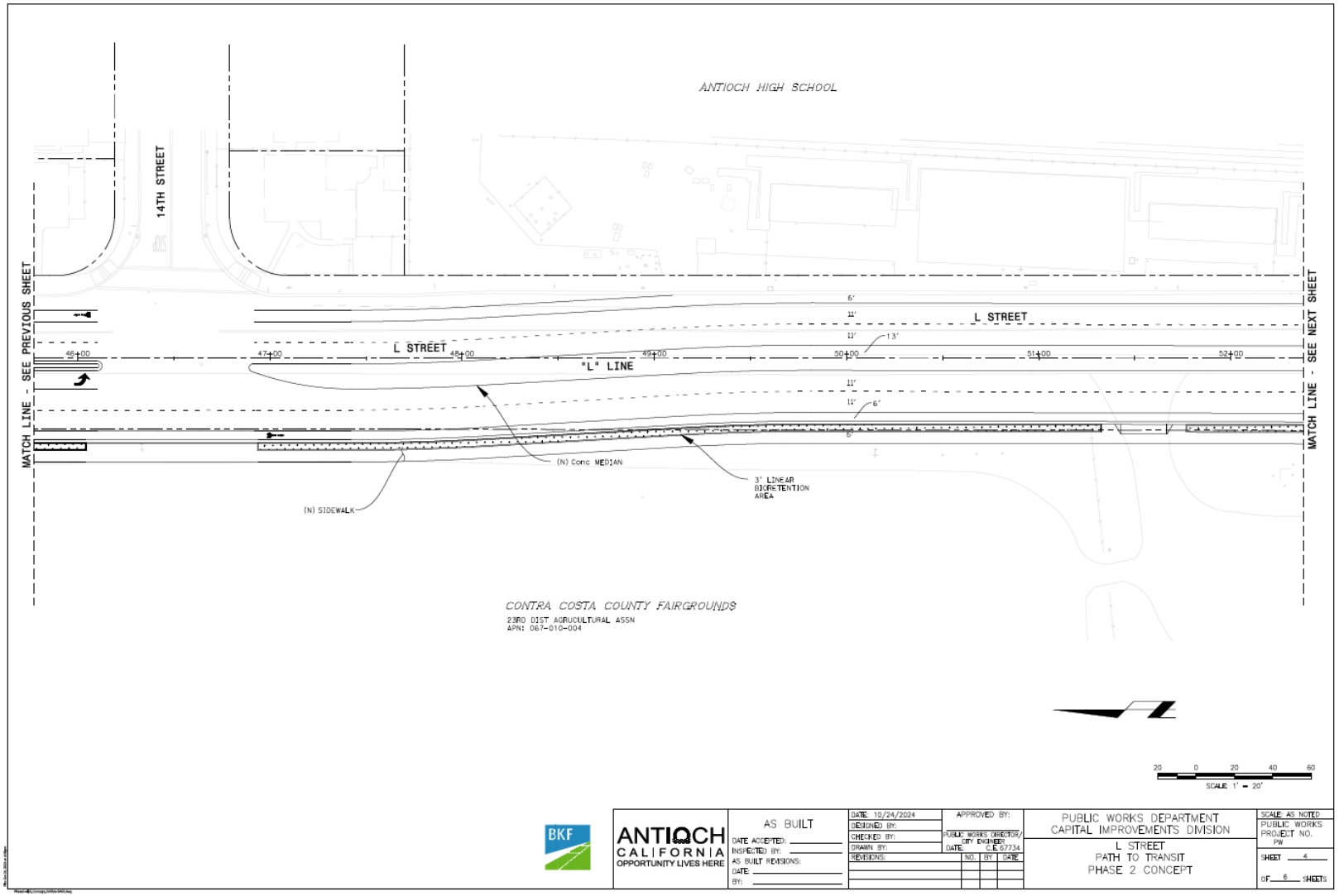


Figure 2-4. Proposed Build Alternative

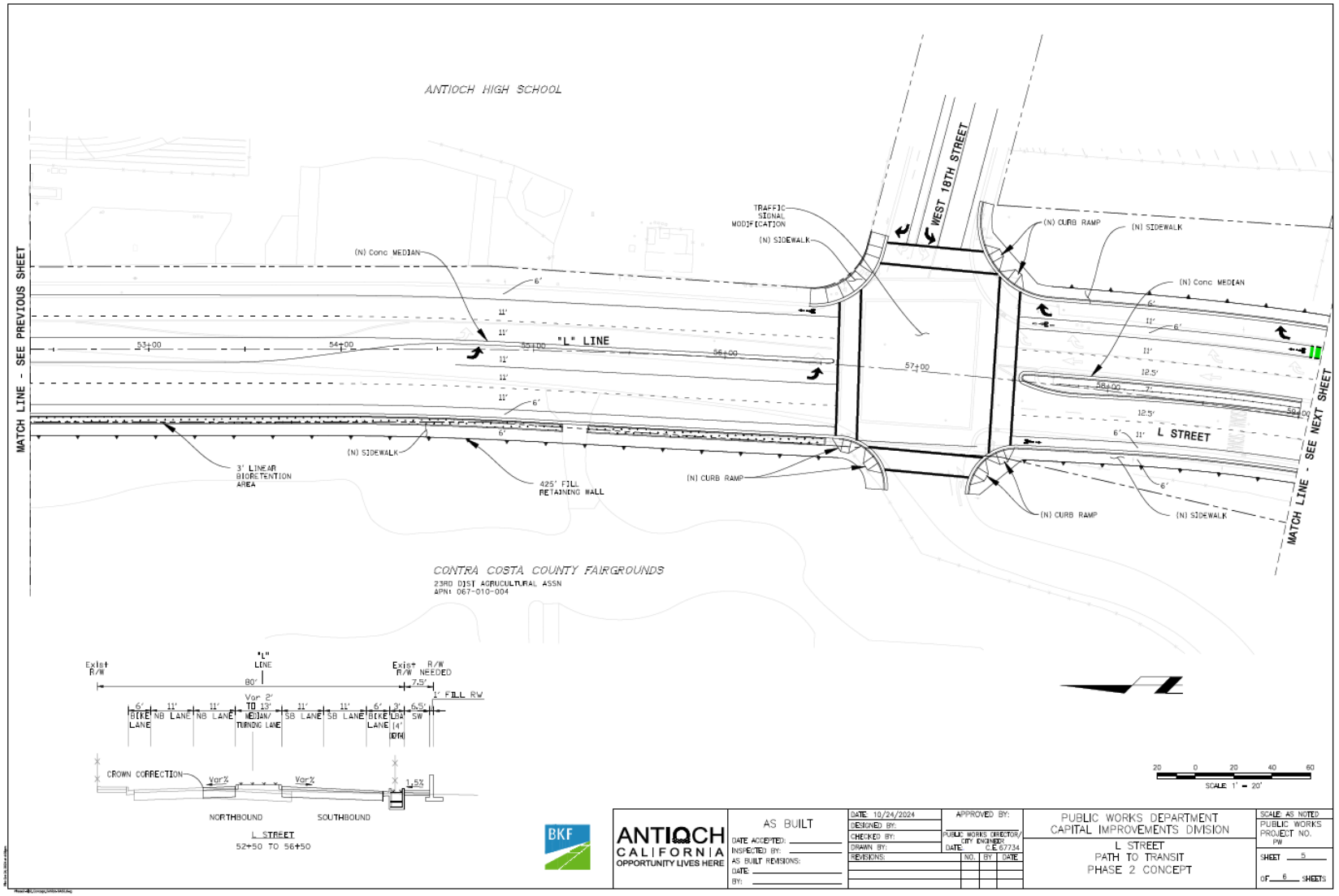
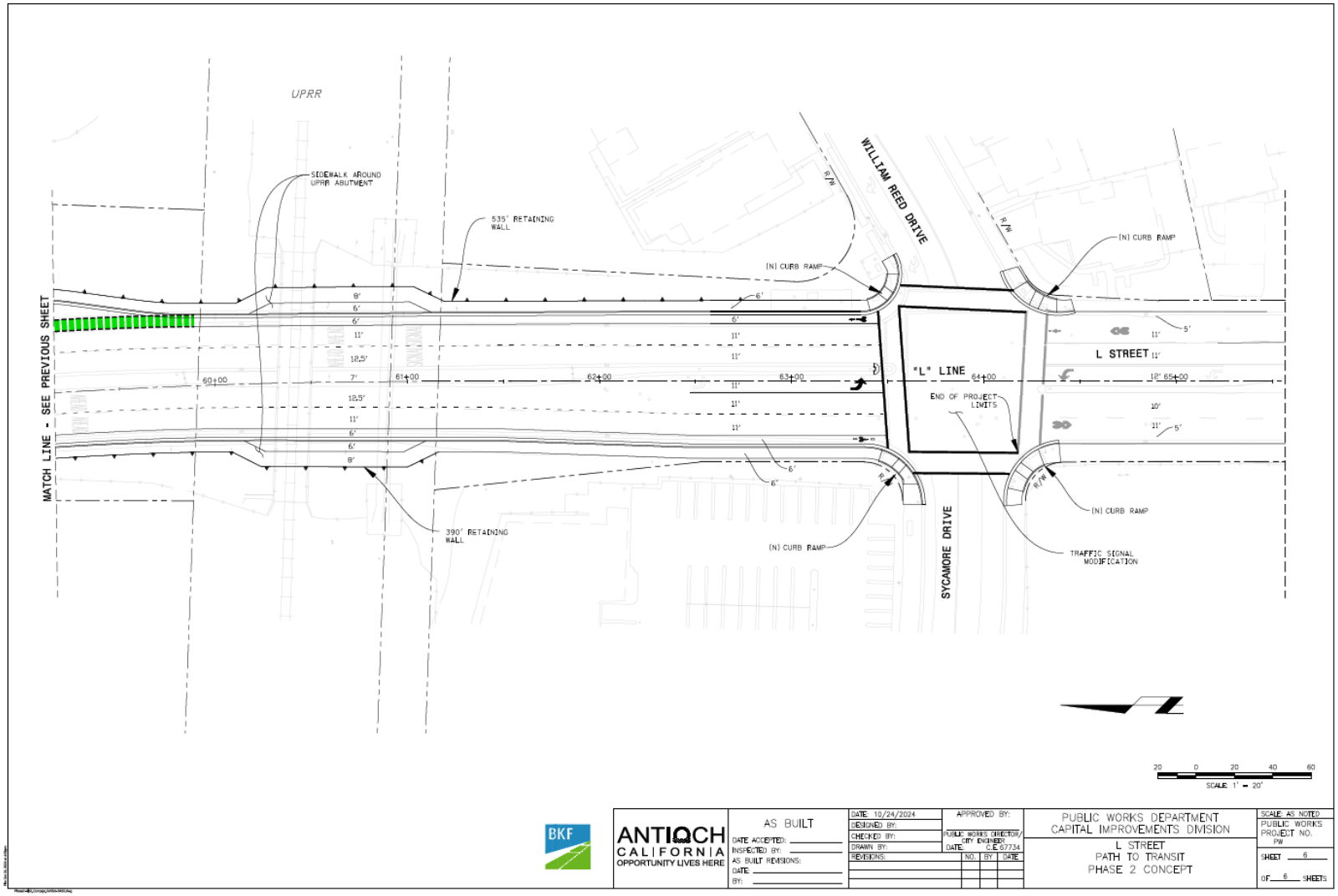


Figure 2-5. Proposed Build Alternative



Chapter 3. Fundamentals of Traffic Noise

The following is a brief discussion of fundamental traffic noise concepts. For a detailed discussion, please refer to Caltrans' Technical Noise Supplement (TeNS) (Caltrans 2013), a technical supplement to the Protocol that is available on Caltrans' website (https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf). Technical terms are defined in Appendix E.

3.1. Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as a loud, unexpected, or annoying sound.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting noise propagation to the receptor determine the sound level and characteristics of the noise perceived by the receptor. The field of acoustics deals primarily with the propagation and control of sound.

3.2. Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 and 20,000 Hz.

3.3. Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (mPa). One mPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 mPa. Because of this huge range of values, sound is rarely expressed in terms of mPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of decibels (dB). The threshold of hearing for young people is about 0 dB, which corresponds to 20 mPa.

3.4. Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through ordinary arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3-dB increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dB—rather, they would combine to produce 73 dB. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dB louder than one source.

3.5. A-Weighted Decibels

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness or human response is determined by the characteristics of the human ear.

Human hearing is limited in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000–8,000 Hz and perceive sounds within that range better than sounds of the same amplitude in higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. Then, an "A-weighted" sound level (expressed in units of dBA) can be computed based on this information.

The A-weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make a judgment of the relative loudness or annoyance of a sound, their judgment correlates well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-, C-, and D-scales), but these scales are rarely used in conjunction with highway traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted decibels or dBA. Table 3-1 describes typical A-weighted noise levels for various noise sources.

Table 3-1. Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet flyover at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 miles per hour (mph)		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	**— 70 —**	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	**— 60 —**	
		Large business office
Quiet urban daytime	**— 50 —**	Dishwasher next room
Quiet urban nighttime	**— 40 —**	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	**— 0 —**	Lowest threshold of human hearing

Source: Caltrans 2013.

3.6. Human Response to Changes in Noise Levels

As discussed above, doubling sound energy results in a 3-dB increase in sound. However, given a sound level change measured with precise instrumentation, the subjective human perception of a doubling of loudness will usually be different than what is measured.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1-dB changes in sound levels when exposed to steady, single-frequency ("pure-tone") signals in the mid-frequency (1,000 Hz–8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dB are generally not perceptible. However, it is widely accepted that people are able to begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5-dB increase is generally perceived as a distinctly noticeable increase, and a 10-dB increase is generally perceived as a doubling of loudness. Therefore, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) that would result in a 3-dB increase in sound would generally be perceived as barely detectable.

3.7. Noise Descriptors

Noise in our daily environment fluctuates over time. Some fluctuations are minor, but some are substantial. Some noise levels occur in regular patterns, but others are random. Some noise levels fluctuate rapidly, but others slowly. Some noise levels vary widely, but others are relatively constant. Various noise descriptors have been developed to describe time-varying noise levels. The following are the noise descriptors most commonly used in traffic noise analysis.

- **Equivalent Sound Level (L_{eq}):** L_{eq} represents an average of the sound energy occurring over a specified period. In effect, L_{eq} is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level ($L_{eq[h]}$) is the energy average of A-weighted sound levels occurring during a one-hour period and is the basis for NAC used by Caltrans and FHWA.

- **Percentile-Exceeded Sound Level (L_{xx}):** L_{xx} represents the sound level exceeded for a given percentage of a specified period (e.g., L_{10} is the sound level exceeded 10% of the time, and L_{90} is the sound level exceeded 90% of the time).

- **Maximum Sound Level (L_{max}):** L_{max} is the highest instantaneous sound level measured during a specified period.

- **Day-Night Level (L_{dn}):** L_{dn} is the energy average of A-weighted sound levels occurring over a 24-hour period, with a 10-dB penalty applied to A-weighted sound levels occurring during nighttime hours between 10 p.m. and 7 a.m.

- **Community Noise Equivalent Level (CNEL):** Similar to L_{dn}, CNEL is the energy average of the A-weighted sound levels occurring over a 24-hour period, with a 10-dB penalty applied to A-weighted sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m., and a 5-dB penalty applied to the A-weighted sound levels occurring during evening hours between 7 p.m. and 10 p.m.

3.8. Sound Propagation

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

3.8.1. Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 decibels 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 decibels for each doubling of distance from a line source.

3.8.2. 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 feet. 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 decibels 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 decibels per doubling of distance.

3.8.3. 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) from the highway 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.

3.8.4. Shielding by Natural or Human-Made Features

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. Natural

terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor specifically to reduce noise. A barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. Taller barriers provide increased noise reduction. Vegetation between the highway and the receptor is rarely effective in reducing noise because it does not create a solid barrier.

Chapter 4. Federal Regulations and State Policies

This report focuses on the requirements of 23 CFR 772, as discussed below.

4.1. Federal Regulations

4.1.1. 23 CFR 772

23 CFR 772 provides procedures for preparing operational and construction noise studies and evaluating noise abatement considered for Federal and Federal-aid projects. Under 23 CFR 772.7, projects are categorized as Type I, Type II, or Type III projects.

FHWA defines a Type I project as a proposed Federal or Federal-aid project for the construction of a highway or roadway on a new location or the physical alteration of an existing highway, which significantly changes either the horizontal or vertical alignment of the highway. The following projects are also considered to be Type I projects:

- The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as a HOV lane, HOT lane, bus lane, or truck climbing lane;
- The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane;
- The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange;
- Restriping existing pavement for the purpose of adding a through traffic lane or an auxiliary lane;
- The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot, or toll plaza.

If a project is determined to be a Type I project under this definition, the entire project area as defined in the environmental document is a Type I project.

A Type II project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. A Type III project is a project that does not meet the classifications of a Type I or Type II project. Type III projects do not require a noise analysis.

Under 23 CFR 772.11, noise abatement must be considered for Type I projects if the project is predicted to result in a traffic noise impact. In such cases, 23 CFR 772 requires that the project sponsor "consider" noise abatement before adoption of the final NEPA document. This process involves identification of noise abatement measures that are reasonable, feasible, and likely to be incorporated into the project, and of noise impacts for which no apparent solution is available.

Traffic noise impacts, as defined in 23 CFR 772.5, occur when the predicted noise level in the design-year approaches or exceeds the NAC specified in 23 CFR 772, or a predicted noise level substantially exceeds the existing noise level (a "substantial" noise increase). 23 CFR 772 does not specifically define the terms "substantial increase" or "approach;" these criteria are defined in the Protocol, as described below.

Table 4-1 summarizes NAC corresponding to various land use activity categories. Activity categories and related traffic noise impacts are determined based on the actual or permitted land use in a given area.

In identifying noise impacts, primary consideration is given to exterior areas of frequent human use. In situations where there are no exterior activities, or where the exterior activities are far from the roadway or physically shielded in a manner that prevents an impact on exterior activities, the interior criterion (Activity Category D) is used as the basis for determining a noise impact. Indoor analysis is conducted at Activity Category D land uses only after all outdoor analysis options have been exhausted and after a determination has been made that exterior abatement measures would not be feasible and reasonable.

4.1.2. Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects

The Protocol specifies the policies, procedures, and practices to be used by agencies that sponsor new construction or reconstruction of Federal or Federal-aid highway projects. The Protocol defines a noise increase as substantial when the predicted noise levels with project implementation exceed existing noise levels by 12 dBA or more. The Protocol also states that a sound level is considered to approach a NAC level when the sound level is within 1 dB of the NAC identified in 23 CFR 772 (e.g., 66 dBA is considered to approach the NAC of 67 dBA, but 65 dBA is not).

The Technical Noise Supplement to the Protocol provides detailed technical guidance for the evaluation of highway traffic noise. This includes field measurement methods, noise modeling methods, and report preparation guidance.

Table 4-1. Activity Categories and Noise Abatement Criteria (23 CFR 772)

Activity Category	Activity $L_{eq}[h]$[1]	Evaluation Location	Description of Activities
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67	Exterior	Residential.
C[2]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A–D or F.
F			Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G			Undeveloped lands that are not permitted.

[1] The $L_{eq[h]}$ activity criteria values are for impact determination only and are not design standards for noise abatement measures. All values are A-weighted decibels (dBA).

[2] Includes undeveloped lands permitted for this activity category.

4.2. State Regulations and Policies

4.2.1. California Environmental Quality Act

Noise analysis under CEQA may be required regardless of whether or not the Project is a Type I project. The CEQA noise analysis is completely independent of the 23 CFR 772 analysis done for NEPA. Under CEQA, the baseline noise level is compared to the build noise level. The assessment entails looking at the setting of the noise impact and then how large or perceptible any noise increase would be in the given area. Key considerations include: the uniqueness of the setting, the sensitive nature of the noise receptors, the magnitude of the noise increase, the number of residences affected, and the absolute noise level.

The significance of noise impacts under CEQA are addressed in the environmental document rather than the NSR. Even though the NSR (or noise technical memorandum) does not specifically evaluate the significance of noise impacts under CEQA, it must contain the technical information that is needed to make that determination in the environmental document.

4.2.2. Section 216 of the California Streets and Highways Code

Section 216 of the California Streets and Highways Code relates to the noise effects of a proposed freeway project on public and private elementary and secondary schools. Under this code, a noise impact occurs if, as a result of a proposed freeway project, noise levels exceed 52 dBA $L_{eq[h]}$ in the interior of public or private elementary or secondary classrooms, libraries, multipurpose rooms, or spaces. This requirement does not replace the "approach or exceed" NAC criterion for FHWA Activity Category D for classroom interiors, but it is a requirement that must be addressed in addition to the requirements of 23 CFR 772.

If a project results in a noise impact under this code, noise abatement must be provided to reduce classroom noise to a level that is at or below 52 dBA $L_{eq[h]}$. If the noise levels generated from freeway and roadway sources exceed 52 dBA $L_{eq[h]}$ prior to the construction of the proposed freeway project, then noise abatement must be provided to reduce the noise to the level that existed prior to construction of the Project.

Chapter 5. Study Methods and Procedures

This chapter describes the methodology used to measure and evaluate noise levels in the Project area.

5.1. Methods for Identifying Land Uses and Selecting Noise Measurement and Modeling Receptor Locations

A field investigation was conducted from Wednesday, May 28, 2025, to Friday, May 30, 2025, to identify land uses that could be subject to traffic and construction noise impacts from the proposed Project. Existing land uses in the Project area were categorized by land use type and Activity Category (see Table 4-1), and the extent of frequent human use areas was documented. The geometry of the Project, relative to nearby existing and planned land uses, was also identified.

Noise receptor locations in the Project area were identified through a review of Project mapping, aerial photographs, and field reconnaissance. Activity Categories B, C, E, and G land uses border the Project.

Long-term measurement sites were selected to capture the diurnal traffic noise level pattern in the Project area. Short-term measurement locations were selected to serve as model validation points for representative modeling locations. Additional non-measurement locations were selected as modeling locations.

Photographs of the measurement sites are provided in Appendix F. Measurement locations selected for the Project area are illustrated in Figure 5-1, Figure 5-2, and Figure 5-3.

5.2. Field Measurement Procedures

A field noise study was conducted in accordance with recommended procedures in the Protocol. Noise measurements were made with Larson Davis Model LxT1 Integrating Sound Level Meters (SLMs) set at “slow” response. The SLMs were equipped with PCB Model 377B02 1/2" free-field, prepolarized condenser microphones fitted with windscreens. The SLMs were calibrated prior to the noise measurements using a Larson Davis Model CAL200 or Model CA250 acoustical calibrator. The response of the system was checked after each measurement session and was always found to be within 0.2 dBA. No calibration adjustments were made to the measured sound levels. At the completion of monitoring, the noise data were obtained from the SLM using the Larson Davis G4 software program. All instrumentation used during the noise survey met the requirements of the American National Standards Institute SI 4-1983 for Type I use.

5.2.1. Short-Term Measurements

Eight short-term, observed noise measurements (ST-1 to ST-8) were made along the Project corridor to document existing noise levels. Short-term measurements were made in concurrent time intervals with the data collected at the long-term reference measurement sites. This method facilitates a direct comparison between both the short-term and long-term noise measurements and allows for the identification of the loudest-hour noise levels at land uses in the Project vicinity where long-term noise measurements were not made, but where both short-term and long-term measurements are exposed to the same primary noise source. During the short-term measurements, technical staff attended each meter. Two or more consecutive 10-minute measurements were made at each noise measurement site. Dominant noise sources were identified and logged. At all locations, noise levels were measured 5 feet above the ground surface and at least 10 feet from structures or barriers. Noise measurement data collected at these locations were used to validate the traffic noise model.

Traffic counts and speed observations were made along L Street, 9th Street, 14th Street, 18th Street, and William Reed Drive during the short-term noise measurements for model calibration purposes. Traffic volumes were classified into five vehicle types: (1) light-duty autos and trucks, (2) medium-duty trucks, (3) heavy-duty trucks, (4) buses, and (5) motorcycles. An automobile was defined as a vehicle with two axles and four tires that is designed primarily to carry passengers. Small vans and light trucks were included in this category. Medium-duty trucks included all cargo vehicles with two axles and six tires. Heavy-duty trucks include all vehicles with three or more axles. The observed speed on L Street was 35 mph, and on 14th Street, 18th Street, and William Reed Drive, the observed speed was 25 mph.

5.2.2. Long-Term Measurements

Long-term reference noise measurements were made at two locations along the Project corridor to quantify the diurnal trend in noise levels and to establish the peak traffic noise hour. These reference noise measurements included one along L Street at 1024 10th Street (LT-1) and one along L Street near Antioch Speedway at 1201 10th Street (LT-2). The long-term noise measurements were made over approximately 48 hours, from the morning of Wednesday, May 28, 2025, to the morning of Friday, May 30, 2025. Long-term measurements were taken at heights of about 10 feet above ground level. Care was taken to select sites that were primarily affected by traffic noise and to avoid those sites where extraneous noise sources, such as barking dogs or mechanical equipment, could

contaminate the noise data. After the data were downloaded from the SLM, the data were reviewed to identify any periods contaminated by local noise sources. Data points were excluded from the dataset where significant contamination was noted. The trends in ambient noise levels measured at long-term locations are summarized graphically in Appendix G.

5.2.3. Meteorology

Handheld weather meters were used to collect weather data at noise measurement locations during the field noise investigation. Meteorological conditions were observed during the long-term and short-term noise measurements. Conditions during short-term measurements ranged from clear skies with calm winds (0 to 5 mph). Temperatures generally ranged between 70°F to 80°F during short noise measurements. Noise monitoring would not occur if weather conditions consisted of rain or high winds (i.e., greater than 11 mph); these weather conditions did not occur during field noise measurements.

5.3. Traffic Noise Levels Prediction Methods

Traffic noise levels were predicted using TNM 2.5. TNM 2.5 is a computer model based on two FHWA reports: FHWA-PD-96-009 and FHWA-PD-96-010 (FHWA 1998a, 1998b). Due to the reliability constraints of TNM 2.5 to accurately calculate noise levels at great distances from the roadway, Caltrans limits noise assessments to approximately 500 feet of the roadway source.

TNM 2.5 calculates traffic noise levels based on the geometry of the sites, which includes the positioning of travel lanes, receptors, barriers, terrain, ground type, buildings, etc. The noise source is the traffic flow, as defined by the user, in terms of hourly volumes of automobiles, medium-duty trucks, heavy-duty trucks, buses, and motorcycles. Existing traffic and Design Year (2050) peak hour traffic volume data and speed estimates were used as model inputs for local roads and ramps. *BKF* provided the geometric plans used to create the base traffic noise model. The proposed roadway, existing and future receptors, terrain lines, ground zones, and noise barriers were digitized and input into the traffic noise model.

5.3.1. Validation of the Traffic Noise Model

TNM 2.5 cannot accurately account for pavement types and conditions, atypical vehicle noise populations, transparent shielding (such as wood fences with shrinkage gaps), reflections from nearby buildings and structures, or meteorological conditions. For these

reasons, noise measurements are conducted, and traffic noise model adjustments and validation factors are developed. For each measured condition, the corresponding observed traffic conditions are used in the model to calculate the noise level. The calculated and measured noise levels are compared to assess differences and validate the traffic noise model.

Traffic counts made during the noise monitoring survey were adjusted to reflect one-hour conditions, assuming the traffic volumes during the noise measurement interval (10 minutes) were equal during the six 10-minute intervals of an hour. These adjusted one-hour volumes were input into the model for validation. Traffic volumes and traffic mix information recorded during the noise monitoring survey and used for validation of the model are given in Appendix H.

Validation factors or model adjustments developed from this process are used to modify the model to represent measured conditions more closely. Comparison of model results under different conditions is made after the model results are rounded. Modeled results that vary from measurements by more than 3 dB are adjusted after a careful review of all measurements and modeled data. The adjustments are calculated as follows, based on the supplemental guidance provided in Appendix E of the Protocol:

- A model is considered validated if modeled and measured levels are within +/-3 dB. Adjustment = 0.

- Where modeled levels are more than 3 dB lower or higher than measured levels, the modeled results are adjusted to measured conditions: Adjustment = Measured – Modeled.

5.3.2. Traffic Inputs used for Noise Modeling

Once TNM 2.5 was validated, the loudest hour traffic noise levels were calculated for the Existing, 2050 No Build, and 2050 Build traffic scenarios. The loudest hour is not necessarily the hour with peak traffic volumes. Congestion results in slower speeds, which substantially reduces traffic noise levels. The loudest hour is generally characterized by free-flowing traffic at the roadway design speed (i.e., Level of Service [LOS] C/D or better).

Traffic volume and mix inputs for the traffic noise model were taken from the traffic projections. Future traffic volumes for 2050 No Build and 2050 Build Alternative cases

were provided by *Kittelson & Associates.* Arterial roadways were modeled at the posted speed limits for the roadway.

Traffic mix information provided by *Kittelson & Associates* was used for both existing and future scenarios for L Street, Sycamore Drive, 18th Street, 10th Street, and 4th Street.

Traffic volumes, speeds, and vehicle mix information used in the TNM 2.5 model are provided in Table A-1, Table A-2, and Table A-3 in Appendix A.

5.4. Methods for Identifying Traffic Noise Impacts and Consideration of Abatement

Traffic noise impacts are considered to occur at receptor locations where predicted design-year noise levels are 12 dB or greater than existing noise levels, or where predicted design-year noise levels approach or exceed the NAC for the applicable activity category, as shown in Table 4-1. Caltrans has defined the meaning of approaching the NAC to be 1 dBA below the NAC (e.g., 66 dBA is considered approaching the NAC for Activity Category B activity areas). Where traffic noise impacts are identified, noise abatement must be considered for reasonableness and feasibility as required by 23 CFR 772 and the Protocol.

Noise abatement is only considered necessary where frequent human usage occurs and where a lowered noise level would be of benefit. Areas of frequent human usage are considered to occur at exterior locations where people are exposed to traffic noise for an extended time period on a regular basis. Therefore, impacts are typically assessed at locations with defined outdoor activity areas, such as residential backyards, common exterior use areas, trails, pools, patios, and parks (e.g., playfields, playgrounds, or picnic tables). Other examples are outdoor seating areas at restaurants or outdoor use areas at hotels.

Caltrans policies and procedures for traffic noise analysis are contained in the Protocol and TeNS. The feasibility of noise abatement is an engineering consideration. According to the Protocol, abatement measures are considered acoustically feasible if a minimum noise reduction of 5 dB at impacted receptor locations is predicted with implementation of the abatement measures. Other factors that affect feasibility include topography, utility conflicts, and safety considerations.

Once all feasible noise abatement is identified, a procedure is conducted to assess the reasonableness of the noise abatement. The determination of the reasonableness of the noise abatement is more subjective than the determination of its feasibility. As defined in

Section 772.5 of 23 CFR 772, reasonableness is the combination of social, economic, and environmental factors considered in the evaluation of a noise abatement measure. NSRs calculate the reasonable cost allowance for feasible noise barriers, but do not determine whether a feasible barrier would be reasonable.

The overall reasonableness of noise abatement is determined by the following three factors:

- The noise reduction design goal (a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefited receptors).
- The cost of noise abatement (2025 allowance of $146,000 per benefited receptor).
- The viewpoints of benefited receptors (including property owners and residents of the benefited receptors).

The Caltrans acoustical design goal is that a barrier must be predicted to provide at least 7 dB of noise reduction at one benefited receptor.

The Protocol defines the procedure for assessing reasonableness of noise barriers from a cost perspective. Cost considerations for determining noise abatement reasonableness are based on an allowance per benefitted receptor. This reasonable allowance may be adjusted based on the most recent annual Construction Price Index. The annual price index for the fourth quarter of any year is usually posted by February of the following year. The base cost allowance for any 2025 reasonable/feasible analysis is $146,000 for each benefited receptor (i.e., receptors that receive at least 5 dB of noise reduction from a noise barrier). The total allowance for each barrier is calculated by multiplying the number of benefited receptors by $146,000.

The NSR identifies traffic noise impacts and evaluates noise abatement for acoustical feasibility. It also reports information that will be used in the reasonableness analysis, including if the 7 dB design goal reduction in noise can be achieved and the abatement allowances. The overall feasibility and reasonableness of noise abatement is reported in the Noise Abatement Decision Report (NADR).

Figure 5-1. Noise Measurement Positions between 7th Street and 11th Street

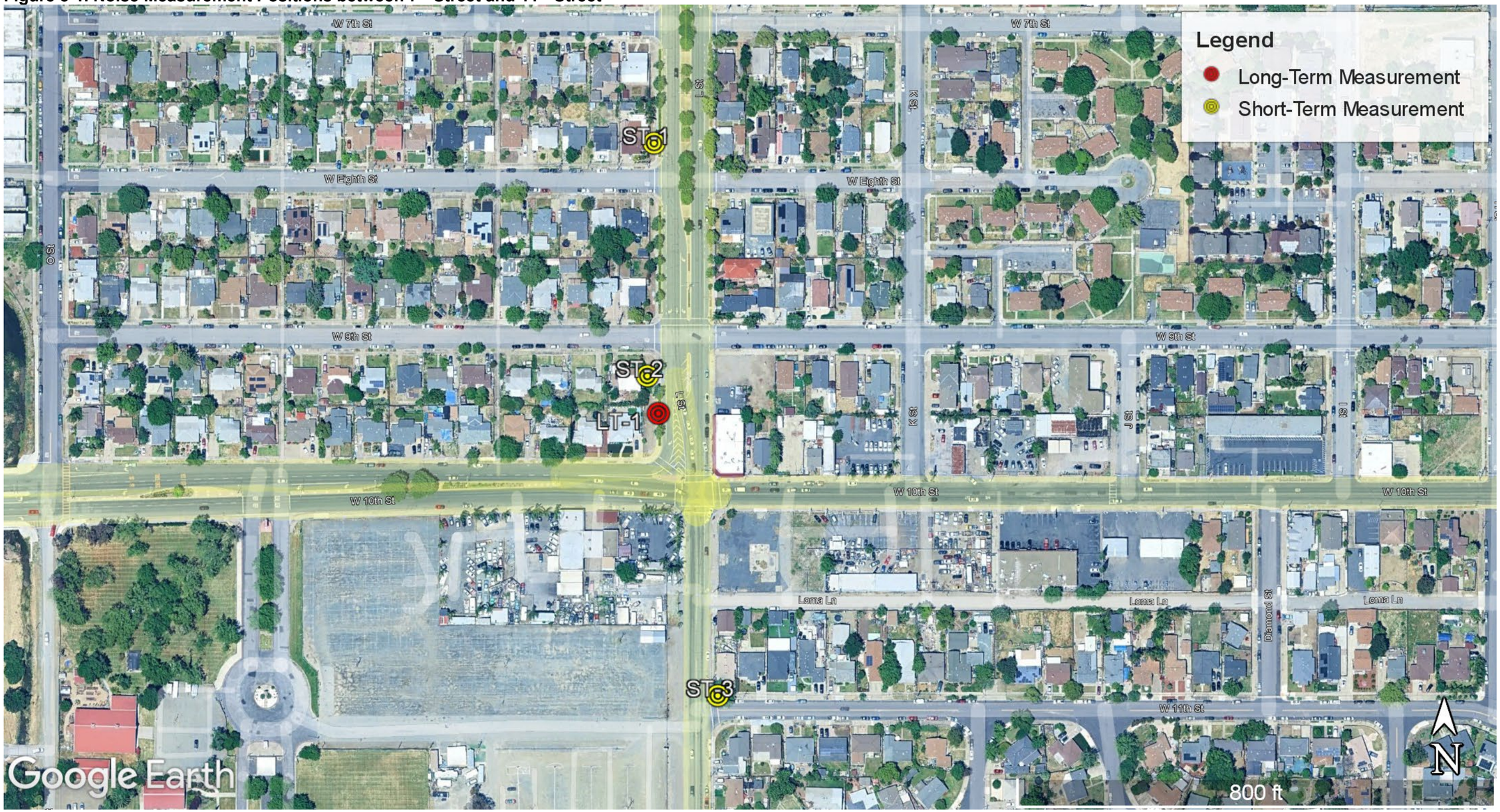
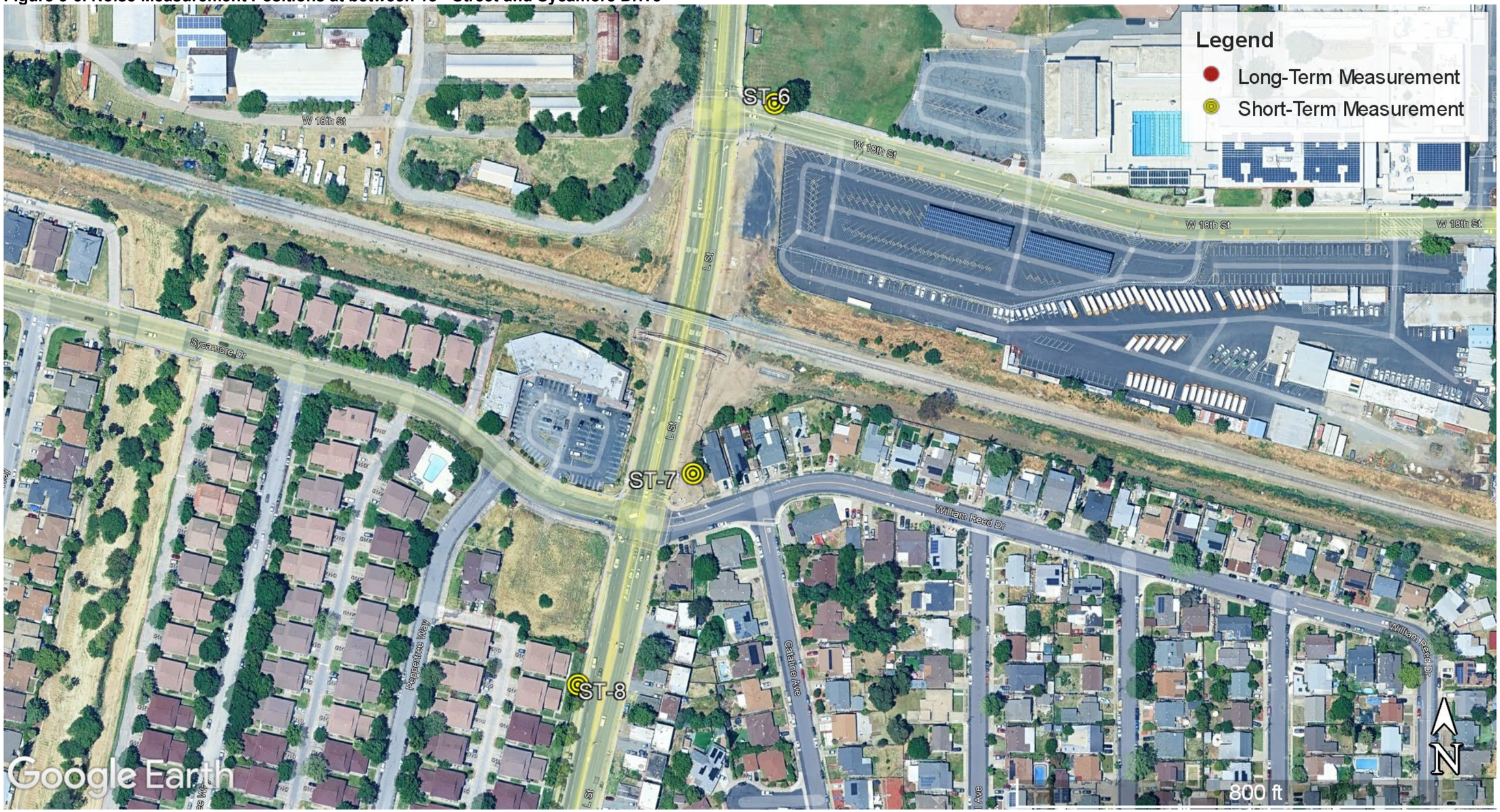


Figure 5-2. Noise Measurement Positions at 14th Street



Figure 5-3. Noise Measurement Positions at between 18th Street and Sycamore Drive



Chapter 6. Existing Noise Environment

The following is a discussion of existing noise levels in the Project area.

6.1. Existing Land Uses

Existing land uses in the Project area were categorized by Activity Category, as outlined in Section 4.1 (see Table 4-1 for land use descriptions). Activity Category A land uses (lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose) were not identified in the Project area. The following land uses were identified in the Project area:

- Category B – Residential
- Category C - School
- Category E – Commercial
- Category G – Undeveloped.

Although all developed land uses are evaluated in this analysis, noise abatement is only considered for areas of frequent human use that would benefit from a lowered noise level. Accordingly, this impact analysis focuses on locations with defined outdoor activity areas, such as residential backyards, common exterior use areas for multi-family development, and trails/parks. The noise-sensitive uses identified in the Project area are described in further detail in Chapter 7.

6.2. Noise Measurement Results

The existing noise environment throughout the Project area varies by location, depending on site characteristics, such as proximity of receptors to L Street or local roadways, the relative base elevations of roadways and receptors, and the presence of any intervening structures or barriers.

6.2.1. Short-Term Monitoring

Eight short-term noise measurements (ST-1 to ST-8) were made along the Project corridor. All short-term noise measurements were made at heights of 5 feet above ground level to represent the average height of a human's ears. Short-term noise measurement locations

were used to validate the traffic noise model. The 10-minute traffic volumes counted during the short-term measurements are shown in Table 6-1. Table H-1 and Table H-2 in Appendix H contain the computed hourly traffic counts used to validate the model.

The calculated existing loudest-hour noise levels at short-term noise measurement locations are based on validated noise modeling results.

Table 6-1. Summary of Short-Term Noise Measurements

Receptor ID	Location (Appendix F)	Activity Category	Land Use	Date	Start Time	10-minute L_{eq} (dBA)	Roadway	Autos	Medium Trucks	Heavy Trucks	Observed Speed (mph)
ST-1	1104 8th Street	B	Residential	5/28/2025	10:00 a.m.	63	L Street	34	1	2	35/35/35
					10:10 a.m.	62		38	0	1	
ST-2	1105 9th Street	B	Residential	5/28/2025	10:30 a.m.	60	L Street	41	0	0	35/35/35
							10th Street	88	2	1	25/25/25
					11:50 a.m.	61	L Street	72	2	0	35/35/35
							10th Street	95	4	1	25/25/25
ST-3	1045 L Street	B	Residential	5/28/2025	10:50 a.m.	69	L Street	93	2	1	35/35/35
					11:00 a.m.	69		81	0	1	
ST-4	1125 L Street	B	Residential	5/28/2025	11:20 a.m.	67	L Street	63	1	0	35/35/35
					11:30 a.m.	69		93	4	0	

Receptor ID	Location (Appendix F)	Activity Category	Land Use	Date	Start Time	10-minute L_{eq} (dBA)	Roadway	Autos	Medium Trucks	Heavy Trucks	Observed Speed (mph)
ST-5	1142 Leggett Street	B	Residential	5/30/2025	9:10 a.m.	58	L Street	85	0	1	35/35/35
							14th Street	19	0	0	25/25/25
					9:20 a.m.	56	L Street	80	1	1	35/35/35
							14th Street	9	0	0	25/25/25
ST-6	700 18th Street	C	School	5/30/3035	9:40 a.m.	66	L Street	79	2	1	38/38/38
							18th Street	59	0	0	25/25/25
					9:50 a.m.	66	L Street	87	2	1	38/38/38
							18th Street	65	0	0	25/25/25
ST-7	262 William Reed Drive	B	Residential	5/30/3035	10:10 a.m.	66	L Street	125	2	0	38/38/38
							William Reed Drive	21	0	0	25/25/25
					10:20 a.m.	64	L Street	111	0	0	38/38/38
							William Reed Drive	19	0	0	25/25/25

Receptor ID	Location (Appendix F)	Activity Category	Land Use	Date	Start Time	10-minute L_{eq} (dBA)	Roadway	Autos	Medium Trucks	Heavy Trucks	Observed Speed (mph)
ST-8	2112 L Street	B	Residential	5/30/3035	10:40 a.m.	69	L Street	154	3	1	38/38/38
					10:50 a.m.	70		161	0	1	

Note: Refer to Figure 5-1, Figure 5-2, Figure 5-3 for measurement locations.

6.2.2. Long-Term Monitoring

Two long-term noise measurements (LT-1 and LT-2) were made to quantify the diurnal trend in noise levels and establish the peak traffic noise hour. The long-term noise measurements were made over an approximate 48-hour period, from the morning on Wednesday, May 28, 2025, to the morning on Friday, May 30, 2025.

Long-term monitoring location LT-1 was near 1106 W 10th Street, approximately 50 feet west of the centerline of L Street. LT-2 was located on the Contra Costa County Fairgrounds property, approximately 45 feet west of the centerline of L Street. Long-term measurements were taken at heights of about 10 feet above ground level.

The results of the long-term field measurements are also summarized in Table 6-2. As indicated in Table 6-2, the existing loudest hour noise levels ranged from 66 to 75 dBA $L_{eq[h]}$ at long-term locations. Figure 6-1 and Figure 6-2 summarize the overall results of the long-term noise monitoring for sites LT-1 and LT-2, respectively. The daily trends in ambient noise levels measured at long-term locations are summarized graphically in Appendix G.

Table 6-2. Summary of Long-Term Noise Monitoring

Receptor ID	Location (See Photos in Appendix F)	Date	Loudest Hour(s)	Loudest Hour $L_{eq[h]}$, dBA
LT-1	1106 W 10th Street	5/28/2025	12:00 p.m.	75
		5/29/2025	8:00 a.m.	71
		5/30/2025	7:00 a.m.	66
LT-2	Contra Costa County Fairgrounds	5/28/2025	7:00 p.m.	72
		5/29/2025	8:00 a.m.	74
		5/30/2025	10:00 a.m.	73

Figure 6-1. Long-Term Monitoring at Location LT-1, May 28, 2025 to May 30, 2025

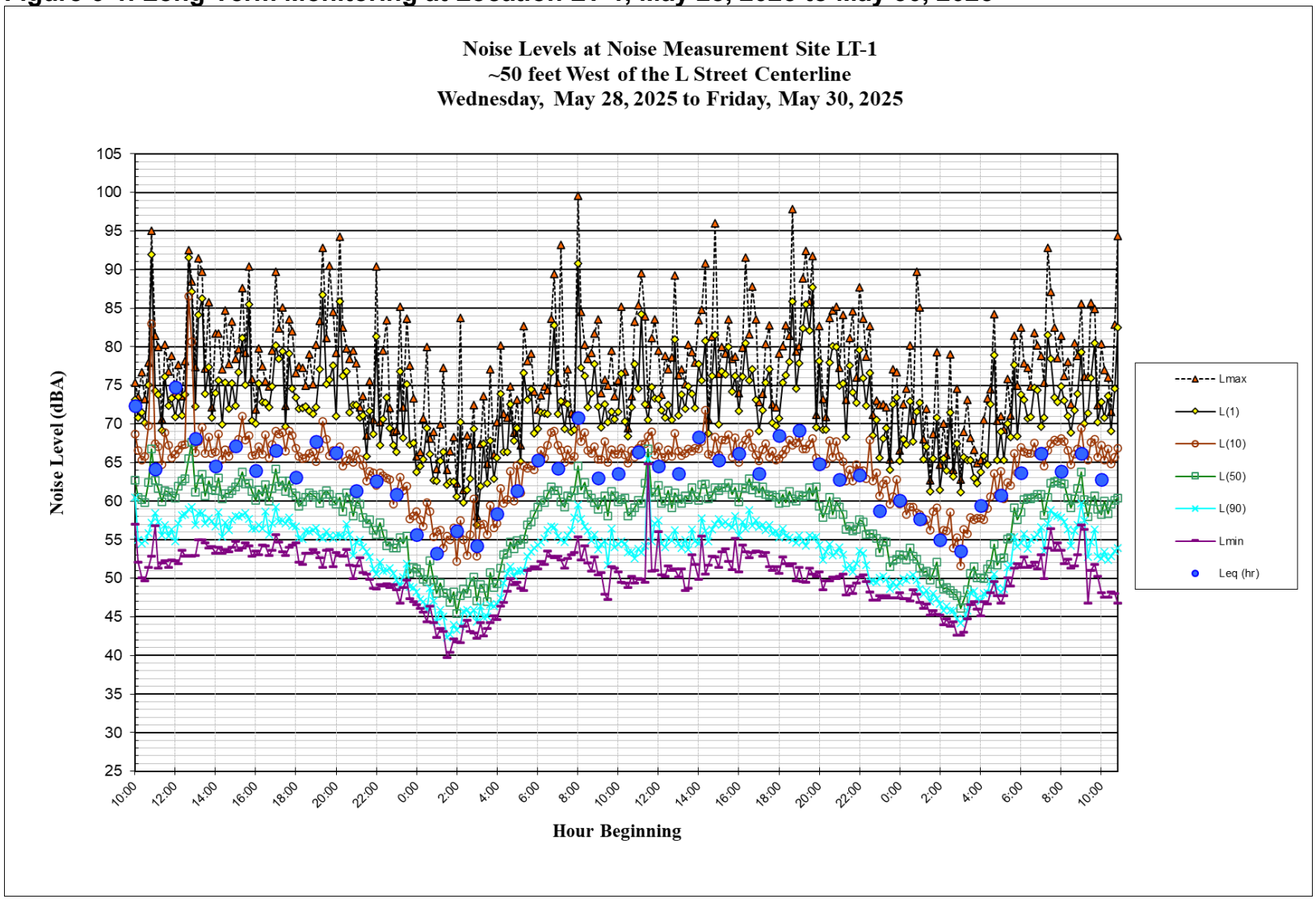
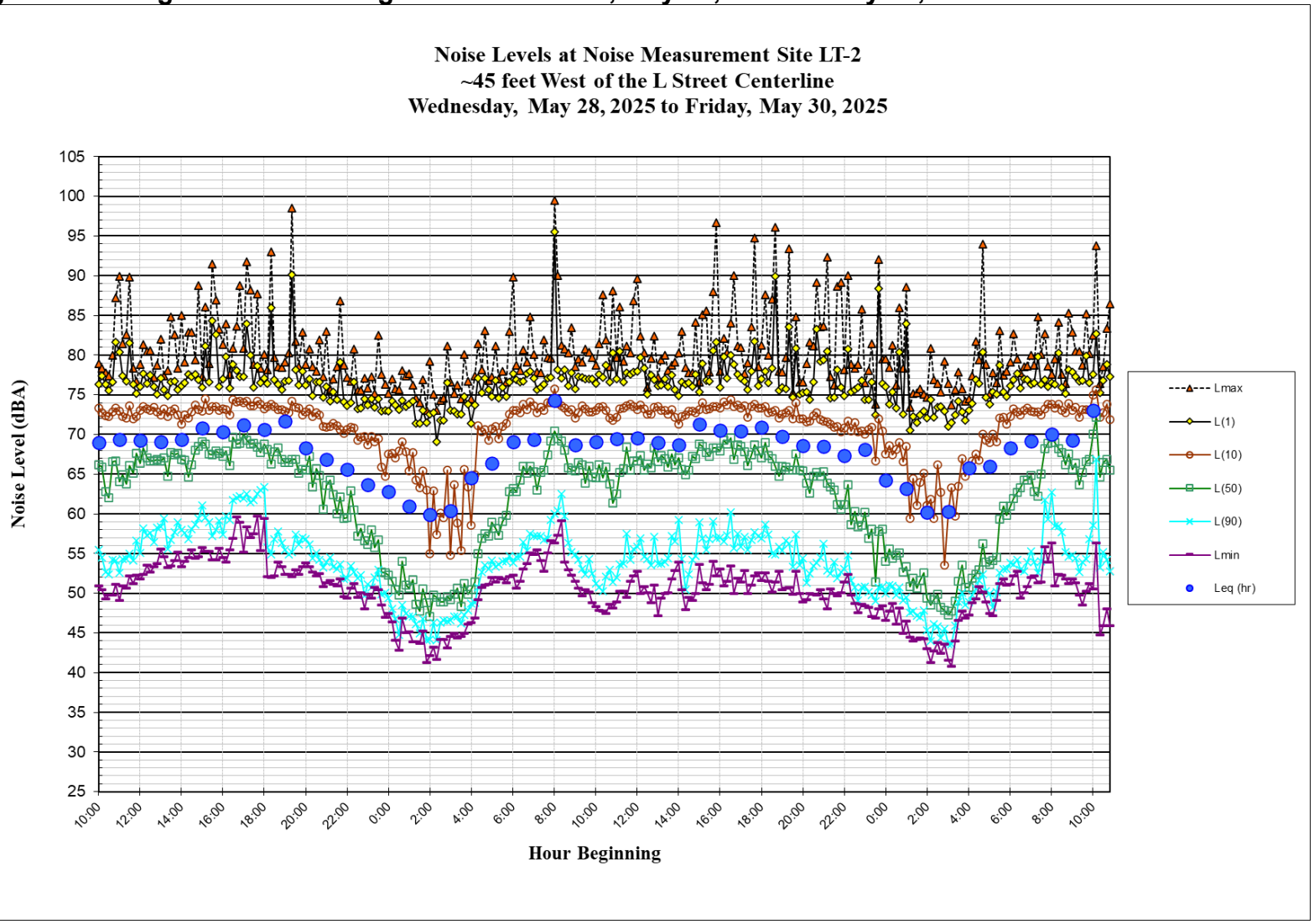


Figure 6-2. Long-Term Monitoring at Location LT-2, May 28, 2025 to May 30, 2025



6.3. Model Validation to Existing Conditions

TNM 2.5 was used to calculate existing noise levels at field measurement locations during periods when the measurements were made, and traffic was counted. Adjustments or "Validation Factors" were then developed where the traffic noise model and the measured levels varied by 3 dBA or greater. The development of each Validation Factor followed the methodology detailed in Section 5.3. The Validation Factor is added to modeled results for existing and future loudest-hour traffic conditions. The Validation Factor for each receptor can be found in Table 6-3.

Table 6-3. Comparison of Measured and Predicted Sound Levels in TNM

Receptor ID	10-min L_{eq} Noise Level, dBA						Validation Factor, dBA
	Measured Level	TNM 2.5 Modeled Level	Difference (Measured - Modeled)	Measured Level	TNM 2.5 Modeled Level	Difference (Measured - Modeled)	
ST-1	63	61	2	62	59	3	0
ST-2	60	57	3	61	61	0	0
ST-3	69	67	2	69	66	3	0
ST-4	68	64	3	69	66	3	0
ST-5	58	55	3	56	53	3	0
ST-6	66	63	3	66	63	3	0
ST-7	66	63	3	64	61	3	0
ST-8	69	67	2	70	67	3	0

6.4. Future Undeveloped Land Uses

The Protocol requires that the NSR discuss the development of future land uses in the vicinity of the Project. All of the land in the Project area is developed. Lists of planned and approved projects within Antioch near the Project corridor were reviewed to identify undeveloped and previously developed lands for which development is planned, designed, and programmed so that those proposed developments may be considered approved (or a part of the existing conditions). According to the Protocol, future development would be considered planned, designed, and programmed once it receives final development approval. The review focused on projects within approximately 500 feet of the Project limits, where traffic noise levels from the improved Project roadways could dominate the noise environment. Projects located beyond this distance were excluded from further analysis. Based on a review of the City of Antioch's website[1] there are no proposed developments located within 500 feet of the Project limits.

[1]https://www.antiochca.gov/community-development-department/planning-division/current-projects/, Accessed June 12, 2025.

Chapter 7. Future Noise Environment, Impacts, and Considered Abatement

This chapter discusses potential noise impacts and presents a preliminary analysis of noise abatement measures.

7.1. Future Noise Environment and Impacts

Traffic noise modeling results and predicted traffic noise impacts for existing and design year conditions are shown in Table B-1 for the Build Alternative. In Table B-1 Build/Project condition exterior noise levels are compared to Existing conditions and to No Build conditions. The comparison to Existing conditions is included in the analysis to identify traffic noise impacts, as defined under 23 CFR 772. The comparison between Build and No Build conditions indicates the direct effect of the Project. As stated in the TeNS, modeling results are rounded to the nearest decibel before comparisons are made.

Impacted receptors were identified by Activity Category, and the number of impacted receptors is summarized to calculate reasonable monetary allowances for feasible noise barriers that also meet the 7 dB noise reduction design goal. Noise levels discussed in this section are based on the adjusted model results, using loudest-case traffic conditions (in terms of noise generation) for the Existing, No Build, and Build scenarios.

Eight short-term noise measurement locations (ST-1 to ST-8) and 40 modeled receptor locations (R1-R40) were used to calculate existing and future traffic noise levels. Receptors are shown in Figure 7-1, Figure 7-2, Figure 7-3, Figure 7-4, and Figure 7-5.

Figure 7-1. Receptor Locations North of W 10th Street



Figure 7-2. Receptor Locations South of W 10th Street



Figure 7-3. Receptor Locations at 14th Street



Figure 7-4. Receptor Locations at 18th Street

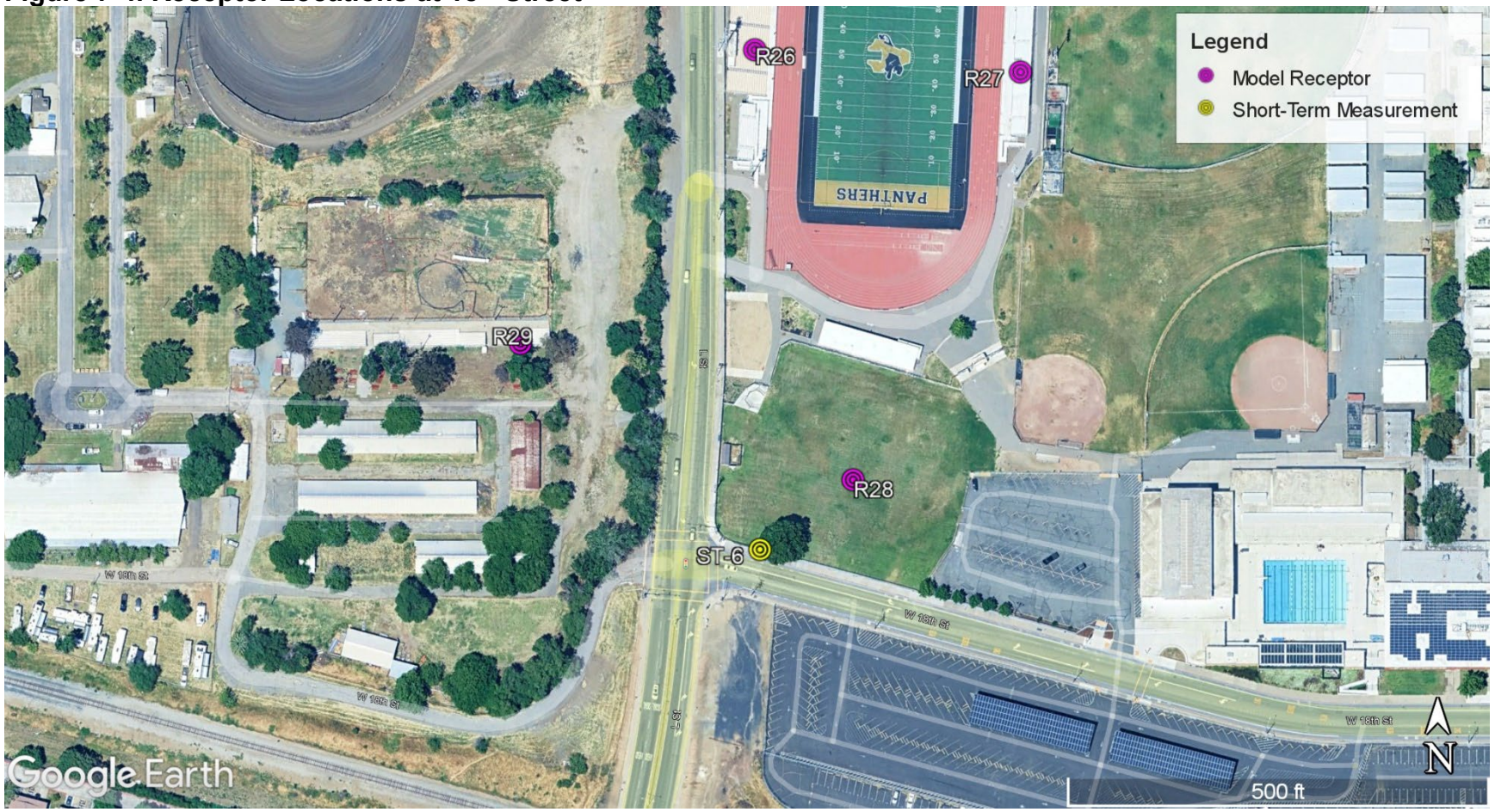


Figure 7-5. Receptor Locations at Sycamore Drive/William Reed Drive



7.1.1. Build Alternative – Exterior Noise Levels in Category B, C, and E Land Uses

As shown in Table B-1, the loudest-hour noise levels at Category B land uses where receptors are representative of common outdoor use areas are calculated to range from 48 to 64 dBA $L_{eq[h]}$ under Existing conditions, from 49 to 64 dBA $L_{eq[h]}$ under 2050 No Build conditions, and from 49 to 65 dBA $L_{eq[h]}$ under 2050 Build conditions. The 2050 Build traffic noise levels are not predicted to approach or exceed the NAC at any Category B receptors.

The loudest-hour noise levels at Category C land uses where receptors are representative of outdoor use areas are calculated to range from 54 to 61 dBA $L_{eq[h]}$ under Existing conditions, from 55 to 63 dBA $L_{eq[h]}$ under 2050 No Build conditions, and from 56 to 63 dBA $L_{eq[h]}$ under 2050 Build conditions. The 2050 Build traffic noise levels are not predicted to approach or exceed the NAC at any Category C receptors.

The loudest-hour noise levels at Category E land uses are calculated to reach 63 dBA $L_{eq[h]}$ under Existing conditions, 64 dBA $L_{eq[h]}$ under 2050 No Build conditions, and 65 dBA $L_{eq[h]}$ under 2050 Build conditions. The 2050 Build traffic noise levels are not predicted to approach or exceed the NAC at any Category E receptors.

Noise levels would increase by up to 3 dBA over Existing conditions under 2050 No Build conditions. When compared to Existing conditions, changes in noise levels under 2050 Build conditions would range from -1 to +5 dBA. When compared to No Build conditions, changes in noise levels under 2050 Build conditions would range from -2 to +2. The changes to noise levels that would result from the Project are not considered substantial as they would not be at or above the Caltrans 12 dBA threshold.

7.1.2. Interior Noise Levels in Category D Land Uses

A noise impact would occur as a result of a proposed project, if noise levels approach or exceed 52 dBA $L_{eq[h]}$ in the interior of auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios. Based on FHWA Guidance, a typical Category D use structure would be anticipated to provide about 10 dBA of noise reduction from exterior noise sources with windows open, and 20 to 30 dBA of noise reduction with windows in the closed position, depending on

the window and exterior wall construction.[2] Therefore, Category D use structures that do not have forced-air mechanical ventilation, to allow occupants to keep windows closed to control noise, could be anticipated to have interior noise levels approaching or exceeding 52 dBA $L_{eq[h]}$, with exterior exposures of 62 dBA $L_{eq[h]}$ or more. For structures with windows in the closed position, exterior noise levels of 72 to 82 dBA $L_{eq[h]}$ or less, depending on the acoustical construction of the structure, would result in acceptable interior noise levels.

No Category D structures were identified within 500 feet of the Project alignment.

[2] FHWA Highway Traffic Noise: Analysis and Abatement Guide, December 2011.

Chapter 8. Construction Noise

Noise generated by Project-related construction activities would be a function of the noise levels generated by individual pieces of construction equipment, the type and amount of equipment operating at any given time, the timing and duration of construction activities, the proximity of nearby sensitive land uses, and the presence or lack of shielding at these sensitive land uses. Construction noise levels would vary on a day-to-day basis during each phase of construction, depending on the specific task being completed.

8.1. Regulatory Criteria

Noise associated with construction is controlled by Caltrans Standard Specification Section 14-8.02, "Noise Control," which states the following:

- Control and monitor noise resulting from work activities.
- Do not exceed 86 dBA L_{max} at 50 feet from the job site activities from 9:00 p.m. to 6:00 a.m.

8.2. Construction Phasing and Noise Levels

Project construction is anticipated to occur over 18 months. Details about the Project construction are discussed in Chapter 2. The Project would widen along L Street, between W. 10th Street and Sycamore Drive. The widening is required along the corridor between 10th Street to 18th Street primarily to close gaps in the sidewalk and bicycle lane network in both NB and SB directions and will accommodate the addition of one SB and one NB travel lane between 10th Street and 18th Street. Project construction would include grubbing & land clearing, grading & excavation, drainage, utilities, & sub-grade, and paving. When feasible, construction work would occur between 8:00 a.m. and 5:00 p.m. on weekdays and from 9:00 a.m. to 5:00 p.m. on weekends, consistent with the City of Antioch's allowable construction hours.

8.2.1. Build Alternative Construction Noise Levels

Construction noise would primarily result from the operation of heavy construction equipment and the arrival and departure of heavy-duty trucks. The types of equipment needed to complete the construction may include, but are not limited to, the following: tractors, excavators, graders, rollers, front-end loaders, scrapers, tractors/loaders/backhoes,

air compressors, compactors, pumps, and pavers. Impact pile driving is not anticipated to be required under this alternative.

Table 8-1 presents construction noise levels calculated for each major phase of the Project at a distance of 50 feet, based on calculations conducted in FHWA's Roadway Construction Noise Model (RCNM) using Project-specific construction information detailed in Appendix I. This construction noise model includes representative sound levels for the most common types of construction equipment and the approximate usage factors of such equipment that were developed based on an extensive database of information gathered during the construction of the Central Artery/Tunnel Project in Boston, Massachusetts (CA/T Project or "Big Dig"). In some instances, maximum instantaneous noise levels are calculated to be slightly lower than hourly average noise levels. This occurs because the model reports the maximum instantaneous noise level generated by the loudest single piece of construction equipment, while reporting the hourly average noise levels resulting from the additive effect of multiple pieces of construction equipment operating simultaneously. Noise generated by construction equipment drops off at a rate of 6 dB per doubling of distance.

Table 8-1. Noise Levels by Construction Phase at 50 Feet

Construction Phase	Maximum Noise Level (L_{max}, dBA)	Hourly Average Noise Level ($L_{eq[h]}$, dBA)
Grubbing & Land Clearing	84	83
Grading & Excavation	85	89
Drainage, Utilities, & Sub-Grade	85	87
Paving	80	81

Source: FHWA's RCNM

8.3. Construction Noise Impacts

Although the overall construction schedule is anticipated to occur over a period of 18 months, roadway construction activities typically occur for relatively short periods of time in specific locations as construction proceeds along the Project's alignment. Construction noise would mostly be of concern in areas where heavy construction would be concentrated for extended periods of time in areas adjacent to noise-sensitive receptors, where noise levels from individual pieces of equipment are substantially higher than ambient conditions, or when construction activities would occur during noise-sensitive time periods, such as early morning, evening, or nighttime hours.

As indicated in Table 8-1, with the exception of short periods of grading/excavation and drainage/utilities/sub-grade construction noise levels would not be expected to exceed the quantitative noise limits established by Caltrans, which only apply during the nighttime period. If grading/excavation and drainage/utilities/sub-grade occurs between the daytime hours of 6:00 a.m. and 9:00 p.m., construction noise levels would not be regulated by Caltrans.

8.4. Construction Noise Minimization Measures

To reduce the potential for noise impacts resulting from Project construction, the following measures shall be implemented during Project construction.

- All construction equipment shall conform to Section 14-8.02, Noise Control, of the latest Standard Specifications.
- Noise-generating construction activities shall be restricted to between 8:00 a.m. and 5:00 p.m. on weekdays and from 9:00 a.m. to 5:00 p.m. on weekends and holidays.
- All internal combustion engine driven equipment shall be equipped with manufacturer recommended intake and exhaust mufflers or shrouds that are in good condition and appropriate for the equipment.
- Unnecessary idling of internal combustion engines within 100 feet of residences shall be strictly prohibited.
- Noise generating equipment shall be located as far as practical from sensitive receptors when sensitive receptors adjoin or are near the construction Project area.

- Notify community and stakeholders in advance in accordance with Local Agency procedures.

- Locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

Chapter 9. Construction Vibration

Construction activities would include grubbing & land clearing, grading & excavation, drainage, utilities & sub-grade, and paving. Impact pile driving and blasting, which have the potential to result in high levels of vibration, would not be utilized. Traffic, including heavy trucks traveling on a highway, rarely generates vibration amplitudes high enough to cause structural or cosmetic damage.

Due to the short-term nature of construction, the primary concern is the potential for vibration to damage a structure. Demolition and construction activities required for construction often generate perceptible vibration levels and levels that could affect nearby structures when heavy equipment or impact tools (e.g., jackhammers, hoe rams) are used in the vicinity of nearby sensitive land uses. Building damage generally falls into three categories:

- Cosmetic damage (also known as threshold damage) is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects.
- Minor damage is defined as hairline cracking in masonry or the loosening of plaster.
- Major structural damage is defined as wide cracking or the shifting of foundation or bearing walls.

Critical factors pertaining to the impact of construction vibration on sensitive receptors include the proximity of the existing structures to the Project site, soil conditions, the soundness of the structures, and the methods of construction used.

9.1. Regulatory Criteria

Caltrans identifies a vibration limit of 0.5 in/sec Peak Particle Velocity (PPV) as the threshold at which there is a potential risk of damage to new residential and modern commercial/industrial structures, 0.3 in/sec PPV for older residential structures, and a conservative limit of 0.25 in/sec PPV for historic and some old buildings (see Table 9-1).

Table 9-1. Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, April 2020.

9.2. Construction Vibration Levels

Construction activities with the greatest potential of generating perceptible vibration levels would include the removal of pavement and soil, the dropping of heavy objects, and the movement of heavy tracked equipment.

Table 9-2 presents typical vibration levels that could be expected from representative construction equipment at a reference distance of 25 feet and calculated vibration levels at distances representative of the setbacks from the Project to the nearest structures. Vibration levels are highest close to the source and then attenuate with increasing distance, depending on soil conditions. Assuming normal propagation, construction vibration would attenuate at the rate $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet.

Table 9-2. Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Representative of Setbacks of Nearest Structures (in/sec PPV)[1]		
			10 feet	20 feet	30 feet
Clam shovel drop		0.202	0.553	0.258	0.165
Hydromill (slurry wall)	in soil	0.001	0.047	0.010	0.007
	in rock	0.002	0.100	0.022	0.014
Vibratory Roller		0.210	0.575	0.268	0.172
Hoe Ram		0.089	0.244	0.114	0.073
Large bulldozer		0.089	0.244	0.114	0.073
Caisson drilling		0.089	0.244	0.114	0.073
Loaded trucks		0.076	0.208	0.097	0.062
Jackhammer		0.035	0.096	0.0.045	0.029
Small bulldozer		0.003	0.008	0.004	0.002

[1]These levels were calculated assuming normal propagation conditions, using a standard equation of $PPV_{Equipment} = PPV_{Ref}(25/D)^{1.1}$, from Caltrans, April 2020.

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, September 2018, as modified by *Illingworth & Rodkin, Inc.*, May 2025.

9.3. Construction Vibration Impacts

As shown in Table 9-1, Caltrans recommends a vibration limit of 0.5 in/sec PPV for new residential and modern commercial/industrial structures, 0.3 in/sec PPV for older residential structures, and 0.25 in/sec PPV for historic and some old buildings. Distances to exceedances of the vibration limits for various structure types are shown in Table 9-3.

Table 9-3. Distance to Exceedance of Vibration Limit by Structure Type

Structure Type	Threshold	Distance to Exceedance of Threshold, feet[1]					
		Vibratory Roller	Clam Shovel Drop	Hoe Ram, Large Bulldozer	Loaded Trucks	Jackhammer	Small Bulldozer
Historic Buildings	0.25 in/sec PPV	22 feet	21 feet	10 feet	9 feet	5 feet	1 foot
Older Residences	0.3 in/sec PPV	18 feet	18 feet	9 feet	8 feet	4 feet	0.5 feet
New Residential and Commercial / Industrial Buildings	0.5 in/sec PPV	12 feet	11 feet	6 feet	5 feet	3 feet	0.3 feet

[1]These levels are calculated assuming normal propagation conditions, using a standard equation of $PPV_{Equipment} = PPV_{Ref}(25/D)^{1.1}$, from Caltrans, April 2020.

9.3.1. Historical Structures

Vibratory rollers and dropping of heavy objects operating within 22 feet of historic buildings, hoe rams and large bulldozers operating within 10 feet of historic buildings, loaded trucks operating within 9 feet of historic buildings, and jack hammers operating within 5 feet of historic buildings would have the potential to produce vibration levels that would exceed the 0.25 in/sec PPV threshold. Based on a review of the City of Antioch's historical sites[3] and the National Parks Service[4] historic resource inventories/mapping, there are no historical structures within 100 feet of the Project limits.

9.3.2. Older Residential Structures

The operation of vibratory rollers and dropping of heavy objects within 18 feet, hoe rams and large bulldozers within 9 feet, loaded trucks within 8 feet, and jackhammers within 4 feet would have the potential to produce noise levels that would exceed the 0.3 in/sec PPV threshold for older residential structures. For this analysis, all structures along the Project alignment will be considered older residential construction and would be subject to the 0.3 in/sec PPV threshold.

Three older residential structures adjoining the alignment along L Street (ranging from 15 to 20 feet from the nearest project boundary) and three structures along 10th Street (ranging from 10 to 25 feet from the nearest project boundary) would be subject to the 0.3 in/sec PPV threshold. All buildings located within 25 feet of the nearest project boundary are summarized in Table 9-4, along with the estimated vibration levels. Vibration levels generated by vibratory rollers and dropping heavy objects would potentially exceed the threshold for older residential structures (0.3 in/sec PPV) at 1024 10th Street, 1045 L Street, and 1001 L Street, as identified in Table 9-4.

[3]City of Antioch Historical Sites Inventory accessed via chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.antiochca.gov/fc/community-development/planning/The-Ranch/4_5_cultural_resources.pdf, July 16, 2025.

[4]National Register of Historic Structures accessed via https://www.nps.gov/subjects/nationalregister/database-research.htm, July 16, 2025.

Table 9-4. Vibration Source Levels Estimated at Older Residential Structures Located within 25 feet of the Project Limits

Equipment		Vibration Levels (in/sec PPV)[1]					
		La Zamorana Market at 1024 W 10th Street (10ft)	Res. at 1045 L Street (15 ft)	Res. at 1101 L Street (17ft)	Res. at 2101l L Street (20ft)	Res. at 1110 W 10th Street (24ft)	Res. at 1106 W 10th Street (25ft)
Clam shovel drop		**0.553**	**0.354**	**0.309**	0.258	0.094	0.202
Hydromill (slurry wall)	in soil	0.022	0.014	0.012	0.010	0.004	0.022
	in rock	0.047	0.030	0.026	0.022	0.008	0.047
Vibratory Roller		**0.575**	**0.368**	**0.321**	0.268	0.098	0.210
Hoe Ram		0.244	0.156	0.136	0.114	0.042	0.089
Large bulldozer		0.244	0.156	0.136	0.114	0.042	0.089
Caisson drilling		0.244	0.156	0.136	0.114	0.042	0.089
Loaded trucks		0.208	0.133	0.116	0.097	0.035	0.076
Jackhammer		0.096	0.061	0.053	0.045	0.016	0.035
Small bulldozer		0.008	0.005	0.005	0.004	0.001	0.003

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, September 2018 as modified by Illingworth & Rodkin, Inc., July 2025.

[1]These levels are calculated assuming normal propagation conditions, using a standard equation of $PPV_{Equipment} = PPV_{Ref}(25/D)^{1.1}$, from Caltrans, April 2020

9.3.3. Commercial Structures

For this analysis, all structures along the Project alignment will be considered of older residential construction and subject to the 0.3 in/sec PPV threshold.

9.4. Construction Vibration Minimization Measures

To reduce the potential for vibration impacts resulting from Project construction, the following measures shall be implemented during Project construction:

- Avoid the use of vibratory rollers within 18 feet of structures. Static mode compaction shall be used when construction activities are less than 18 feet from structures.
- Avoid dropping heavy objects or equipment within 18 feet of structures.
- Avoid the use of CIDH piles, hoe rams, large bulldozers, and caisson drilling equipment within 9 feet of structures.
- If vibratory rollers must be used within 18 feet, and all other equipment must be used within 9 feet of structures, the following measures will be required:
    - Contractor must perform vibration monitoring, crack monitoring and photo/video documentation of the effected facilities during construction. The requirements to perform vibration monitoring, crack monitoring and photo/video documentation will be included in the project's construction specifications as part of the construction contract documents.

Chapter 10. References

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Chapter 11. List of Preparers

The following individuals had substantial roles in the preparation of this report:

- Micah Black (Illingworth & Rodkin, Inc. —Consultant) – Noise measurements.
- Heather Bruce (Illingworth & Rodkin, Inc. — Senior Consultant) – Project Manager, data analysis, traffic noise modeling, and report preparation.
- Michael Thill (Illingworth & Rodkin, Inc. — Principal Consultant) – Quality assurance review.

Appendix A Traffic Data

This appendix contains Table A-1, Table A-2, and Table A-3 presenting the traffic data for existing conditions, design-year conditions without the Project, and design-year conditions with the Project, respectively.

Table A-1. Traffic Data for Existing (2020) Conditions

Roadway		Number of Lanes	Total Volume Peak Hour Traffic Volume	Auto		Medium Trucks		Heavy Trucks		Speed A/MT/HT (mph)
Direction	Segment			%	Volume	%	Volume	%	Volume	
Northbound	L Street north of SR 4	2	589	98.4%	580	0.8%	5	0.8%	5	35/35/35
Southbound	L Street north of SR 4	2	1083	98.4%	1066	0.8%	9	0.8%	9	35/35/35
Northbound	L Street south of Sycamore Drive	2	488	98.2%	479	0.9%	4	0.9%	4	35/35/35
Southbound	L Street south of Sycamore Drive	2	1073	98.0%	1952	1.0%	11	1.0%	11	35/35/35
Northbound	L Street south of 18th Street	1-2	948	97.8%	927	1.1%	10	1.1%	10	35/35/35
Southbound	L Street south of 18th Street	2	835	98.0%	818	1.0%	8	1.0%	8	35/35/35
Northbound	L Street north of 18th Street	1	906	97.8%	886	1.1%	10	1.1%	10	35/35/35
Southbound	L Street north of 18th Street	1	350	98.0%	3243	1.0%	4	1.0%	4	35/35/35
Northbound	L Street south of 10th Street	1	579	98.2%	569	0.9%	5	0.9%	5	35/35/35
Southbound	L Street south of 10th Street	1	374	98.0%	367	1.0%	4	1.0%	4	35/35/35
Northbound	L Street north of 10th Street	1-2	226	98.2%	222	0.9%	2	0.9%	2	35/35/35
Southbound	L Street north of 10th Street	1-2	91	98.4%	90	0.8%	1	0.8%	1	35/35/35
Northbound	L Street south of 4th Street	2	105	97.6%	102	1.2%	1	1.2%	1	35/35/35
Southbound	L Street south of 4th Street	2	243	98.0%	238	1.0%	2	1.0%	2	35/35/35

Roadway		Number of Lanes	Total Volume Peak Hour Traffic Volume	Auto		Medium Trucks		Heavy Trucks		Speed A/MT/HT (mph)
Direction	**Segment**			**%**	**Volume**	**%**	**Volume**	**%**	**Volume**	
Westbound	Sycamore Drive west of L Street	1	94	98.4%	92	0.8%	1	0.8%	1	25/25/25
Eastbound	Sycamore Drive west of L Street	1	634	98.8%	626	0.6%	4	0.6%	4	25/25/25
Westbound	18th Street east of L Street	1	267	97.0%	259	1.5%	4	1.5%	4	25/25/25
Eastbound	18th Street east of L Street	1	711	97.8%	695	1.1%	8	1.1%	8	25/25/25
Westbound	10th Street west of L Street	2	1536	97.6%	1499	1.2%	18	1.2%	18	25/25/25
Eastbound	10th Street west of L Street	2	497	97.4%	484	1.3%	6	1.3%	6	25/25/25
Westbound	10th Street east of L Street	1	221	97.4%	215	1.3%	3	1.3%	3	25/25/25
Eastbound	10th Street east of L Street	1	1030	97.6%	1005	1.2%	12	1.2%	12	25/25/25
Westbound	4th Street west of L Street	2	446	95.6%	426	2.2%	10	2.2%	10	25/25/25
Eastbound	4th Street west of L Street	2	202	95.2%	192	2.4%	5	2.4%	5	25/25/25
Westbound	4th Street east of L Street	1	190	95.2%	181	2.4%	5	2.4%	5	25/25/25
Eastbound	4th Street east of L Street	1	295	95.6%	282	2.2%	6	2.2%	6	25/25/25

Table A-2. Traffic Data for 2050 No Build

Roadway		Number of Lanes	Total Volume Peak Hour Traffic Volume	Auto		Medium Trucks		Heavy Trucks		Speed A/MT/HT (mph)
Direction	Segment			%	Volume	%	Volume	%	Volume	
Northbound	L Street north of SR 4	2	556	98.4%	547	0.8%	4	0.8%	4	35/35/35
Southbound	L Street north of SR 4	2	1431	98.2%	1405	0.9%	13	0.9%	13	35/35/35
Northbound	L Street south of Sycamore Drive	2	469	98.2%	461	0.9%	4	0.9%	4	35/35/35
Southbound	L Street south of Sycamore Drive	2	1421	98.0%	1393	1.0%	14	1.0%	14	35/35/35
Northbound	L Street south of 18th Street	1-2	1220	97.8%	1193	1.1%	13	1.1%	13	35/35/35
Southbound	L Street south of 18th Street	2	876	97.8%	857	1.1%	10	1.1%	10	35/35/35
Northbound	L Street north of 18th Street	1	938	97.8%	917	1.1%	10	1.1%	10	35/35/35
Southbound	L Street north of 18th Street	1	415	97.6%	405	1.2%	5	1.2%	5	35/35/35
Northbound	L Street south of 10th Street	1	960	97.8%	939	1.1%	11	1.1%	11	35/35/35
Southbound	L Street south of 10th Street	1	507	97.4%	494	1.3%	7	1.3%	7	35/35/35
Northbound	L Street north of 10th Street	1-2	331	97.2%	322	1.4%	5	1.4%	5	35/35/35
Southbound	L Street north of 10th Street	1-2	172	97.6%	168	1.2%	2	1.2%	2	35/35/35
Northbound	L Street south of 4th Street	2	143	95.2%	136	2.4%	3	2.4%	3	35/35/35
Southbound	L Street south of 4th Street	2	785	97.2%	763	1.4%	11	1.4%	11	35/35/35

Roadway		Number of Lanes	Total Volume Peak Hour Traffic Volume	Auto		Medium Trucks		Heavy Trucks		Speed A/MT/HT (mph)
Direction	**Segment**			**%**	**Volume**	**%**	**Volume**	**%**	**Volume**	
Westbound	Sycamore Drive west of L Street	1	105	98.0%	103	1.0%	1	1.0%	1	25/25/25
Eastbound	Sycamore Drive west of L Street	1	775	97.6%	756	1.2%	9	1.2%	9	25/25/25
Westbound	18th Street east of L Street	1	802	97.2%	780	1.4%	11	1.4%	11	25/25/25
Eastbound	18th Street east of L Street	1	982	97.4%	956	1.3%	13	1.3%	13	25/25/25
Westbound	10th Street west of L Street	2	1874	96.2%	1803	1.9%	36	1.9%	36	25/25/25
Eastbound	10th Street west of L Street	2	677	96.4%	653	1.8%	12	1.8%	12	25/25/25
Westbound	10th Street east of L Street	1	430	96.0%	413	2.0%	9	2.0%	9	25/25/25
Eastbound	10th Street east of L Street	1	1016	95.4%	969	2.3%	23	2.3%	23	25/25/25
Westbound	4th Street west of L Street	2	1324	93.6%	1239	3.2%	42	3.2%	42	25/25/25
Eastbound	4th Street west of L Street	2	439	92.4%	406	3.8%	17	3.8%	17	25/25/25
Westbound	4th Street east of L Street	1	480	93.0%	446	3.5%	17	3.5%	17	25/25/25
Eastbound	4th Street east of L Street	1	643	94%	604	3.0%	19	3.0%	19	25/25/25

Table A-3. Traffic Data for 2050 Build

Roadway		Number of Lanes	Total Volume Peak Hour Traffic Volume	Auto		Medium Trucks		Heavy Trucks		Speed A/MT/HT (mph)
Direction	Segment			%	Volume	%	Volume	%	Volume	
Northbound	L Street north of SR 4	2	560	98.4%	551	0.8%	4	0.8%	4	35/35/35
Southbound	L Street north of SR 4	2	1538	98.2%	1510	0.9%	14	0.9%	14	35/35/35
Northbound	L Street south of Sycamore Drive	2	473	98.2%	464	0.9%	4	0.9%	4	35/35/35
Southbound	L Street south of Sycamore Drive	2	1531	98.0%	1500	1.0%	15	1.0%	15	35/35/35
Northbound	L Street south of 18th Street	1-2	1321	97.8%	1292	1.1%	15	1.1%	15	35/35/35
Southbound	L Street south of 18th Street	2	830	97.8%	812	1.1%	9	1.1%	9	35/35/35
Northbound	L Street north of 18th Street	1	1493	98.0%	1463	1.0%	15	1.0%	15	35/35/35
Southbound	L Street north of 18th Street	1	443	97.8%	433	1.1%	5	1.1%	5	35/35/35
Northbound	L Street south of 10th Street	1	1152	97.8%	1127	1.1%	13	1.1%	13	35/35/35
Southbound	L Street south of 10th Street	1	530	97.4%	516	1.3%	7	1.3%	7	35/35/35
Northbound	L Street north of 10th Street	1-2	285	97.6%	278	1.2%	3	1.2%	3	35/35/35
Southbound	L Street north of 10th Street	1-2	240	97.8%	235	1.1%	3	1.1%	3	35/35/35
Northbound	L Street south of 4th Street	2	131	96.0%	126	2.0%	3	2.0%	3	35/35/35
Southbound	L Street south of 4th Street	2	870	97.0%	844	1.5%	13	1.5%	13	35/35/35

Roadway		Number of Lanes	Total Volume Peak Hour Traffic Volume	Auto		Medium Trucks		Heavy Trucks		Speed A/MT/HT (mph)
Direction	**Segment**			**%**	**Volume**	**%**	**Volume**	**%**	**Volume**	
Westbound	Sycamore Drive west of L Street	1	105	98.2%	103	0.9%	1	0.9%	1	25/25/25
Eastbound	Sycamore Drive west of L Street	1	740	97.6%	722	1.2%	9	1.2%	9	25/25/25
Westbound	18th Street east of L Street	1	419	96.8%	406	1.6%	7	1.6%	7	25/25/25
Eastbound	18th Street east of L Street	1	977	97.0%	948	1.5%	15	1.5%	15	25/25/25
Westbound	10th Street west of L Street	2	1908	96.2%	1835	1.9%	36	1.9%	36	25/25/25
Eastbound	10th Street west of L Street	2	684	96.2%	658	1.9%	13	1.9%	13	25/25/25
Westbound	10th Street east of L Street	1	464	95.8%	445	2.1%	10	2.1%	10	25/25/25
Eastbound	10th Street east of L Street	1	1002	95.4%	975	2.3%	24	2.3%	24	25/25/25
Westbound	4th Street west of L Street	2	1394	93.6%	1305	3.2%	45	3.2%	45	25/25/25
Eastbound	4th Street west of L Street	2	440	92.6%	407	3.7%	16	3.7%	16	25/25/25
Westbound	4th Street east of L Street	1	496	93.0%	461	3.5%	17	3.5%	17	25/25/25
Eastbound	4th Street east of L Street	1	646	94.0%	607	3.0%	19	3.0%	19	25/25/25

Appendix B Predicted Future Noise Levels and Noise Barrier Analysis

Table B-1 summarizes the traffic noise modeling results for existing and design-year conditions with and without the Project. Where applicable, this table also compare the predicted noise reductions by barrier height for each noise barrier analyzed.

Table B-1. Predicted Future Noise Levels and Barrier Analysis for 2050 Build Alternative

Receptor I.D.	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA[2]	L Steet Path to Transit Phase 2 Project Build Alternative Future Worst Hour Noise Levels - $L_{eq}(h)$, dBA																										
						Design Year Noise Level without Project[2] $L_{eq}(h)$, dBA	Design Year Noise Level with Project [2] $L_{eq}(h)$, dBA	Design Year Noise Level without Project minus Existing Conditions $L_{eq}(h)$, dBA	Design Year Noise Level with Project Minus No Project Conditions $L_{eq}(h)$, dBA	Activity Category (NAC)	Impact Type[1]	Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																			
												6 feet			8 feet			10 feet			12 feet			14 feet			16 feet		
												$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
ST-1		Residential	1	1104 8th Street	60	62	62	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-2		Residential	1	1105 9th Street	60	62	64	2	2	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-3		Residential	1	1045 L Street	70	70	70	0	0	B (67)	None[4]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-4		Residential	1	1125 L Street	69	70	70	1	0	B (67)	None[4]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-5		Residential	1	1142 Leggett Street	56	56	57	0	1	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-6		School	1	700 18th Street	68	70	70	2	0	C (67)	None[4]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-7		Residential	1	262 William Reed Drive	67	68	68	1	0	B (67)	None[4]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ST-8		Residential	1	2112 L Street	69	70	71	1	1	B (67)	None[4]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor I.D.	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA[2]	L Steet Path to Transit Phase 2 Project Build Alternative Future Worst Hour Noise Levels - $L_{eq}(h)$, dBA																									
						Design Year Noise Level without Project[2] $L_{eq}(h)$, dBA	Design Year Noise Level with Project [2] $L_{eq}(h)$, dBA	Design Year Noise Level without Project minus Existing Conditions $L_{eq}(h)$, dBA	Design Year Noise Level with Project Minus No Project Conditions $L_{eq}(h)$, dBA	Activity Category (NAC)	Impact Type[1]	Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																		
												6 feet			8 feet			10 feet			12 feet			14 feet			16 feet		
												$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R1		Residential		1105 7th Street	56	58	58	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2		Residential		1112 8th Street	49	51	51	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3		Residential		1017 7th Street	51	53	53	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R4		Residential		709 L Street	55	57	57	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5		Residential		1109 8th Street	53	55	55	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R6		Residential		810 9th Street	57	59	59	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R7		Residential		1025 8th Street	57	59	59	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R8		Residential		815 L Street	53	55	55	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R9		Residential		1109 9th Street	51	53	55	2	2	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R10		Residential		1106 10th Street	53	56	58	3	2	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R11		Undeveloped		1017 9th Street	59	61	62	2	1	G	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R12		Residential		1016 W 10th Street	55	57	57	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor I.D.	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA[2]	L Steet Path to Transit Phase 2 Project Build Alternative Future Worst Hour Noise Levels - $L_{eq}(h)$, dBA																							
						Design Year Noise Level without Project[2] $L_{eq}(h)$, dBA	Design Year Noise Level with Project [2] $L_{eq}(h)$, dBA	Design Year Noise Level without Project minus Existing Conditions $L_{eq}(h)$, dBA	Design Year Noise Level with Project Minus No Project Conditions $L_{eq}(h)$, dBA	Activity Category (NAC)	Impact Type[1]	Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 feet			8 feet			10 feet			12 feet			14 feet			16 feet		
												$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R13		Undeveloped		1029 W 10th Street	63	64	64	1	0	G	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R14		Residential		1045 L Street	62	63	61	1	-2	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R15		Residential		1026 11th Street	54	55	53	1	-2	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R16		Residential		1013 11th Street	48	49	49	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R17		Residential		1101 L Street	50	51	51	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R18		Residential		1125 L Street	50	51	51	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R19		Residential		1134 Leggett Street	49	50	50	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R20		Residential		1141 L Street	55	55	56	0	1	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R21		Campground		Contra Costa County Fair RV Park – 1201 W 10th Street	57	58	59	1	1	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R22		Residential		1401 L Street	64	64	65	0	1	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R23		Residential		1013 Fourteenth Street	57	58	59	1	1	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor I.D.	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA[2]	L Steet Path to Transit Phase 2 Project Build Alternative Future Worst Hour Noise Levels - $L_{eq}(h)$, dBA																							
						Design Year Noise Level without Project[2] $L_{eq}(h)$, dBA	Design Year Noise Level with Project [2] $L_{eq}(h)$, dBA	Design Year Noise Level without Project minus Existing Conditions $L_{eq}(h)$, dBA	Design Year Noise Level with Project Minus No Project Conditions $L_{eq}(h)$, dBA	Activity Category (NAC)	Impact Type[1]	Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 feet			8 feet			10 feet			12 feet			14 feet			16 feet		
												$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R24		Active Sports Area		Antioch Speedway – 1201 W 10th Street	58	58	60	0	2	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R25		Active Sports Area		Antioch Speedway – 1201 W 10th Street	54	55	56	1	1	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R26		School		Antioch High School Football Field – 700 18th Street	57	58	57	1	-1	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R27		School		Antioch High School Football Field – 700 18th Street	55	56	56	1	0	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R28		School		Antioch High School Field – 700 18th Street	60	61	61	1	0	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R29		Active Sports Area		Antioch Dog Show Site – 1304	61	63	63	2	0	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor I.D.	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA[2]	L Steet Path to Transit Phase 2 Project Build Alternative Future Worst Hour Noise Levels - $L_{eq}(h)$, dBA																							
						Design Year Noise Level without Project[2] $L_{eq}(h)$, dBA	Design Year Noise Level with Project [2] $L_{eq}(h)$, dBA	Design Year Noise Level without Project minus Existing Conditions $L_{eq}(h)$, dBA	Design Year Noise Level with Project Minus No Project Conditions $L_{eq}(h)$, dBA	Activity Category (NAC)	Impact Type[1]	Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 feet			8 feet			10 feet			12 feet			14 feet			16 feet		
												$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
				Sycamore Drive																									
R30		Residential		260 William Reed Drive	61	62	62	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R31		Residential		256 William Reed Drive	59	61	61	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R32		Residential		Contra Loma Homeowners – 1203 Sycamore Drive	59	60	60	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R33		Undeveloped		2100 L Street	63	64	65	1	1	G	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R34		Residential		2101 L Street	59	60	60	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R35		Residential		2113 L Street	54	55	55	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R36		Residential		3 Brisdale Place	52	54	54	2	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R37		Residential		2209 L Street	62	63	63	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R38		Residential		2117 L Street	62	63	63	1	0	B (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R39		Commercial		1101 W 10th Street	63	64	65	1	1	E (72)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor I.D.	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA[2]	L Steet Path to Transit Phase 2 Project Build Alternative Future Worst Hour Noise Levels - $L_{eq}(h)$, dBA																							
						Design Year Noise Level without Project[2] $L_{eq}(h)$, dBA	Design Year Noise Level with Project [2] $L_{eq}(h)$, dBA	Design Year Noise Level without Project minus Existing Conditions $L_{eq}(h)$, dBA	Design Year Noise Level with Project Minus No Project Conditions $L_{eq}(h)$, dBA	Activity Category (NAC)	Impact Type[1]	Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
												6 feet			8 feet			10 feet			12 feet			14 feet			16 feet		
												$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR	$L_{eq}(h)$	I.L.	NBR
R40		Recreation Area		Antioch Flea Market – 1201 W 10th Street	61	61	63	0	2	C (67)	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[1] Impact Type: S = Substantial Increase (12 dBA or more), A/E = Approach or Exceed NAC, None = Increase is less than 12 decibels and noise levels do not approach or exceed the NAC.
[2] As stated in the TeNS, modeling results are rounded to the nearest decibel before comparisons are made.

[3]Minimum height needed to break the line of sight between 11.5 foot truck stack and first row receptors.
[4] This location is not representative of the area of frequent human use, and exterior noise levels are provided for TNM model validation only. An additional modeled receiver was placed in the area of frequent human use.

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Appendix C Noise Barrier Analysis

Noise impacts were not identified, and noise abatement was not analyzed.

Appendix D Calculated Interior Noise Levels

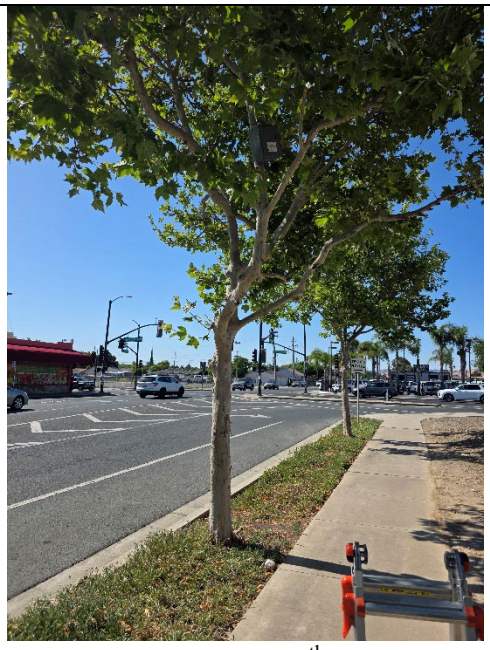
No Category D structures were identified within 500 feet of the Project alignment.

Appendix E Definition of Technical Terms

Definitions are from the Handbook of Acoustical Measurement and Noise Control.

Term	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro-Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz, and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m. to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence, and tonal or informational content, as well as the prevailing ambient noise level.

Appendix F Site Photographs



LT-1: 1024 W 10th Street



LT-2: 1201 W 10th Street



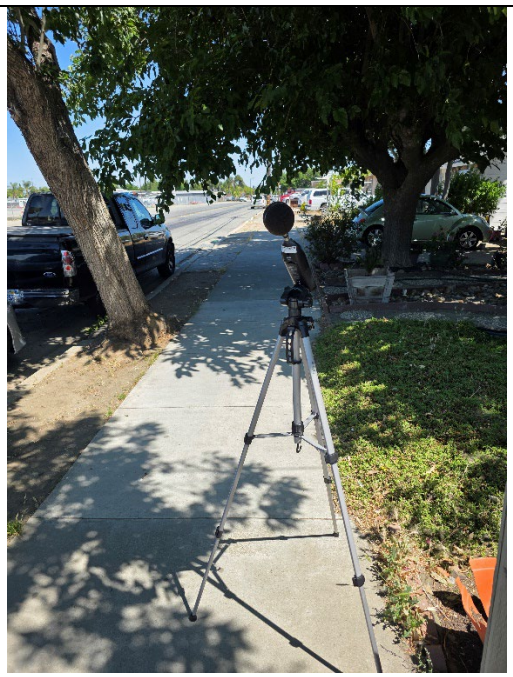
ST-1: 1104 8th Street



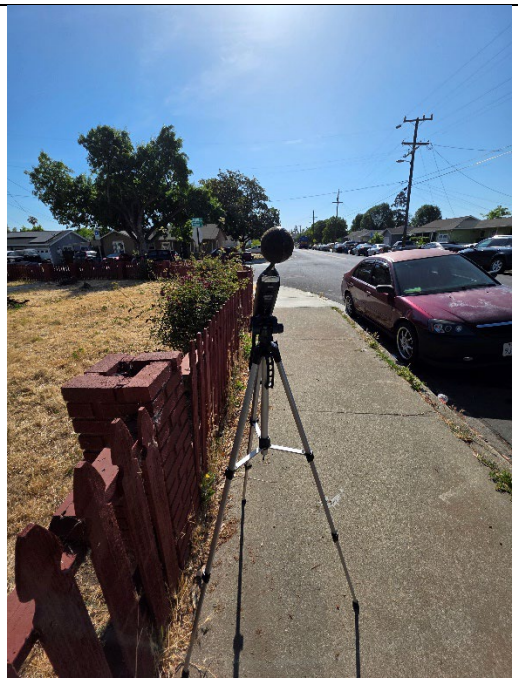
ST-2: 1105 9th Street



ST-3: 1045 L Street



ST-4: 1125 L Street



ST-5: 1142 Leggett Street



ST-6: 700 18th Street



ST-7: 262 William Reed Drive



ST-8: 2112 L Street

Appendix G Long-Term Noise Measurement Data

Figure G-1. Daily Noise Trends at LT-1, Wednesday, May 28, 2025

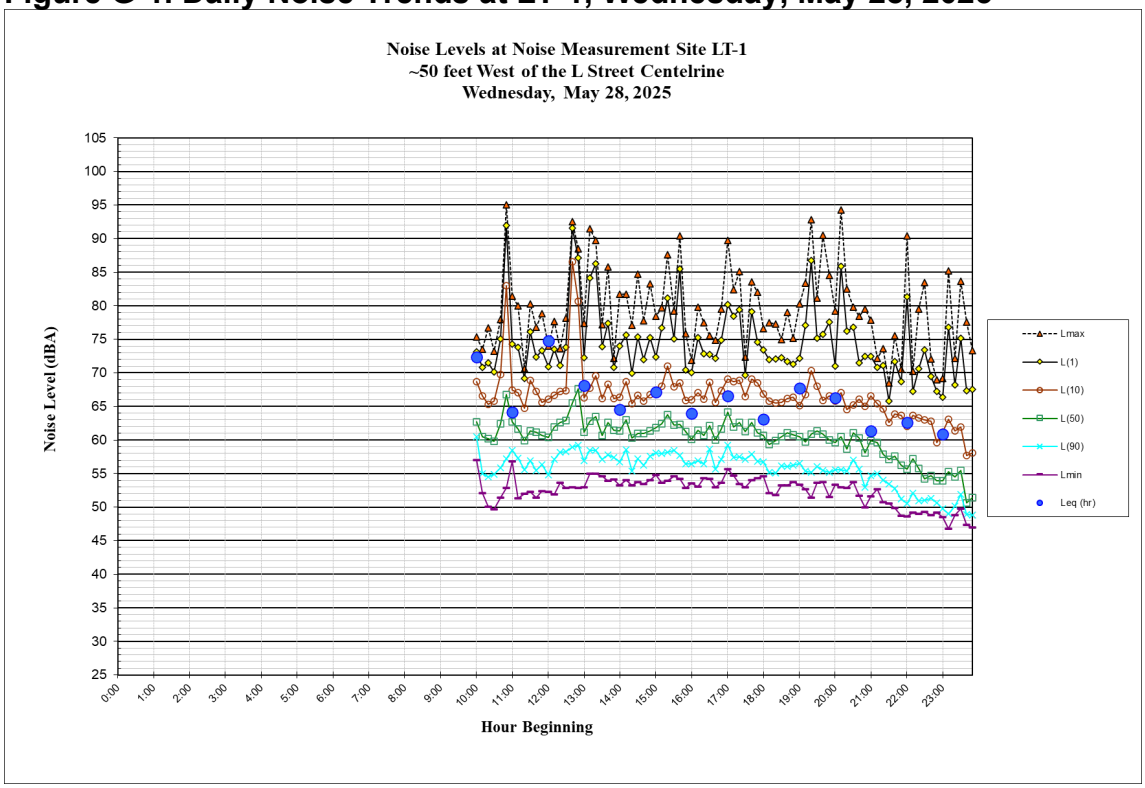


Figure G-2. Daily Noise Trends at LT-1,Thursday, May 29, 2025

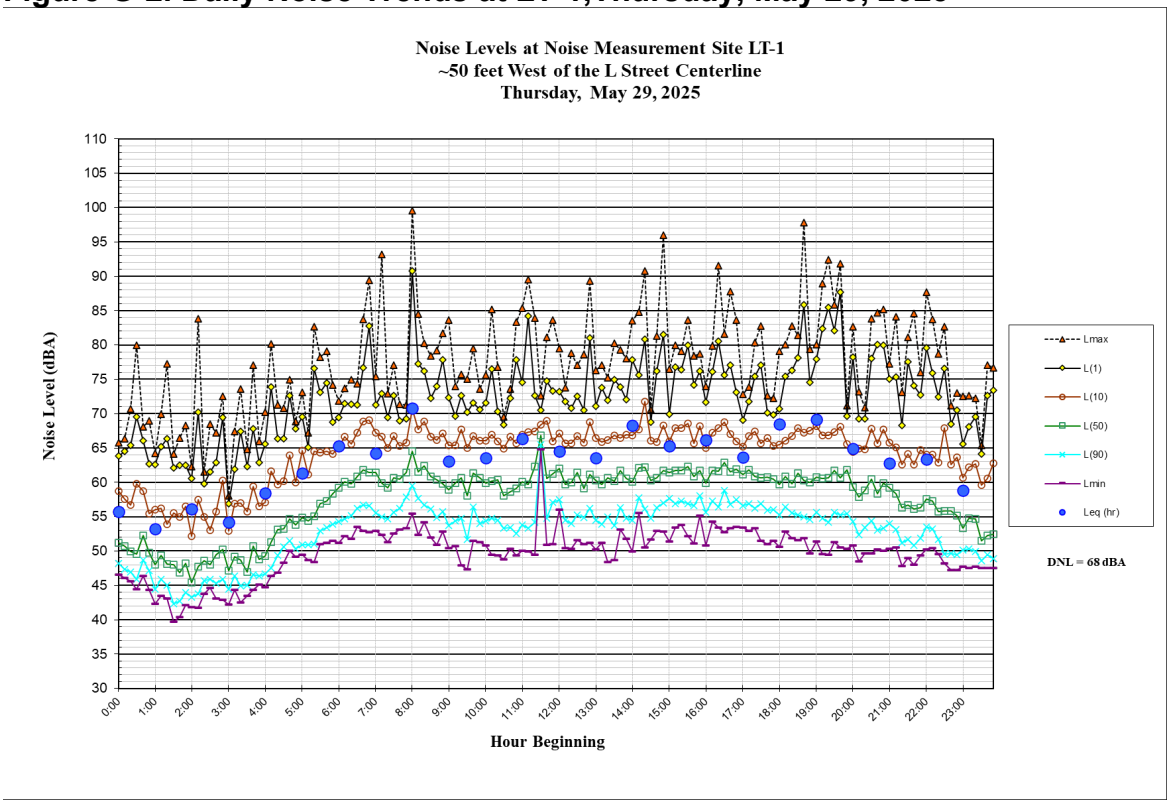


Figure G-3. Daily Noise Trends at LT-1,Friday, May 30, 2025

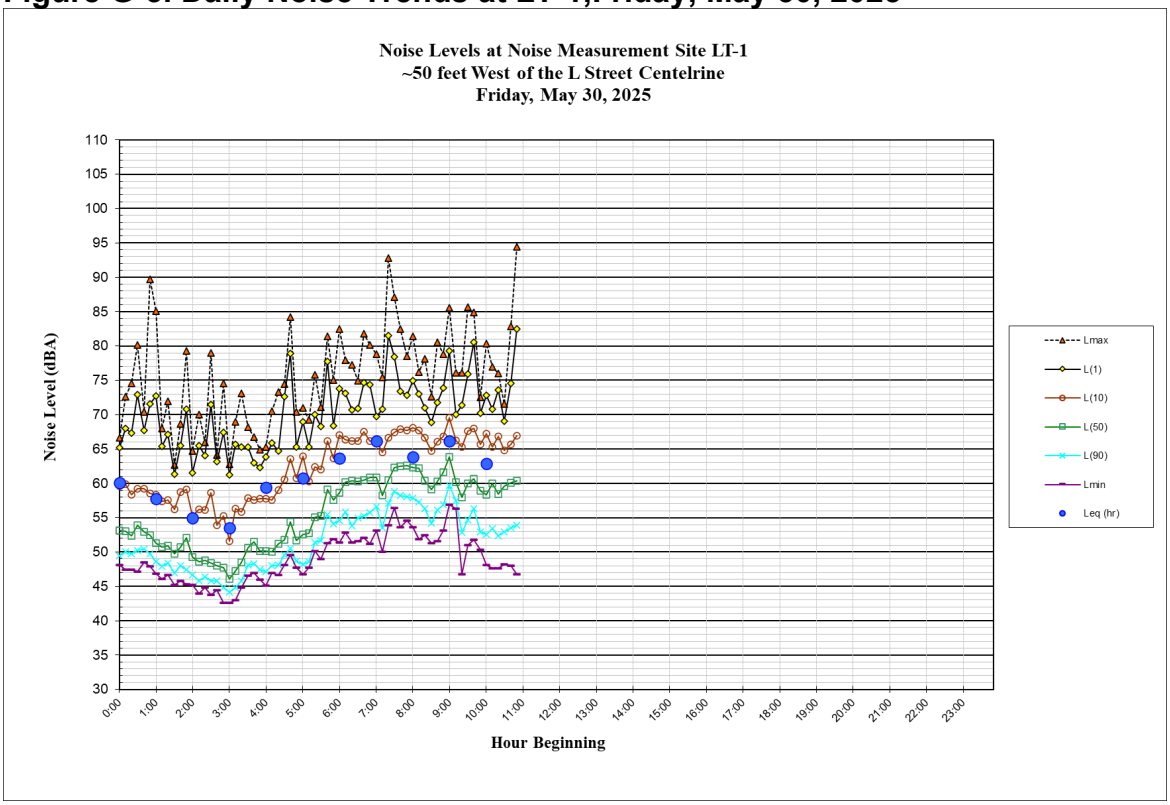


Figure G-4. Daily Noise Trends at LT-2, Wednesday, May 28, 2025

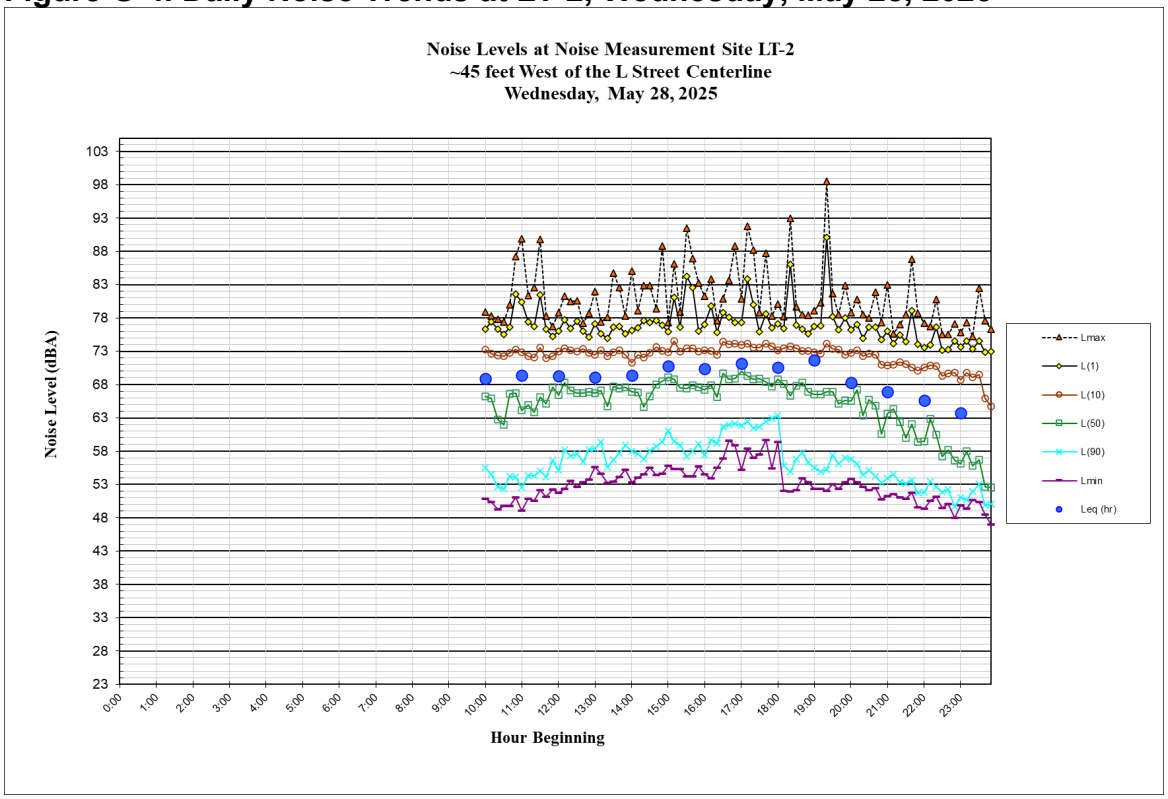


Figure G-5. Daily Noise Trends at LT-2, Thursday, May 29, 2025

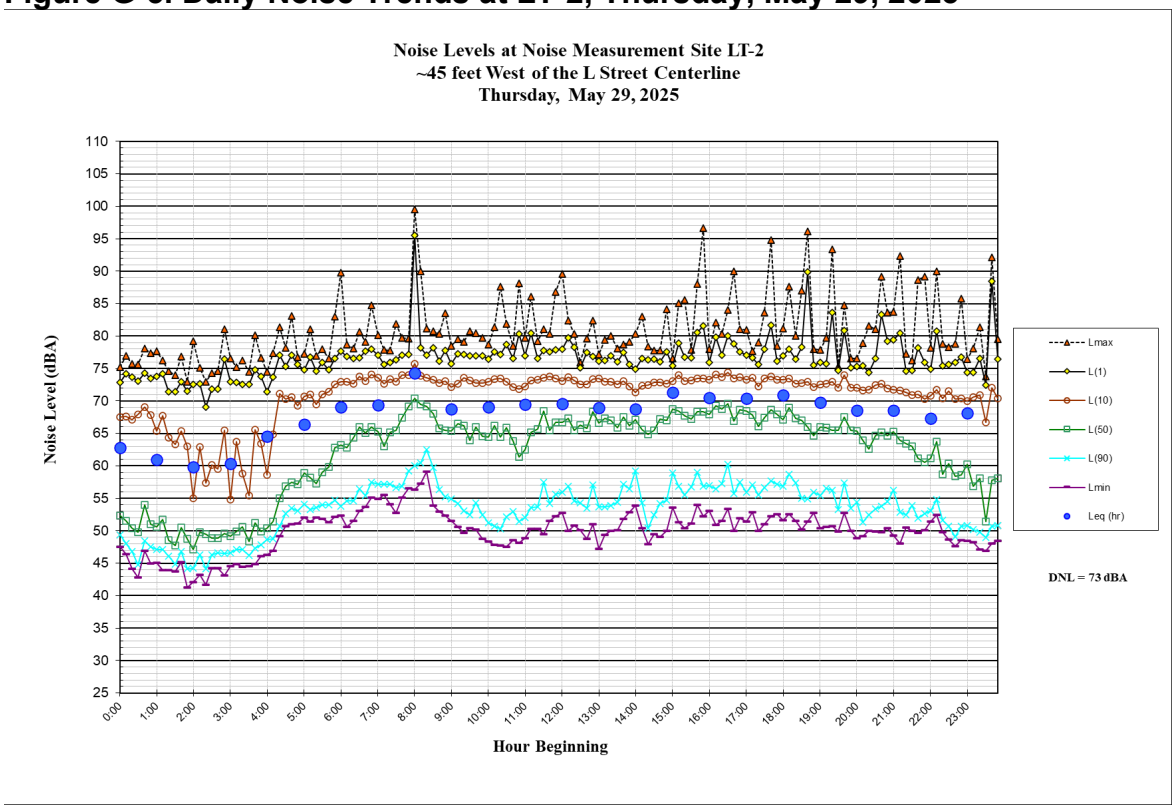
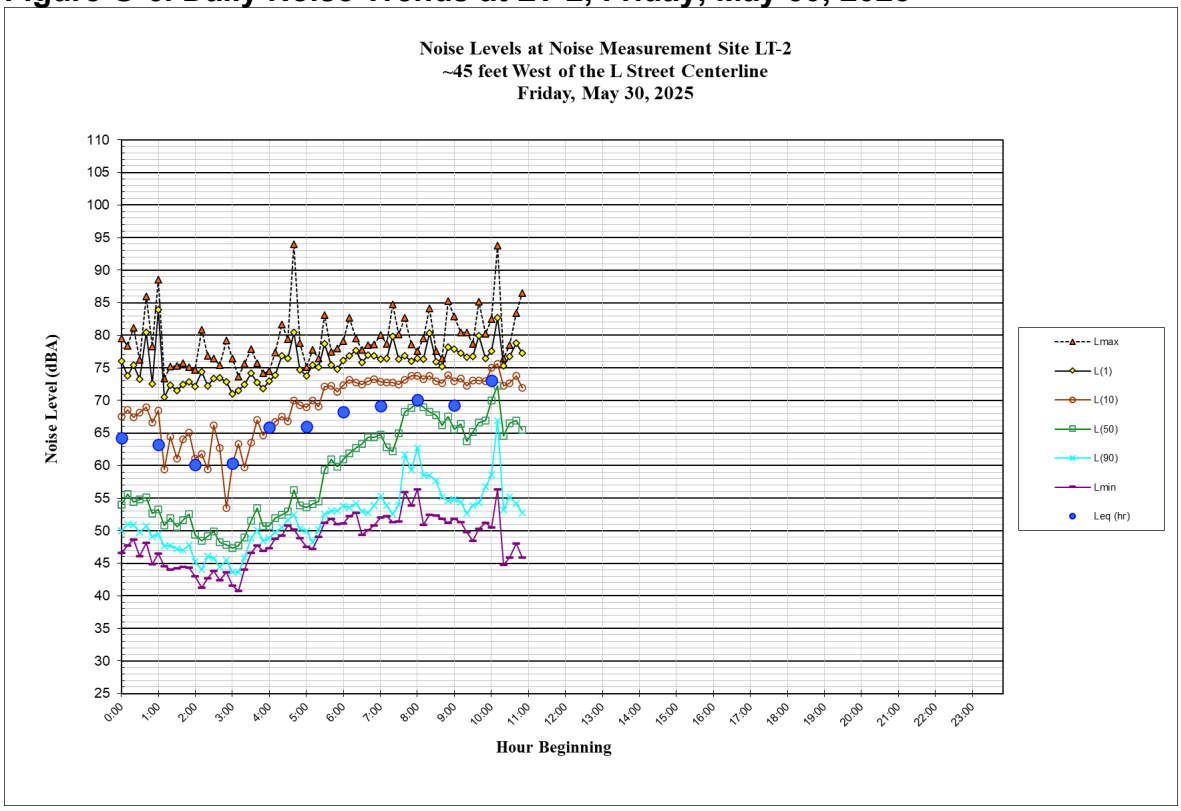


Figure G-6. Daily Noise Trends at LT-2, Friday, May 30, 2025



Appendix H Traffic Volumes Used for TNM Model Validation

Table H-1.L Street Traffic Volumes Used for TNM Model Validation

Date	Start Time	Northbound					Southbound				
		A	M	H	B	X	A	M	H	B	X
5/28/2025	10:00 a.m.	102	3	6	3	0	102	3	6	3	0
	10:10 a.m.	114	0	3	0	0	114	0	3	0	0
	10:30 a.m.	123	0	0	0	0	123	0	0	0	0
	10:50 a.m.	279	6	3	0	3	279	6	3	0	3
	11:00 a.m.	243	0	3	0	3	243	0	3	0	3
	11:20 a.m.	189	3	0	0	3	189	3	0	0	3
	11:30 a.m.	279	12	0	0	3	279	12	0	0	3
	11:50 a.m.	216	6	0	3	0	216	6	0	3	0
5/30/2025	9:10 a.m.	255	0	3	0	0	255	0	3	0	0
	9:20 a.m.	240	3	3	0	0	240	3	3	0	0
	9:40 a.m.	237	6	3	6	3	237	6	3	6	3
	9:50 a.m.	261	6	3	0	0	261	6	3	0	0
	10:10 a.m.	375	6	0	0	6	375	6	0	0	6
	10:20 a.m.	333	0	0	0	0	333	0	0	0	0
	10:40 a.m.	462	9	3	3	0	462	9	3	3	0
	10:50 a.m.	483	0	3	0	3	483	0	3	0	3

Table H-2. Local Roadway Traffic Volumes Used for TNM Model Validation

Date	Start Time	Roadway	A	M	H	B	X
5/28/2025	10:30 a.m.	10th Street	528	12	6	0	0
	11:50 a.m.	10th Street	570	24	0	6	0
5/30/3035	9:10 a.m.	14th Street	114	0	0	0	0
	9:20 a.m.	14th Street	54	0	0	0	0
	9:40 a.m.	18th Street	354	0	0	0	0
	9:50 a.m.	18th Street	390	0	0	0	0
	10:10 a.m.	William Reed Road	126	0	0	0	0
	10:20 a.m.	William Reed Road	114	0	0	0	0

Appendix I RCNM Output Files

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/16/2025
Case Description: Grubbing & Land Clearing

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
50 foot Receptor	Residential	65.0	55.0	55.0

Equipment

Impact Description	Usage Device	Spec Lmax (%)	Actual Lmax (dBA)	Receptor Distance (dBA)	Estimated (feet)	Shielding (dBA)
Tractor	No	40	84.0		50.0	0.0
Excavator	No	40		80.7	50.0	0.0
Excavator	No	40		80.7	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq
Tractor	84.0	80.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A				
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A				
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A				
Total	84.0	82.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
							N/A	N/A				

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/16/2025
Case Description: Grading & Excavation

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
50 foot Receptor	Residential	65.0	55.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Tractor	No	40	84.0		50.0	0.0
Excavator	No	40		80.7	50.0	0.0
Excavator	No	40		80.7	50.0	0.0
Excavator	No	40		80.7	50.0	0.0
Grader	No	40	85.0		50.0	0.0
Grader	No	40	85.0		50.0	0.0
Roller	No	20		80.0	50.0	0.0
Roller	No	20		80.0	50.0	0.0
Front End Loader	No	40		79.1	50.0	0.0
Scraper	No	40		83.6	50.0	0.0
Scraper	No	40		83.6	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0

Results

Equipment	Calculated (dBA) Lmax	Leq	Noise Limits (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq	Noise Limit Exceedance (dBA) Day Lmax	Leq	Evening Lmax	Leq	Night Lmax	Leq
Tractor	84.0	80.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Excavator		80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Excavator		80.7	76.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Grader		85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Grader		85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Roller	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
							N/A	N/A	N/A	N/A
Roller	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
							N/A	N/A	N/A	N/A
Front End Loader		79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Scraper		83.6	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Scraper		83.6	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
						N/A	N/A	N/A	N/A	N/A
Total	85.0	89.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
							N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/16/2025
Case Description: Grading & Excavation

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
50 foot Receptor	Residential	65.0	55.0	55.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compressor (air)	No	40		77.7	50.0	0.0
Grader	No	40	85.0		50.0	0.0
Compactor (ground)	No	20		83.2	50.0	0.0
Pumps	No	50		80.9	50.0	0.0

Front End Loader	No	40	79.1	50.0	0.0
Scraper	No	40	83.6	50.0	0.0
Backhoe	No	40	77.6	50.0	0.0
Backhoe	No	40	77.6	50.0	0.0
Backhoe	No	40	77.6	50.0	0.0

Results

Noise Limits (dBA) | Noise Limit Exceedance (dBA)

Equipment	Calculated (dBA) Lmax	Calculated (dBA) Leq	Day Lmax	Day Leq	Evening Lmax	Evening Leq	Night Lmax	Night Leq	Day/Evening Lmax	Day/Evening Leq	Night Lmax	Night Leq
Compressor (air)	77.7	73.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Compactor (ground)	83.2	76.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pumps	80.9	77.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	79.1	75.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Scraper	83.6	79.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	86.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/16/2025
Case Description: Drainage, Utilities, & Sub-Grade

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night

50 foot Receptor	Residential	65.0	55.0	55.0

Equipment

Impact Description	Usage (%)	Device	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Paver	No	50		77.2	50.0	0.0
Roller	No	20		80.0	50.0	0.0
Roller	No	20		80.0	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0
Backhoe	No	40		77.6	50.0	0.0

Results

			Noise Limits (dBA)						Noise Limit Exceedance (dBA)			
		Calculated (dBA)		Day		Evening		Night		Day		Night	
Equipment		Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Paver		77.2	74.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roller	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roller	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe		77.6	73.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	80.0	81.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

SS4AL-6072 Antioch L Street Pathways to Transit NSR_12-10-2025

Final Audit Report 2026-03-17

Created:	2026-03-17
By:	Thomas Premo (s152613@dot.ca.gov)
Status:	Signed
Transaction ID:	CBJCHBCAABAABDdxNaoW7Ncha1T4H9dGAU0_qPKz-Gvo

"SS4AL-6072 Antioch L Street Pathways to Transit NSR_12-10-2025" History

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