Dublin Boulevard-North Canyons Parkway Extension

Noise Study Report (NSR)

Dublin Boulevard-North Canyons Parkway Extension Project

East of Dublin Boulevard/Fallon Road Intersection to North Canyons Parkway/Doolan Road

District 4-ALA-RTPL-5432 (019)

Project ID 21473/ALA150003

August 2018

Caltrans

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Noise Study Report

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North of Interstate 580 (I-580) from east of the Dublin Boulevard/Fallon Road intersection to the North Canyons Parkway/Doolan Road intersection
District 4-ALA-RTPL-5432 (019)

Project ID 21473/ALA150003

August 2018

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Summary

The City of Dublin (Dublin), in cooperation with the California Department of Transportation (Caltrans), City of Livermore (Livermore), Alameda County (County), and Federal Highway Administration (FHWA), proposes to extend Dublin Boulevard 1.5 miles eastward through eastern Dublin and an unincorporated portion of the County, terminating at the boundary between the County and Livermore city limits (project).

Dublin is the lead agency under the California Environmental Quality Act (CEQA). Caltrans, as assigned by the FHWA, is the lead agency under the National Environmental Policy Act (NEPA).

The purpose of this Noise Study Report (NSR) is to evaluate 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 FHWA noise standards.

This project is a Type I Project because it will involve the construction of a new roadway in an undeveloped area and therefore requires noise abatement to be considered for impacted receptors. Compliance with 23 CFR 772 provides compliance with the noise impact assessment requirements of the NEPA. Noise impacts associated with this project under CEQA are evaluated in Appendix D of this report.

Activity Category B (residential), Category E (hotels and restaurants), and Category F (agriculture) land uses were identified in the vicinity of the project. The study included noise measurements and calculations of future noise levels with the construction and operation of the project. The FHWA Traffic Noise Model, TNM 2.5, was used to calculate existing and future traffic noise levels and analyze traffic noise impacts. The primary existing noise source at existing receptors located along the project alignment is vehicles traveling along Interstate 580 (I-580), which is located 500 feet to 2,500 feet from these receptors, and local non-traffic related noise sources including general aviation aircraft, sounds of nature, and agricultural operations. TNM has been validated for distances within 500 feet of a roadway. Since all receptors are located 500 feet or greater from the primary noise source in the area, existing noise levels were established based on the results of noise modeling and noise monitoring results. Future noise levels

from project implementation were assessed in TNM based on future traffic conditions provided by *Kittelson & Associates, Inc*.

Loudest-hour noise levels resulting from 2040 Build conditions would range from 48 to 64 dBA $L_{eq(h)}$ at existing and proposed Category B land uses along the project alignment and from 65 to 69 dBA $L_{eq(h)}$ at existing and proposed Category E land uses along the project alignment. 2040 Build traffic noise levels are not predicted to approach or exceed the Noise Abatement Criteria (NAC) at any noise sensitive areas of frequent human use in the project vicinity. At existing land uses, noise levels are calculated to increase by up to 1 dBA over Existing conditions under 2040 No Build conditions and by up to 2 dBA over Existing and over 2040 No Build conditions under 2040 Build conditions. These noise level increases are not considered substantial. Noise increase thresholds would not apply to future receptors.

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. No traffic noise impacts are anticipated with development of the project; therefore, no noise abatement measures are required.

Construction activities would result in temporary increases to noise levels at noise-sensitive receptors within 500 feet of construction. Construction activities would be conducted in compliance with applicable regulations and would be short-term and intermittent. Measures to reduce construction noise are included in this report.

The State’s CEQA guidelines, Appendix G, are used to assess the potential significance of environmental noise impacts pursuant to local policies. The significance of noise impacts under CEQA are addressed in Appendix D of this report to be used in the environmental document.

In addition to the impacts analyzed under 23 CFR 772, CEQA assesses the impacts attributable to project construction generated groundborne vibration and traffic noise increases on the roadway network outside of the project area. 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.

Table of Contents

List of Figures

List of Tables

Page

List of Abbreviated Terms

23CFR772	Title 23, Part 772 of the Code of Federal Regulations
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
dB	Decibel
dBA	A-Weighted Decibel
FHWA	Federal Highway Administration
Hz	Hertz
I-580	Interstate 580
kHz	Kilohertz
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
$L_{eq[h]}$	Equivalent Sound Level over one hour
L_{xx}	Percentile-Exceeded Sound Level
LT	Long-Term Reference Noise Measurement
L_{max}	Maximum Instantaneous Sound Level
mPa	micro-Pascals
mph	miles per hour
NAC	Noise Abatement Criteria
NADR	Nosie Abatement Decision Report
NEPA	National Environmental Policy Act
NSR	Noise Study Report
Protocol	Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
RCNM	FHWA Roadway Construction Noise Model v.1.0
ROW	Right of Way
SLM	Sound Level Meter
SPL	Sound Pressure Level
ST	Short-Term Noise Measurement
TeNS	Caltrans' Technical Noise Supplement
TOAR	Traffic Operations Analysis Report
TNAP	Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
TNM	FHWA Traffic Noise Model Version 2.5

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 Title 23, Part 772 of the Code of Federal Regulations (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 Federal Highway Administration (FHWA) noise standards. Compliance with 23 CFR 772 provides compliance with the noise impact assessment requirements of the National Environmental Policy Act (NEPA).

The Caltrans Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) (Caltrans 2011) provides Caltrans policy for implementing 23 CFR 772 in California. The Protocol outlines the requirements for preparing noise study reports. 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 this project under the California Environmental Quality Act (CEQA) are evaluated in Appendix D.

1.2. Project Purpose and Need

The purpose of the Dublin Boulevard – North Canyons Parkway Extension project is to improve east-west local roadway connectivity between the City of Dublin and the City of Livermore; improve mobility, multimodal access, efficiency for all roadway users; and remove existing gaps in multimodal access. The purpose is also to indirectly relieve vehicular congestion in the region by providing a completed freeway reliever route along the north side of I-580 between I-680 and Route 84 (Isabel Avenue).

The need for the project is to:

- Eliminate a gap in local roadway network connectivity between the cities of Dublin and Livermore, including the five designated Planned Development Areas within these jurisdictions.

- Facilitate the buildout of eastern Dublin, as planned for in the General Plan, EDSP, and Plan Bay Area, by establishing the needed transportation facilities and other public infrastructure to serve planned development.

- Reduce vehicle miles traveled (VMT) on the regional highway system by providing local access to existing and planned land uses, including residential, commercial, industrial, and business uses, and local destinations on an alternate local route that is convenient to I-580.

- Reduce local trip lengths in Dublin and between Dublin and Livermore by diverting localized inter-city trips from I-580.

- Provide complete streets and mutimodal access between Dublin and Livermore, particularly for key public facilities such as Las Positas College, consistent with the requirements of Senate Bill (SB) 375 and regional complete streets policies on multimodal roadways and sustainable transportation.

- Meet or exceed the policies and projects contained in regional documents including the Countywide Multimodal Arterial Plan, Countywide Transit Plan and Countywide Bike and Pedestrian Master Plan.

- Indirectly relieves congestion on I-580 by providing a completed local route on the north side of I-580 between west of I-680 in Dublin to SR-84 in Livermore, an integrated corridor management strategy.

Chapter 2. Project Description

The project site is within Dublin, the County, and Livermore, north of I-580 between the existing terminus of Dublin Boulevard to the west and terminus of North Canyons Parkway to the east. The project area land use designations include residential, industrial, open space, and commercial uses in Dublin; resource management and large parcel agricultural uses in the County; and business and commercial uses in Livermore. The project area consists of primarily undeveloped ranchland and open space, with rural residences and outbuildings. Improvements to the agricultural lands generally consist of private paved and unpaved roads used to access private property, fences, barns, corrals, wells, water tanks, single-family homes, and various outbuildings. Developed residential areas are located within Dublin, and there is one commercial property, a landscaping business, in the County. The topography of the project area ranges from relatively flat at the southern portion near I-580, to gently rolling hills to the north. The topography slopes slightly northward, and Cottonwood Creek drains from north to west across part of the project area.

Project alternatives would include No Build and Build Alternative, as discussed below:

2.1. No Build

Under the No Build Alternative, none of the project features described under the project would be constructed. Dublin Boulevard and North Canyons Parkway would continue to operate unconnected in their current configurations.

2.2. Build Alternative

The Build Alternative would include the extension of Dublin Boulevard 1.5 miles eastward through eastern Dublin and an unincorporated portion of the County. The roadway extension would start from the current terminus of Dublin Boulevard at the Dublin Boulevard/Fallon Road intersection in Dublin and would end at the Doolan Road/North Canyons Parkway intersection along the boundary of the County and Livermore. This roadway extension would provide four to six travel lanes and bicycle and pedestrian facilities (i.e., sidewalks and bike lanes). Beginning at Fallon Road, the roadway extension would have six travel lanes (three in each direction). Continuing eastward, the roadway extension would transition to four travel lanes (two in each direction) before or at the intersection with Croak Road. From Croak Road to Doolan Road, the roadway extension would remain in the four lane configuration. The permanent area needed for the project, including the roadway, sidewalks, intersections, and land acquired for right-of-way is estimated at 29 acres.

Project design features and components include (from west to east):

- Intersection improvements at Fallon Road and the elimination of the existing intersection of Croak Road and Fallon Road
- Grading and earthwork northeast of the Dublin Boulevard/Fallon Road intersection, including grading at the foot of the Livermore Hills, to allow for the roadway extension, and more minor grading throughout the road alignment to meet engineering and safety requirements
- Abandonment of a north-south portion of Croak Road parallel to Fallon Road
- The addition of a "T" shaped hammerhead turnaround at the new terminus of Croak Road adjacent to Fallon Road
- Removal of overhead utility lines between Fallon Road and Croak Road
- Creation of a new intersection between the Dublin Boulevard extension and Croak Road
- Construction of a new bridge over Cottonwood Creek
- Construction staging and laydown between the extension and Collier Canyon Road, along Doolan Road
- Intersection improvements at Doolan Road
- The extension of underground utility lines into the project site, within the paved areas of the proposed roadway extension
- Construction of the new roadway, which would include a median, inside shoulder, vehicle travel lanes, street bicycle facilities, a parkway strip and separated sidewalk or a separated Class I bike path/MUP, lighting, and cut/fill embankments
- Retaining walls may be use in addition to, or as an alternative to, cut/fill embankments associated with roadway and hillside grading. If used, retaining walls would be placed outside of the sidewalk and path areas on either side of the roadway cross section, within the construction footprint and within the permanent right-of-way. Retaining walls would measure 3 feet to 10 feet in height and would

generally require a smaller area of grading or ground disturbance in comparison to cut/fill slopes.

Right-of-way acquisitions would be needed from multiple private property owners. No displacement of any residences or businesses would be required. Ancillary facilities associated with the project include traffic signals, lighting, landscaping, irrigation, drainage, and storm water treatment facilities.

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' Web site (http://www.dot.ca.gov/hq/env/noise/pub/TeNS_Sept_2013B.pdf). Technical terms are defined in Appendix A.

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 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 determines sound level and characteristics of the noise perceived by the receptor. The field of acoustics deals primarily with the propagation and control of sound.

3.1. 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 Hz and 20,000 Hz.

3.2. 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.

3.3. 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.

3.4. 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 fly-over at 1000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 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.

3.5. 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.

3.6. 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 noise abatement criteria (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.

3.7. 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.

3.7.1. 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.

3.7.2. 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.

3.7.3. 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.

3.7.4. 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 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 high-occupancy vehicle (HOV) lane, high-occupancy toll (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.

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 an 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 (CEQA)

Noise analysis under the California Environmental Quality Act (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 Appendix D to be used in the environmental document. 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-Leq(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-Leq(h). If the noise levels generated from freeway and roadway sources exceed 52 dBA-Leq(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

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

A field investigation was conducted from December 12th to 14th, 2017, 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. Noise receptor locations exposed to potential traffic noise impacts, including construction noise impacts, were identified along the project corridor through a review of project mapping, aerial photos, and field reconnaissance. The nearest Activity Category B residential land uses are to the north of the project alignment approximately 700 to 1,300 feet from the proposed right of way. The remainder of permitted land uses along the project alignment are either Activity Category E, F, or G land uses.

As stated in the Protocol, noise abatement is only considered where frequent human use occurs and where a lowered noise level would be of benefit. Although all land uses are evaluated in this analysis, the focus is on locations 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 and common use areas at multi-family residences.

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 represent each major developed and potential development area within the project area. Short-term measurement locations were selected to serve as representative modeling locations.

Photographs of the measurement sites are provided in Appendix B. Receptor locations selected for the project area are illustrated in Figure 5-1.

5.2. Field Measurement Procedures

A field noise study was conducted in accordance with recommended procedures in the Technical Noise Supplement (TeNS) to the Traffic Noise Analysis Protocol. Noise measurements were made with Larson Davis Model 820 and 831 Integrating Sound Level Meters (SLMs) set at “slow” response. The sound level meters were equipped with G.R.A.S. Type 40AQ ½-inch random incidence microphones fitted with windscreens. The sound level meters 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 each monitoring event, the measured interval noise level data were obtained from the SLM using the Larson Davis SLM utility software program.

5.2.1. Long-Term Measurements

Long-term (LT) reference noise measurements were made at two (2) locations in the project area and vicinity to quantify the diurnal trend in noise levels and to establish the peak traffic noise hour. These reference noise measurements included one located along the existing portion of Dublin Road to the west of the project (L1) and one along the existing portion of North Canyons Parkway to the east of the project (L2). L1 and L2 were selected to be representative of traffic noise levels occurring along existing continuous portions of the roadway. The noise measurements were made over an approximate 48-hour period, from midday on Tuesday, December 12th, 2017 to midday on Thursday, December 14th, 2017. Measurements were taken at heights of about 12 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 was downloaded from the sound level meter, the data was reviewed to identify any time periods possibly 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 C.

5.2.2. Short-Term Measurements

Six (6) short-term noise measurements (S1-S6) were made in the project vicinity 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. Two or more consecutive 10-minute measurements were made at each noise measurement site. At all locations, noise levels were measured five feet above the ground surface and at least 10 feet from structures or barriers. Noise measurement locations were used as noise modeling receptors for the prediction of existing and future loudest-hour traffic noise levels.

Traffic counts and speed observations were made along I-580 and local roads 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 (typically trucks with two axles and more than four wheels), (3) heavy-duty trucks (typically trucks with more than two axles), (4) buses, and (5) motorcycles.

5.2.3. Meterology

Meteorological conditions were observed during the long-term and short-term noise measurements and generally consisted of clear skies, calm to moderate winds (1 to 5 mph), and seasonable temperatures (62 to 70°F during midday). Noise monitoring did not occur if weather conditions consisted of rain or high winds (i.e., greater than 11 mph).

5.3. Traffic Noise Levels Prediction Methods

Future traffic noise levels were predicted using the FHWA Traffic Noise Model Version 2.5 (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).

TNM has been validated by FHWA within 500 feet of a highway or roadway noise source. Due to the reliability constraints of TNM to accurately calculate noise levels at greater distances, the TeNS indicates that receptors located beyond 500 feet do not need to be considered for analysis unless there is a reasonable expectation that noise impacts would extend beyond that boundary.

TNM 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 Future Build (2040) peak hour traffic volume data and speed estimates provided by *Kittelson & Associates, Inc.* were used as model inputs for local roads. Traffic volumes for I-580 were based on traffic counts available from Caltrans. *BKF Engineers* 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

The primary existing noise source at receptors located along the proposed alignment of the Dublin Boulevard – North Canyons Parkway Extension is vehicles traveling on I-580, which is located 500 feet to 2,500 feet from these receptors. Local non-traffic related noise sources include aircraft, sounds of nature, and agricultural operations. As described above, the TNM model has only been validated at distances within 500 feet from a roadway. Therefore, validation of the project specific noise model to existing conditions, in which the existing traffic noise sources are 500 feet or further from receptors, was not possible. Existing noise levels were established based on the results of noise monitoring results.

5.3.2. Traffic Inputs used for Noise Modeling

Existing and No-Build (2040) noise levels were established based on noise modeling and monitoring results. Future Build (2040) loudest hour traffic noise levels were calculated based on noise modeling results. The loudest hour is generally characterized by free-flowing traffic at the roadway design speed (i.e., Level of Service [LOS] C or better).

Traffic volume inputs for the traffic noise model were taken from the traffic projections provided by *Kittelson & Associates, Inc*. Dublin Boulevard is forecast to be at LOS C or better during peak hours under design year conditions. Therefore, provided traffic volumes are anticipated to result in free-flowing traffic conditions and were used for the traffic noise modeling of Future Build conditions. For this analysis, it is assumed the design speed of each roadway lane has a maximum capacity of 1,000 vehicles per hour. Table 5-1 shows the traffic volumes used in the TNM model.

Table 5-1. Traffic Volumes

Roadway	Travel Lanes	Peak Vehicles Per Hour		
		Existing	Future No Build	Future Build
Dublin Boulevard, West of Fallon Road	4	817	1208	2093
Dublin Blvd, Fallon Road to Croak Road	6	[a]	[a]	2694
Dublin Blvd, Croak Rd to Doolan Road	4	[a]	[a]	1709
Dublin Boulevard, East of Doolan Road	4	109	109	1758
Fallon Road, North of Dublin Boulevard	4	1751	2076	2158
Fallon Road, South of Dublin Boulevard	4	1955	3569	3377
Croak Road, North of Dublin Boulevard	2	24[b]	24[b]	491
Croak Road, South of Dublin Boulevard	2	24[b]	24[b]	433

Roadway	Travel Lanes	Peak Vehicles Per Hour		
		Existing	Future No Build	Future Build
Doolan Road, North of Dublin Boulevard	2	39	39	39
Doolan Road, South of Dublin Boulevard	2	76	76	76

[a] Roadway segment does not exist under Existing and Future No Build scenarios.
[b] Traffic volumes not provided for these roadway segments. TNM traffic inputs based on traffic counts made during noise monitoring survey.

Traffic mix information for the Future Build scenario was based on the average traffic mix data developed during the noise monitoring survey for Dublin Road to the west of the project alignment and North Canyons Parkway to the east. All roadway traffic was modeled at the posted speed limits. The proposed Dublin Boulevard extension is anticipated to have a posted speed limit of 40 mph. Table 5-2 specifies the traffic mix information used in the traffic noise modeling, based on traffic volumes measured during the noise monitoring survey.

Table 5-2. Traffic Mix Information

Roadway	Traffic Percentages		
	Autos/Light Duty Vehicles	Medium Duty Trucks	Heavy Duty Trucks
Dublin Boulevard	89%	1%	10%

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 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 period of time 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 noise abatement. The determination of the reasonableness of noise abatement is more subjective than the determination of its feasibility. As defined in Section 772.5 of the regulation, 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 based on cost.

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

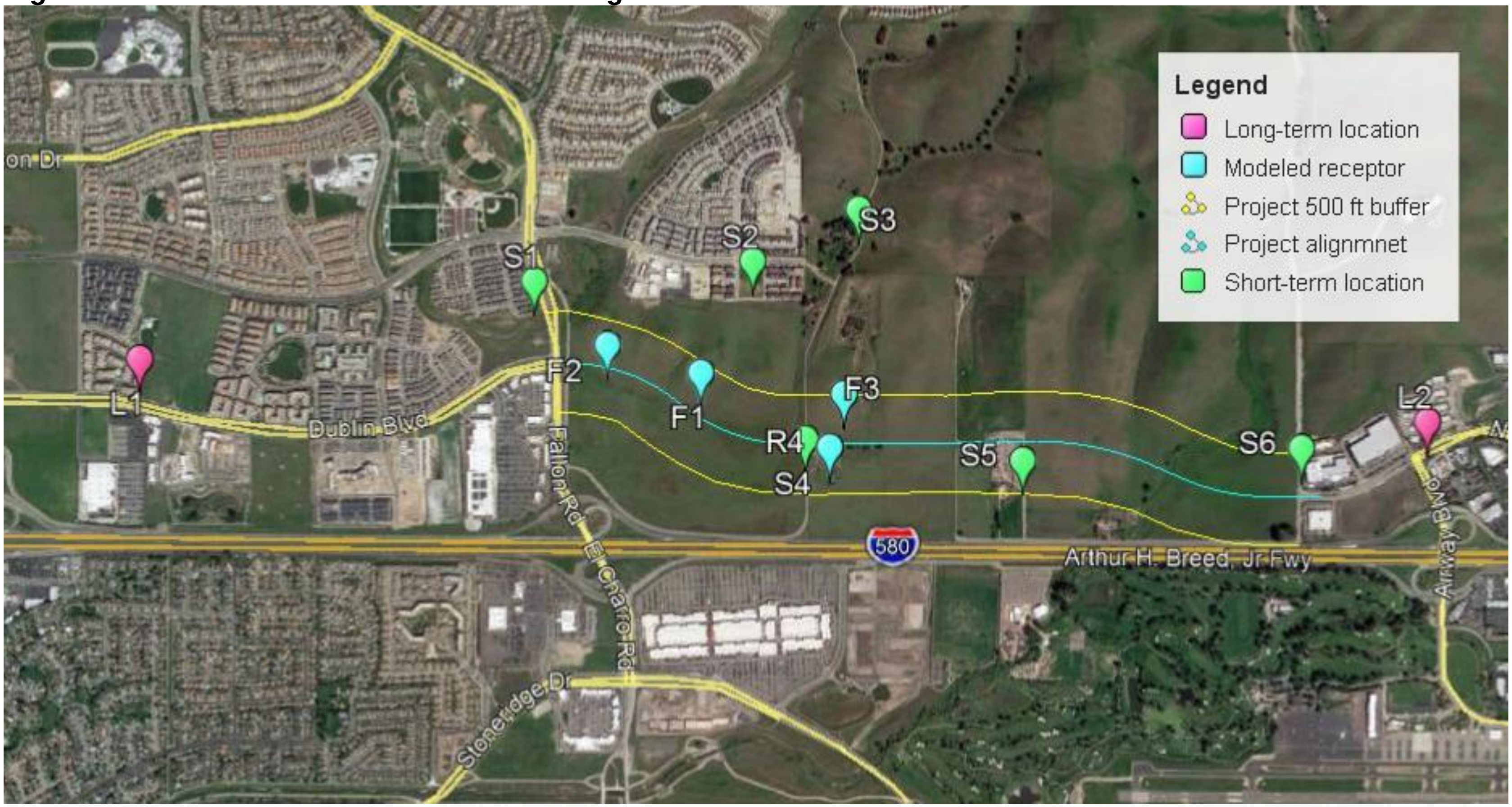
- The noise reduction design goal (a barrier must be predicted to provide at least 7 dB of noise reduction at one or more benefited receptors).
- The cost of noise abatement (2018 allowance of $95,000 per benefited receptor).
- The viewpoints of benefited receptors (including property owners and residents 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. This design goal applies to any receptor and is not limited to impacted receptors.

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 maybe 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 2018 reasonable/feasible analysis is $95,000 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 $95,000.

The noise study report 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 noise study report does not make any conclusions regarding reasonableness. The feasibility and reasonableness of noise abatement is reported in the Noise Abatement Decision Report (NADR).

Figure 5-1. Noise Measurement and Modeling Positions



Chapter 6. Existing Noise Environment

6.1. Existing Land Uses

A field investigation was conducted to identify land uses that could be subject to traffic and construction noise impacts from the proposed project. No 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 identified along the project corridor. The following noise-sensitive land uses were identified during the noise survey made along the project corridor:

- Activity Category B - Residential;
- Activity Category E – Hotels, Restaurants;

Land uses along the project corridor that are not noise-sensitive include Activity Category F and Activity Category G (see Table 4-1 for land use descriptions). 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.

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 corridor varies by location, depending on site characteristics such as proximity of receptors to I-580, local roadways, or other significant sources of noise in the area, the relative base elevations of roadways and receptors, and the presence of any intervening structures or barriers.

Two long-term noise measurements were made to quantify the diurnal trend in noise levels and establish the peak traffic noise hour along existing portions of Dublin Boulevard and North Canyons Parkway (L1 and L2). These locations are outside of the project limits and noise levels measured at these positions were used as a reference only.

Six (6) short-term noise measurements (S1-S6) were made at land uses in the vicinity of the project area. All short-term noise measurements were made at heights of 5 feet above ground level. As described previously, receptors located beyond 500 feet from a roadway or highway do not need to be considered for analysis unless there is a reasonable explanation that noise impacts would extend beyond that boundary. Due to the construction of an entirely new section of roadway in an area with limited shielding provided between distant receptors and the proposed roadway and, in some cases, very low existing ambient noise levels, Category B receptors located 700 to 1,300 feet to the north of the proposed alignment were considered for analysis. The purpose of the analysis of these receptors is to ensure that substantial noise increases do not occur at these locations. Locations located more than 500 feet from the roadway in the project limits are identified in the tables.

The results of the long- and short-term field measurements are summarized in Table 6-1 and Table 6-2. The calculated existing loudest-hour noise levels at short-term noise measurement locations are based on long-term noise measurement results.

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

Receptor ID	Location (See Appendix B for Photos)	Date	Loudest Hour(s)	Loudest Hour $L_{eq[h]}$, dBA
L1[1]	3637 Dublin Boulevard, 75 feet north of the center of Dublin Boulevard	12/13/2017	8:00 a.m.	70
L2[1]	1051 Airway Boulevard, 60 feet south of the center of North Canyons Parkway	12/13/2017	7:00 a.m.	70

[1] Location is more than 500 feet from the roadway in the project limits.

Table 6-2. Summary of Short-Term Noise Measurements

Receptor ID	Location (See Appendix B)	Date	Start Time	10- minute L_{eq}, dBA	Calculated Loudest-Hour $L_{eq[h]}$, dBA
S1	2601 Alliston Loop, Dublin	12/13/2017	11:30 a.m.	60	64
			11:40 a.m.	60	
S2	3899 Camino Loop, Dublin	12/14/2017	11:20 a.m.	52	50[1]
			11:30 a.m.	46	
S3	Croak Road, north of Central Parkway, Dublin	12/14/2017	10:50 a.m.	45	48[1]
			11:00 a.m.	45	
S4[2]	Croak Road, 730 feet north of I-580, Dublin	12/14/2017	10:10 a.m.	58	62
			10:20 a.m.	57	

Receptor ID	Location (See Appendix B)	Date	Start Time	10- minute L_{eq}, dBA	Calculated Loudest-Hour $L_{eq[h]}$, dBA
S5	500 feet north of I-580, Dublin	12/14/2017	10:00 a.m.	59	65
			10:10 a.m.	61	
S6	901 Doolan Road, Livermore	12/14/2017	10:30 a.m.	59	64
			10:40 a.m.	60	

[1]Roadway traffic is not the primary existing noise source at this location. Existing loudest hour calculated based on comparison between short-term and long-term results, as appropriate.
[2] Measurement location S4 was not located at a noise sensitive land use and was not used as a modeling receptor for the purposes of the noise analysis as described in Chapter 7. Measurement results were used to determine the Existing loudest hour at the adjacent sensitive land use represented by R4.

6.3. Future Undeveloped Land Uses

The Protocol requires that the NSR discuss the development of future land uses in the vicinity of the project. Much of the land in the project area and vicinity is undeveloped. Lists of planned and approved projects in the Cities of Dublin and Livermore and Alameda County were reviewed to identify undeveloped 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 has received final development approval. The review focused on projects within approximately 500 feet of the Dublin Boulevard-North Canyons Parkway Extension within the project limits, where traffic noise levels from the highway or other improved project roadways could dominate the noise environment. Projects located beyond this distance were excluded from further analysis.

6.3.1. Dublin

The City of Dublin currently has one project ‘under review’ in the project area. The Grand View Project is proposed primarily south of the Dublin Boulevard-North Canyons Parkway Extension in the City of Dublin. The conceptual proposal is for a mixed use project comprised of up to 2,391,668 square feet of retail/commercial and office uses and up to 338 housing units. Preliminary concepts for the project include a pedestrian oriented “main street” that would be supported by retail, office, hotels and recreational uses. The proposed project would include the extension of Dublin Boulevard and improvements to Croak Road in order to accommodate the proposed development. Noise modeling receptors were placed at locations representative of the hotel (F-1), garden restaurant (F-2), and single family residences (F-3), as shown in the Conceptual Plans.

Noise increase thresholds would not apply to future receptors that are not planned, programmed, and approved prior to project approval.

6.3.2. Alameda County

There are no planned or approved projects located in unincorporated Alameda County within the project area.

6.3.3. Livermore

The City of Livermore currently has three ‘approved’ projects and one project under construction in the project area. The three approved projects include the demolition of an existing hotel and construction of two new hotels at 1000 Airway Boulevard, the construction of a new hotel with 122 guest rooms at 5200 Wolf House Drive (currently 2000 Freisman Road), and the construction of a new hotel with 104 guest rooms at 5400 Wolf House Drive (currently also 2000 Freisman Road). A portion of the 2000 Freisman Road property is currently under construction with retail, restaurant, hotel, and auto dealership uses. All four of these projects are located more than 500 feet from the project alignment. The three projects proposed at 2000 Freisman Road, would be located across I-580 from the project site. And the primary noise source at these locations is anticipated to be vehicular traffic traveling along I-580. These projects are not analyzed further in this report.

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

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 7-1. The modeling results are discussed in detail following Table 7-1. In this table, 2040 Build traffic noise levels with the project are compared to existing conditions and to 2040 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 2040 Build and 2040 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. In some cases, this can result in relative changes that may not appear intuitive. An example would be a comparison between calculated sound levels of 64.4 and 64.5 dBA. The difference between these two values is 0.1 dB. However, after rounding, the difference is reported as 1 dB. Impacted receptors were identified by Activity Category. 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, 2040 No Build, and 2040 Build scenarios.

Table 7-1. Predicted Noise Levels

Receptor ID[3]	Location	Loudest-Hour Noise Levels, $L_{eq[h]}$ dBA[2]			Noise Increase Over Existing, dBA		2040 Build Noise Increase Over No Build, dBA	Activity Category (NAC)	Impact[1]
		Existing	2040 No Build	2040 Build	2040 No Build	2040 Build			
S1	2601 Alliston Loop, Dublin	63	64	65	1	2	1	B(67)	None
S2	3899 Camino Loop, Dublin	50[2]	50[2]	51[2]	0	1	1	B(67)	None
S3	Croak Road, north of Central Parkway, Dublin	48[2]	48[2]	48[2]	0	0	0	B(67)	None
R4	Croak Road residence, Dublin	63	63	64	0	1	1	B(67)	None
S5	500 feet north of I-580, Dublin	67	67	67	0	0	0	F	None
S6	901 Doolan Road, Livermore	63	63	65	0	2	2	E(72)	None
F1[3]	Proposed Grand View Hotel, 50 feet from Dublin Blvd	55	55	69	0	N/A[4]	N/A[4]	E(72)	None
F2[3]	Proposed Grand View Garden	56	57	69	1	N/A[4]	N/A[4]	E(72)	None

Receptor ID[3]	Location	Loudest-Hour Noise Levels, $L_{eq[h]}$ dBA[2]			Noise Increase Over Existing, dBA		2040 Build Noise Increase Over No Build, dBA	Activity Category (NAC)	Impact[1]
		Exist-ing	2040 No Build	2040 Build	2040 No Build	2040 Build			
	Restaurant, 75 feet from Dublin Blvd								
F3[3]	Proposed Grand View Residence, 125 feet from Dublin Blvd	59	59	64	0	N/A [4]	N/A[4]	B(67)	None

1 Impact Type: S = Substantial Increase (12 dBA or more), A/E = Approach or Exceed NAC.
2 Noise levels based on noise modeling and measurement results.
3 Approximate location of proposed land use based on Grand View conceptual plan.
4 These proposed land uses are "under review" by the City of Dublin. Noise increase thresholds would not apply to future receptors that are not planned, programmed, and approved prior to project approval.

Five short-term measurement positions were used as modeling receptors in the vicinity of the project alignment (S1, S2, S3, S5, and S6). In addition, there is one modeled receptor location representative of an existing noise sensitive use (R4) and three modeling locations representative of noise sensitive uses proposed as part of the Grand View Project (F1, F2, and F3). There are no existing noise barriers in the vicinity of the project.

As shown in Table 7-1, the loudest-hour noise levels at Existing and Proposed Category B land uses are calculated to range from 48 to 63 dBA $L_{eq(h)}$ under Existing conditions, from 48 to 64 dBA $L_{eq(h)}$ under 2040 No Build conditions, and from 48 to 65 dBA $L_{eq(h)}$ under 2040 Build conditions. The loudest-hour noise levels at Existing and Proposed Category E land uses are calculated to range from 55 to 63 dBA $L_{eq(h)}$ under Existing and 2040 No Build conditions and from 65 to 69 dBA $L_{eq(h)}$ under 2040 Build conditions. 2040 Build traffic noise levels are not predicted to approach or exceed the NAC any noise sensitive areas of frequent human use in the project vicinity.

At existing land uses, noise levels are calculated to increase by up to 1 dBA over Existing conditions under 2040 No Build conditions and by up to 2 dBA over Existing and under 2040 No Build conditions under 2040 Build conditions. These noise level increases are not considered substantial. Noise increase thresholds would not apply to future receptors that are not planned, programmed, and approved prior to project approval.

7.2. Noise Abatement Analysis

In accordance with 23 CFR 772(13)(c) and 772(15)(c), noise abatement must be considered where noise impacts are predicted in an area of frequent human use, which would benefit from a lowered noise level. As no traffic noise impacts are anticipated, no noise abatement measures are required.

Chapter 8. Construction Noise

Components of the project are described in detail in Chapter 2. 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 type of construction depending on the specific task being completed.

8.1. Regulatory Criteria

8.1.1. State Policy

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.

8.1.2. Local Regulations

The project is not located within the Caltrans right of way and the City of Dublin is the CEQA lead agency for the project. As a result, local regulatory criteria established by cities along the project corridor would apply, as follows:

City of Dublin

The City of Dublin's Municipal Code includes standards pertaining to noise control within the City. Municipal Code Section 5.28.020 prohibits any person within the City to make any loud, or disturbing, or unnecessary, or unusual or habitual noise or any noise which annoys or disturbs or injures or endangers the health, repose, peace or safety of any reasonable person of normal sensitivity present in the area.

City of Livermore

The City of Livermore prohibits the operation, between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and

Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday or at all on city-observed holidays, of any pile driver, pneumatic tools, derrick, electric hoist, sandblaster or other equipment used in construction, demolition or other repair work, the use of which is attended by loud or unusual noise.

Additionally, the city engineer and/or building official shall have the authority to authorize construction activities during the hours specified above for the following reasons:

1. A public agency, other than the city, requires as a condition of a permit that the construction be done during the restricted hours.

2. Public health, safety or welfare requires the work to be done during the restricted hours.

3. Specific construction activities (such as large concrete foundation pours) can be identified and approved to occur as an exemption to this ordinance in the conditions of approval for a project at the time of the public hearing.

If the city engineer and/or building official approves the exception or it is an exception allowed by the conditions of approval for the project, the following shall be done:

1. Notify the Livermore police department, watch commander, at least 24 hours in advance.

2. Notify residents and business owners that are adjacent to the work area at least 24 hours in advance. The limits of this notification shall be determined by the city engineer and/or building official.

Alameda County

Construction is exempt from the noise limits specified in Alameda County's Municipal Code, provided that construction activities are limited to the hours between 7:00 am to 7:00 pm, Mondays through Fridays, and 8:00 am to 5:00 pm on Saturdays and Sundays.

8.2. Construction Phasing and Noise Levels

The project would be constructed through largely undeveloped areas of Dublin and Alameda County. Construction activities would include but are not limited to demolition, earthwork, paving, pile driving, concrete/rebar/formwork, utility trenching, and roadway striping. Pile driving is a possible construction method needed to construct the bridge over Cottonwood Creek. Construction staging would be located at the eastern end of the project site, south of the roadway extension and north of Collier Canyon Road. Project construction would occur in a single construction phase.

Construction noise would primarily result from the operation of heavy construction equipment and arrival and departure of heavy-duty trucks. The highest maximum instantaneous noise levels would result from special impact tools such as impact pile drivers. FHWA's Roadway Construction Noise Model (RCNM) was used to calculate the maximum and average noise levels anticipated during each type of construction. 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"). The usage factors represent the percentage of time that the equipment would be operating at full power. Vehicles and equipment anticipated during each type of construction were input into RCNM to calculate noise levels at a distance of 100 feet. Table 8-1 presents the construction noise levels calculated for each major construction activity of the project. 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 alternatively, the model reports 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 Activity at 100 feet

Construction Activity*	Maximum Noise Level (L_{max}, dBA)	Hourly Average Noise Level ($L_{eq[h]}$, dBA)
Site Preparation	84	85
Grading and Excavation	79	82
Sewer Trenching and Installation	75	79
Utility Trenching and Installation	75	79
Bridge Foundations	75	77
Impact Pile Driving	95	88
Bridge Abutment and Piers	75	76
Bridge Superstructure/ Barriers	75	76
Landscaping, Irrigation, and Lighting	75	76

Paving	77	80

*Detailed equipment assumptions for each construction activity are provided in Appendix E.

8.3. Construction Noise Impacts

Although the overall construction schedule is anticipated to occur over a period exceeding 12 months, roadway construction activities typically occur for relatively short periods of time in any specific location as construction proceeds along the project's alignment. Much of construction would be located more than 500 feet from any noise sensitive receptors. Construction noise would mostly be of concern in areas where impulse-related noise levels from construction activities 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 early morning, evening, or nighttime hours.

As indicated through comparison of Table 8-1, most construction activities would generate average noise levels that would exceed ambient daytime noise levels at adjacent land uses (R4, S5, and S6) by 10 to 15 dBA $L_{eq[h]}$. Site preparation or pile driving would generate average noise levels approximately 20 to 25 dBA $L_{eq[h]}$ higher than ambient noise conditions. Maximum instantaneous noise levels generated by typical construction activities would generally be 5 to 10 dBA above existing maximum noise levels generated by traffic on I-580. Maximum instantaneous noise levels generated by impact pile driving activities would generally be 20 to 30 dBA above existing maximum noise levels generated by traffic on I-580. With the exception of construction activities involving impact tools, noise levels would not be expected to exceed the quantitative noise limits established by Caltrans or local noise ordinances.

8.4. Construction Noise Minimization Measures

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

- All construction equipment should conform to Section 14-8.02, Noise Control, of the latest Standard Specifications.
- The construction activities generating excessive noise should be limited to the hours specified in the appropriate local ordinance, where feasible. If work is necessary outside of these hours, Caltrans should require the contractor to

implement a construction noise monitoring program and provide additional mitigation where practical and feasible.

- Pile driving activities should be limited to daytime hours only.
- Equip all internal combustion engine driven equipment with manufacturer recommended intake and exhaust mufflers that are in good condition and appropriate for the equipment.
- Unnecessary idling of internal combustion engines within 100 feet of residences should be strictly prohibited.
- Locate stationary noise generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a construction project area.
- Utilize "quiet" air compressors and other "quiet" equipment where such technology exists.
- Prohibit unnecessary idling of internal combustion engines within 100 feet of residences.
- Avoid staging of construction equipment within 200 feet of residences and locate all stationary noise-generating construction equipment, such as air compressors, portable power generators, or self-powered lighting systems as far practical from noise sensitive receptors.

Chapter 9. References

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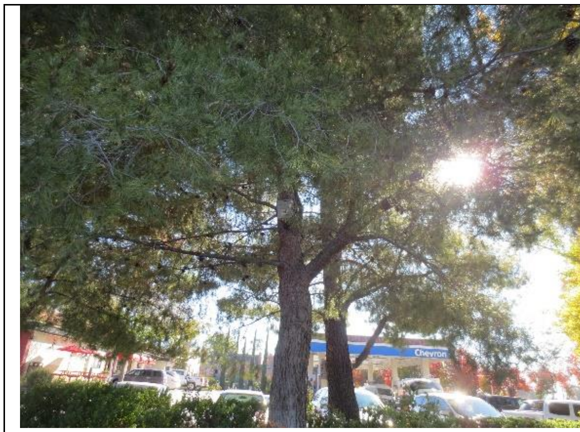
Appendix A Definition of Technical Terms

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 sound 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.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

Appendix B Site Photographs

 L1: 3637 Dublin Boulevard, Dublin	 L2: 1051 Airway Boulevard, Livermore
 S1: 2601 Alliston Loop, Dublin	 S2: 3899 Camino Loop, Dublin
 S3: Croak Road, north of Central Parkway, Dublin	 S4: Croak Road, north of I-580, Dublin

NO PICTURE AVAILABLE S5: 500 feet north of I-580	 S6: 901 Doolan Road, Livermore

Appendix C Long-Term Noise Data

Figure D1. Daily Noise Trends at L1, 1051 Airway Boulevard, Livermore, Wednesday, December 13th, 2017

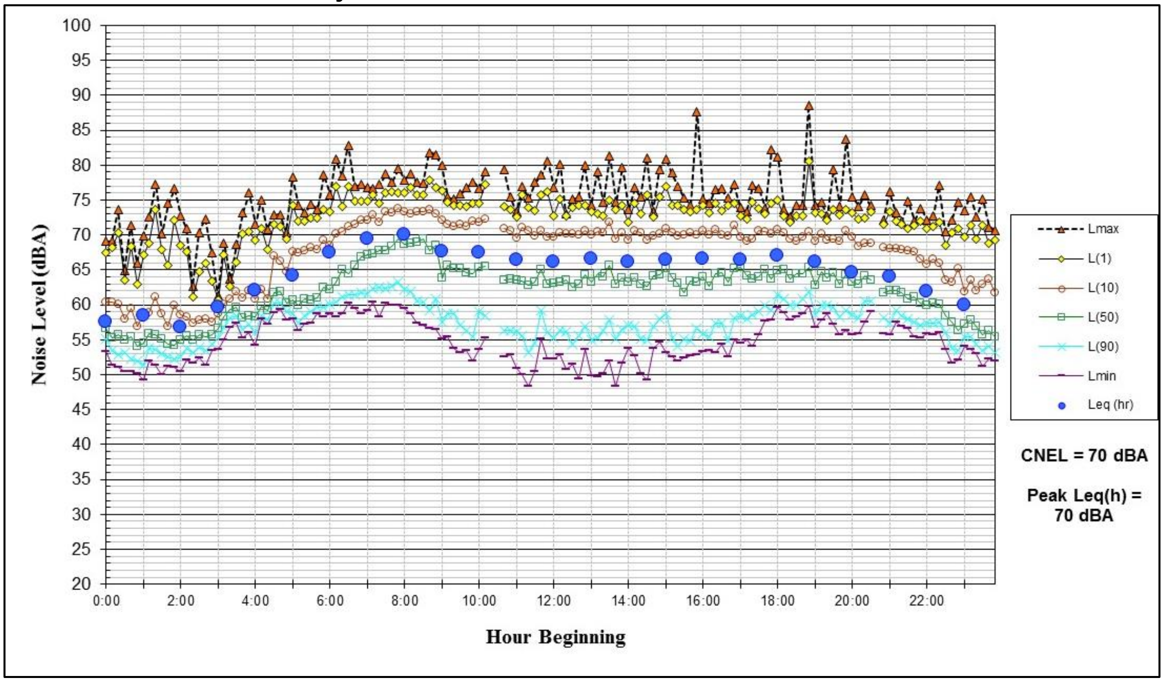
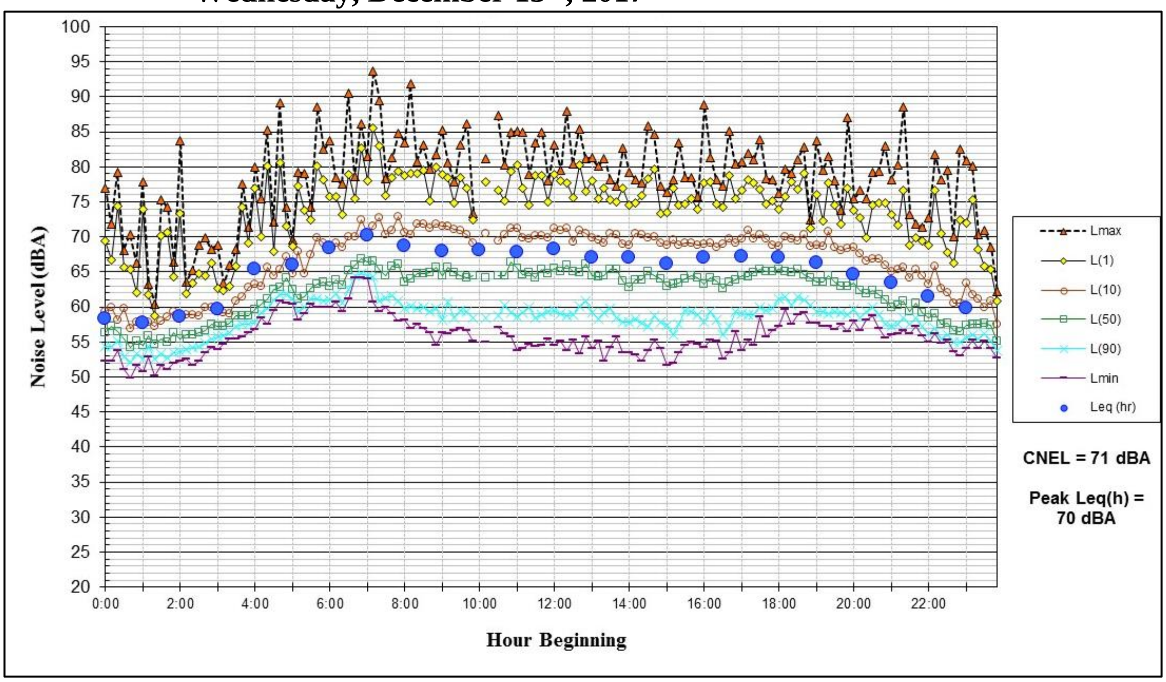


Figure D2. Daily Noise Trends at L1, 3637 Dublin Boulevard, Dublin, Wednesday, December 13th, 2017



Appendix D Additional CEQA Requirements

The State of California has established regulatory criteria that are applicable in this assessment. The State's CEQA guidelines, Appendix G, are used to assess the potential significance of environmental noise impacts pursuant to local policies.

D.1. Regulatory Criteria

D.1.1 State CEQA Guidelines

The California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of environmental noise impacts attributable to a proposed project. Applicable CEQA checklist questions ask whether the project would result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies?

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

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

f) For a project located in the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

The project is proposed within the 55 CNEL noise contour for the Livermore Municipal Airport. However, the project does not propose noise sensitive land uses and aircraft noise levels would be well below the noise produced by the construction equipment necessary to complete the project when construction workers would be working at the site; therefore, checklist items e and f are not applicable to the project. Construction noise impacts (checklist items a and d) are discussed in Chapter 8. Potential impacts from construction vibration (checklist item b) and traffic noise on the surrounding roadway network (checklist items a and c) are discussed below.

D.2 Impacts from Groundborne Vibration

A significant impact would be identified if project construction activity or project-related vehicle traffic would result in vibration levels of 0.3 in/sec PPV or greater at nearby structures (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
0.3	Strongly perceptible to severe	
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, September 2013.

Project-related vehicle traffic is not anticipated to generate perceptible levels of groundborne vibration at nearby structures (vibration levels are anticipated to be below 0.01 in/sec PPV). Project construction equipment to be used on the project is anticipated to include concrete saws, excavators, graders, dozers, backhoes, forklifts, cement mixers, bore/drill rigs, aerial lifts, cranes, welders, generators, pavers, paving equipment, rollers, and pick-up trucks. Pile driving is anticipated as part of the construction of the bridge over Cottonwood Creek. Construction activities with the greatest potential of generating perceptible vibration levels would include pile driving, the removal of pavement and soil, the movement of heavy tracked equipment, and vibratory compacting of roadway base materials by use of a roller. Table 9-2 summarizes typical vibration levels associated with varying pieces of construction equipment at a distance of 25 feet.

Table 9-2. Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)
Pile Driver (Impact)	upper range	1.158
	typical	0.644
Pile Driver (Sonic)	upper range	0.734
	typical	0.170
Clam shovel drop		0.202
Hydromill (slurry wall)	in soil	0.008
	in rock	0.017
Vibratory Roller		0.210
Hoe Ram		0.089
Large bulldozer		0.089
Caisson drilling		0.089
Loaded trucks		0.076
Jackhammer		0.035
Small bulldozer		0.003

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

A review of the anticipated construction equipment and the vibration level data provided in Table 9-2 indicates that vibration levels generated by proposed activities and equipment other than pile driving would be below the 0.3 in/sec PPV criteria when construction occurs at distances of 20 feet or greater from structures. Pile driving activities would be below the 0.3 in/sec PPV criteria when construction occurs at distances of 100 feet or greater from structures. There are no existing structures located within 100 feet of the project alignment and architectural or structural damage to normal structures would not be anticipated. This is a less-than-significant impact.

D.3 Impacts from Project Generated Traffic Noise

The NSR addresses traffic noise impacts with respect to 23 CFR 772.3, which limits the analysis to within 500 feet of the project alignment. Under CEQA, traffic noise increases are analyzed throughout the roadway network in the vicinity of the project. CEQA does not define the noise level increase that is considered substantial. Typically, a permanent increase in the day-night average noise level of 3 dBA CNEL or greater at noise-sensitive receptors would be considered significant when projected noise levels would exceed those considered satisfactory for the affected land use. An increase of 5 dBA CNEL or greater would be considered significant when projected noise levels would continue to meet those considered satisfactory for the affected land use. Both the Cities of Dublin and

Livermore defines a noise level of 60 dBA CNEL or less to be normally acceptable for residential and hotel land uses and 60 dBA CNEL or less to be normally acceptable for commercial land uses.

Traffic data provided by Kittelson & Associates, Inc. was reviewed to calculate potential traffic noise level increases attributable to the Dublin Boulevard – North Canyons Parkway Extension expected along roadways serving the site. Roadways evaluated in the analysis included Dublin Boulevard, North Canyons Parkway, Hacienda Drive, Tassajara Road, Fallon Road, the I-580 ramps, El Charro Road, Airway Boulevard, Doolan Road, Isabel Avenue, Portola Avenue, and Murrieta Boulevard. Traffic volumes under the 2025 + Project scenario were compared to the 2025 No Build scenario and traffic volumes under the 2040 + Project scenario were compared to 2040 No Build conditions to calculate the noise increase attributable to the project.

The data indicate that traffic volumes in the site vicinity will increase as a result of the proposed project. Traffic noise levels due to the proposed project are calculated to increase by 0 to 1 dBA L_{eq} during the worst-hour along all existing roadways in the network. As shown in Table 7-1, traffic noise increases at existing land uses along the proposed project alignment are calculated to increase by 0 to 2 dBA L_{eq}. These noise increases would not be considered significant because the noise increases would be less than 3 dBA CNEL.

Review of Table 7-1 indicates that existing noise levels at residential receptors R4 and S1 of the project currently exceed the Cities' noise and land use compatibility thresholds for residential land use and would continue to do so with the development of the project. The primary noise source at these locations is traffic on I-580 (R4) or traffic on local roadways (S1). The project's contribution to traffic noise levels at these locations would be 1 dBA or less, which would not be considered significant.

Depending on the final design and development of the Grand View Project (F-1, F-2, and F-3), noise levels at future uses could exceed the City of Dublin's noise and land use compatibility thresholds. Based on available conceptual plans, Grand View Project access would be from the Dublin Boulevard – North Canyons Parkway Extension. As such, the Grand View Project is not anticipated to be constructed prior to the Dublin Boulevard – North Canyons Parkway Extension. As the Grand View Project is currently "under review" and has not yet been planned, programmed, or approved, it would be the Grand View Project's responsibility to ensure that future noise levels meet the City's criteria.

This is a less-than-significant impact.

Appendix E Construction Noise Equipment Modeling Inputs