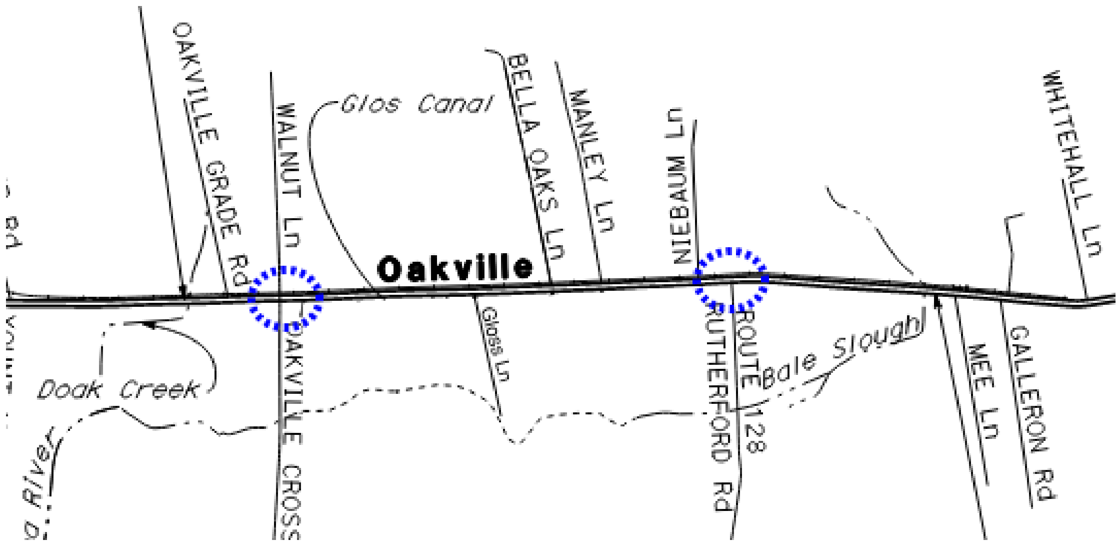
Appendix G Noise Study Report

The Proposed Napa Forward Intersection Improvement Project at Postmiles 22.72 to 24.59 on State Route 29



Noise Study Report

Intersection Improvements along State Route 29 at Rutherford Road and Oakville Cross Road
Communities of Rutherford and Oakville, CA
04-NAP-SR 29-22.72/24.59
EA 2W430
Project ID 421000200

May 2023

Caltrans

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Summary

The purpose of this Noise Study Report (NSR) is to assess potential traffic noise impacts and identify feasible noise abatement measures for the proposed Intersection Improvements along State Route 29 (SR-29) at Rutherford Road and Oakville Cross Road Project (Project). The intersections under study have been experiencing poor traffic operation and a high number of collisions due to the lack of protected turning movements.

- The number of collisions exceed statewide average for similar type of facility
- Poor intersection operation occurs during peak and non-peak periods caused by high traffic volume
- Lack of protected turning movements to allow for access to and from SR-29 due to insufficient gaps in traffic streaming

The NSR was prepared following the requirements of Title 23, Part 772 of the Code of Federal Regulations "Procedures for Abatement of Highway Traffic Noise," and the California of Transportation (Caltrans) Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects (Protocol) (Caltrans 2020).

Land uses along the SR-29 include mainly open space vineyard (Activity Category F) with pockets of residential properties (Activity Category B) and winery/grocery store (Activity Category E). Terrain around the Project area is generally flat.

Traffic along the SR-29 is the dominant source of noise in the study area. For the purposes of this NSR, the study area is divided into 4 separate Noise Study Areas (NSAs).

WSP staff conducted short-term (15-minute) measurements at 4 locations during the morning (AM period) and afternoon (PM period) on September 27 and September 28, 2022. Meteorological conditions (i.e., temperature, wind speed and direction, and relative humidity) were logged for each measurement session using a hand-held weather station. A long-term noise measurement was conducted at one location on September 27, 2022, through September 28, 2022.

Existing Year (2022) and Design Year (2035) No-Build and Build condition forecasted truck percentages, along with AM/PM Peak hour traffic volumes, were used to predict future traffic noise levels. These forecasted traffic volumes were presented in the Traffic

Operations Analysis Report (March 2023). It is noted that the proposed Project Build Alternative would not add capacity, increase traffic volumes, or increase the amount of truck traffic in the study area. The purpose of the Project is to enhance safety and traffic operations at the affected intersections, which is anticipated to decrease congestion in the study area and may improve travel time, reduce delay, and increase free-flow speeds. Increases in traffic volumes would not be attributed to the Project and are a result of regional growth. These predicted future volumes were used to evaluate traffic noise. These modelled noise levels were then analyzed for potential noise impacts at receivers within the Project area. It was determined that future PM Peak Hour traffic would result in the higher predicted noise levels in both existing and design year conditions, and therefore, was used to determine conservative noise impacts in the analysis.

No modeling sites approached or exceeded the impact criteria for Activity Category B or E. No noise abatement is anticipated for this Project.

Construction noise control will conform to the provisions in Section 14-8.02, “Noise Control,” of the Standard Specifications and Special Provisions (SSP 14-8.02). The requirements state that all equipment will be fitted with adequate mufflers and operated according to the manufacturers’ specifications. Construction noise varies greatly depending on the construction process, type, and condition of equipment used, and layout of the construction site. Temporary construction noise impacts would be unavoidable at areas that are immediately adjacent to the Project alignment.

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List of Abbreviated Terms

CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
dB	Decibels
FHWA	Federal Highway Administration
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 Sound Level
LOS	Level of Service
L_{xx}	Percentile-Exceeded Sound Level
mPa	micro-Pascals
mph	miles per hour
NAC	noise abatement criteria
NADR	Noise Abatement Decision Report
NEPA	National Environmental Policy Act
NSR	Noise Study Report
Protocol	Caltrans Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction, and Retrofit Barrier Projects
SPL	sound pressure level
TeNS	Caltrans' Technical Noise Supplement
TNM 2.5	FHWA Traffic Noise Model Version 2.5

Chapter 1. Introduction

The MTC, in cooperation with Napa Valley Transportation Authority (NVTA) and the California Department of Transportation (Caltrans), proposes to improve the operation and safety of SR-29 at the intersections of Oakville Cross Road (PM 22.72) and Rutherford Road (PM 24.59). A single-lane roundabout is proposed at the intersection of SR-29 and Oakville Cross Road. Due to right-of-way limitations, a roundabout will not be feasible at the Rutherford Road intersection without substantial right-of-way impact. Hence, the Project proposes to install a traffic signal and/or other traffic calming measures at the intersection of SR 29/Rutherford Road.

In March 2023, MTC completed a Traffic Operations Analysis Report (TOAR) to identify the causes of and potential solutions to congestion in the greater project vicinity. The results indicated that enhanced intersection control at the two intersections would improve multimodal traffic operations performance along SR-29. Preliminary crash data analysis provided by Caltrans indicates that the total rate of fatal and injury crash at these two intersections are above the average crash rate for similar facilities statewide. Based on the results of traffic and safety analyses and feedback received from project stakeholders, the implementation of a traffic signal and roundabout are viable options to address the operations and safety needs.

Federal Highway Administration (FHWA) studies indicate that a properly designed roundabout would slow down traffic and, hence, reduce the probabilities of most severe types of intersection crashes and injuries. Roundabouts also allow for continuous flow of traffic at lower speed through this segment of the corridor and would be the ideal candidate to address the safety and operations challenges associated with the corridor.

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," related to construction and operation of the Intersection Improvements along State Route 29 at Rutherford Road and Oakville Cross Road Project. Specifically, 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, May 2011) provides Caltrans policy for implementing 23 CFR 772 in California. The Protocol outlines the requirements for preparing noise study reports (NSR). Noise impacts associated with this project under the California Environmental Quality Act (CEQA) are evaluated in the project's environmental document [State Route 29 Improvements at Rutherford and Oakville Intersections Project Initial Study/Mitigated Negative Declaration], and under NEPA in a Documented Categorical Exclusion (CatEx) (23 CFR 771.117(c)(27) Highway safety or traffic operations improvement projects).

1.1. Project Location

The SR-29 is one of the two major north-south corridors that provides connectivity through the cities of Calistoga, St. Helena, Yountville, Napa and American Canyon within Napa County. It is a primary freight, agricultural and commute corridor accessing the San Francisco Bay Area, and Sacramento as well as nearby Solano and Lake Counties. As the gateway to the Napa Valley Wine Country, SR-29 is a main route that brings tens of thousands of tourists to the region each year. Within the Project limits, SR-29 between Whitehall Lane and Oakville Cross Road experiences heavy congestion during peak periods. The existing SR-29 corridor is uncontrolled within the Project study area. Traffic on SR-29 is not required to stop, creating a continuous traffic flow and leaving no gap for side streets to make turns. Therefore, vehicles at many of the side-street stop-controlled intersection approaches along the corridor experience difficulty turning onto SR-29.

1.2. Project Purpose and Need

Purpose

The purpose of the Project is to enhance safety and traffic operations at the intersections of SR-29/Oakville Cross Road and SR-29/Rutherford Road.

- Improve travel time and reduce delay for side streets accessing SR-29
- Enhance traffic safety
- Improve turning movements

Need

The intersections under study have been experiencing poor traffic operation and a high number of collisions due to the lack of protected turning movements.

- The number of collisions exceed statewide average for similar type of facility
- Poor intersection operation occurs during peak and non-peak periods caused by high traffic volume
- Lack of protected turning movements to allow for access to and from SR-29 due to insufficient gaps in traffic streaming

Chapter 2. Project Description

2.1. No-Build

Under the No-Build Alternative, no changes would be made to the intersections of the SR-29 at Rutherford Road and Oakville Cross Road in the Project area.

2.2. Build Alternative

Under the Build Alternative, a single-lane roundabout is proposed at the intersection of SR-29 and Oakville Cross Road. Due to right-of-way limitations, a roundabout will not be feasible at the Rutherford Road intersection without substantial right-of-way impact. Hence, the Project proposes to install a traffic signal and/or other traffic calming measures at the intersection of SR 29/ Rutherford Road.

Oakville Cross Road Intersection

Limits of construction on SR-29 extend approximately 0.5 miles northerly and southerly from the center of the Oakville Cross Road intersection, approximately 500 feet in easterly direction along Oakville Cross Road, and approximately 200 feet in the westerly direction at the existing driveway crossing railroad tracks.

The Oakville Cross Road roundabout would maintain existing traffic patterns, however, ingress to the Oakville Grocery would be modified to right-in and right-out only. The Project would not preclude southbound access to the Oakville Grocery driveway (currently a left turn-in); rather traffic would be routed through the roundabout to access the grocery. Construction of the roundabout also would include the installation of intersection lighting, a pedestrian and bicyclist shared use path with bike ramps, and splitter islands with curb ramps. In addition, the existing drainage would be modified to accommodate the proposed roundabout, and the existing signage within the right-of-way would be replaced or upgraded.

The existing channelization at the intersection of SR-29 and Oakville Grade Road may be restriped as part of the mainline improvement required for the construction of a roundabout at the intersection of SR-29 and Oakville Cross Road.

Rutherford Road Intersection

At the Rutherford Road intersection, the Project proposes improvements such as a traffic signal, active transportation (improvements include bicyclist and pedestrian facilities that make it safer for pedestrian and bicyclist movements at the intersection), median treatments, and traffic calming measures along the mainline at the intersection. Limits of improvements on SR-29 would extend approximately 0.5 miles northerly and southerly from the center of the Rutherford Road intersection, and approximately 500 feet easterly along Rutherford Road.

Due to the proximity to the Napa Wine Train tracks, railroad crossings improvements will also be needed at both intersections.

The Rutherford Road intersection does not meet the requirements of a Type I Project; therefore, noise analysis will not be performed for this intersection.

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 (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).

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 the propagation path 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.

3.1. 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 judgments of the relative loudness or annoyance of a sound, their judgments correlate 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 midfrequency (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 highway 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 highway project for the construction of a highway 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 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 E 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

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

A field investigation was conducted to identify land uses that could be subject to traffic and construction noise impacts from the Project. Existing land uses in the project area were categorized by land use type and Activity Category as defined in Table 4-1, and the extent of frequent human use. 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 were 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. The Project footprint was mapped relative to the existing land uses to determine potential measurement locations according to these criteria. Short-term measurement locations were selected throughout the length of the project area corridor to represent each major grouping of developments meeting the criteria identified above along the segment of SR-29. These short-term measurement locations were selected to serve as representative modeling locations. A single long term measurement site was selected to capture the diurnal traffic noise level patterns in the project area. Additional locations not measured in the field were added to the noise model as modelling locations.

5.2. Field Measurement Procedures

A field investigation was conducted in accordance with recommended procedures in TeNS to collect noise measurements. The following is a summary of the procedures used to collect short-term and long-term sound level data.

5.2.1. Short-Term Measurements

Short-term monitoring was conducted at four locations on Tuesday, September 27, 2022 and Wednesday, September 28, 2022, using a Larson Davis Model 820 Precision Type 1 sound level meter (serial number 1232). The calibration of the meter was checked before and after the measurement using a Larson Davis Model CA200 calibrator (serial number 3415). Measurements were taken over a 15-minute period at each site. Short-term monitoring was conducted at Activity Category B and F land uses. The short-term measurement locations are identified in Figure 5-1.

During the short-term measurements, field staff attended the meter. Minute-to-minute L_{eq} values collected during the measurement period (typically 15 minutes in duration) were logged manually, and dominant noise sources observed during each individual 1-minute period were also identified and logged. Using this approach, those minutes when traffic noise was observed to be a dominant contributor to noise levels at a given measurement location could be distinguished from one-minute noise levels where other non-traffic noise sources (such as aircraft and lawn equipment) contributed significantly to existing noise levels.

Temperature, wind speed, and humidity were recorded manually during the short-term monitoring session using a handheld Kestrel 3000 portable weather station. During the short-term measurements, wind speeds typically ranged from 1 to 4 miles per hour (mph). Temperatures ranged from 24–27°C (75–80°F), with relative humidity typically 35–45%.

Traffic on SR-29 was classified and counted during short-term noise measurements. Vehicles were classified as automobiles, medium-duty trucks, or heavy-duty trucks. An automobile was defined as a vehicle with two axles and four tires that are 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 included all vehicles with three or more axles. The posted speed on SR-29 was 50 miles per hour (mph) and 25 mph on Oakville Cross Road.

5.2.2. Long -Term Measurements

Long-term monitoring was conducted at one location (LT-1) using a Larson Davis Model 712 Type 2 sound level meter (serial number 0218). The purpose of these measurements was to identify variations in sound levels throughout the day. The long-term sound level data was collected a 24-hour period, beginning Tuesday, September 27, 2022, and ending Wednesday, September 28, 2022.

Long-term monitoring location LT-1 selected was located at 7856 St Helena Hwy (Oakville Grocery Store) on the east side of SR 29, approximately 80 feet from the SR 29 edge-of-pavement (refer to Figure 5-1).

5.3. Traffic Noise Levels Prediction Methods

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). Key inputs to the traffic noise model were the locations of roadways, traffic mix and speed, shielding features (e.g., topography and buildings), noise barriers, ground type, and receptors. Three-dimensional representations of these inputs were developed using CAD drawings, aerials, and topographic contours obtained by USGS.

It is noted that the proposed project Build Alternative would not add capacity, increase traffic volumes, or increase the amount of truck traffic in the study area. The purpose of the project is to enhance safety and traffic operations at the affected intersections, which is anticipated to decrease congestion in the study area and may improve travel time, reduce delay, and increase free-flow speeds. Increases in traffic volumes would not be attributed to the Project and are a result of regional growth. These predicted future volumes were used to evaluate traffic noise.

Traffic noise was evaluated under existing conditions and under Build Alternative conditions with the Project alternative. Loudest-hour traffic volumes, vehicle classification percentages, and traffic speeds under existing and build conditions were sourced from the TOAR developed for the Project[1] for input into the traffic noise model. The highest average traffic volumes on SR-29 under the Build Alternative are predicted to occur during the PM peak hour; therefore, PM peak hour traffic volumes were used in the model. Tables A-1 to A-3 in Appendix A summarize the traffic volumes and assumptions used for modeling existing and build conditions.

To validate the accuracy of the model calculations, TNM 2.5 was used to compare measured traffic noise levels to modeled noise levels at field measurement locations. For each receptor, traffic volumes counted during the short-term measurement periods were normalized to 1-hour volumes. These normalized volumes were assigned to the corresponding project area roadways to simulate the noise source strength at the roadways during the actual measurement period. Modeled and measured sound levels were then compared to determine the accuracy of the model and if additional adjustment of the model was necessary. Observed traffic volumes are provided in Appendix A.

[1] GHD, Draft Traffic Operations Analysis Report (TOAR) Napa Forward – State Route 29 (SR-29) Improvements at Rutherford and Oakville Intersections Project (EA 04-2W430) March 2023

Figure 5-1. Analysis Areas and Noise Monitoring Positions

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 more greater than existing noise levels, or where predicted design-year noise levels approach or exceed the NAC for the applicable activity category. Where traffic noise impacts are identified, noise abatement must be considered for reasonableness and feasibility as required by 23 CFR 772 and the Protocol.

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. In addition, barriers should be designed to intercept the line-of-sight from the exhaust stack of a truck to the first tier of receptors, as required by the Highway Design Manual, Chapter 1100. Other factors that affect feasibility include topography, access requirements for driveways and ramps, presence of local cross streets, utility conflicts, other noise sources in the area, and safety considerations.

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

- The noise reduction design goal.
- The cost of noise abatement.
- 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. Based on 2022 construction costs an allowance of $107,000 is provided for each benefited receptor (i.e., receptors that receive at least 5 dB of noise reduction from a noise barrier) (Caltrans, 2022). The total allowance for each barrier is calculated by multiplying the number of benefited receptors by $107,000. The construction cost of noise abatement is evaluated in the Noise Abatement Decision Report (NADR) if abatement is found to be feasible at reducing noise levels. The viewpoints of benefits receptors are determined by a survey that is typically conducted after completion of the noise study report. The process for conducting the survey is described in detail in the Protocol.

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 NADR.

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 Project. The following land uses were identified in the project area:

- Single-family residences: Activity Category B
- Commercial retail uses: Activity Category E
- Commercial retail uses: Activity Category F

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 and common use areas at multi-family residences.

Land uses in the Project area have been grouped into a series of lettered analysis areas that are identified in Figure 5-1 and here forth referred to as Noise Study Areas (NSA). Each of these analysis areas is considered to be acoustically equivalent.

- **Area A (M1 and M2):** Area A is located on the east side of SR-29 north of Oakville Cross Road. A single residential unit (Activity Category B) and outdoor eating area of the Oakville Grocery Store (Activity Category E) are located in this area. This area is generally flat and provides no topographic shielding to the residential unit. (Refer to Figure 5-1.) Vineyards (Activity Category F) are located in the Project area but have no outdoor uses and therefore are not noise sensitive.

- **Area B (M24):** Area B is located on the west side of SR-29 north of Oakville Cross Road. This area is generally flat and the land use is primarily agriculture (Activity Category F) with no outdoor uses. A single commercial building (Activity Category E) is located in this area at the southwest quadrant of SR-29 and Oakville Cross Road.

- **Area C (M3 through M13):** Area C is located on the east side of SR-29 south of Oakville Cross Road. A commercial winery (Activity Category F) is located in this area. Outdoor areas immediately adjacent to the commercial land uses are parking lots. Therefore, no outdoor areas associated with the commercial uses are considered to be areas of frequent human use. The ground is generally flat for the majority of this area but slopes away from the highway at the residential developments (Activity Category B). An existing six-foot height property wall is located between the highway and the residential area represented by modeling sites M6 to M11. There are no topographic shielding between the highway and sensitive land uses represented by sites MM3, M4, M5, M12 and M13. (Refer to Figure 5-1.)

- **Area D (M14 through M23):** Area D is located on the west side of SR-29 south of Oakville Cross Road. Residential (Activity Category B) and agricultural land uses (Activity Category F) are located in this area. An existing eight-foot tall property wall shields modeling sites M17 to M22 between the highway in this area. There are no topographic shielding between the highway and sensitive land uses represented by sites M14 to M16 and M23. (Refer to Figure 5-1.)

6.2. Noise Measurement Results

The existing noise environment in the project area is characterized below based on short- and long-term noise monitoring that was conducted.

6.2.1. Short-Term Monitoring

Table 6-1 summarizes the results of the short-term noise monitoring conducted in the project area. An AM and PM measurement was taken at each site.

Table 6-1. Summary of Short-Term Measurements

Measurement Site	NSA	Land Uses	Date	Start Time	Duration (minutes)	Measured Sound Level L_{eq} (dBA)
ST-1	C	Residential	9/27/2022	1:30 pm	15	61.1
	C	Residential	9/28/2022	9:11 am	15	63.3
ST-2	C	Residential	9/27/2022	2:00 pm	15	67.8
	C	Residential	9/28/2022	9:37 am	15	69.2
ST-3	D	Agricultural	9/27/2022	2:30 pm	15	62.4
	D	Agricultural	9/28/2022	10:05 am	15	64.6
ST-4	D	Residential	9/27/2022	2:55 pm	15	61
	D	Residential	9/28/2022	10:30 am	15	62.1

6.2.2. Long-Term Monitoring

The long-term sound level data was collected over a 24-hour period, beginning Tuesday, September 27, 2022, and ending Wednesday, September 28, 2022.

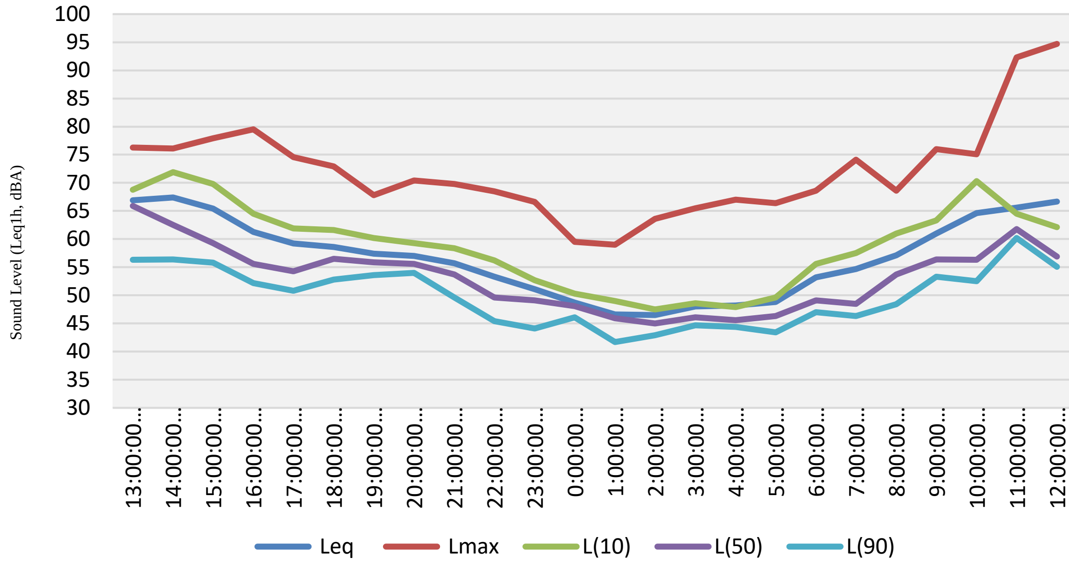
Long-term monitoring location LT-1 was located at 7856 St Helena Hwy (Oakville Grocery) on the east side of SR-29, approximately 80 feet from the SR-29 edge-of-pavement (refer to Figure 5-1). The average loudest-hour sound level measured was 67.4 dBA L_{eq}(h) during the 2:00 p.m. hour. Table 6-2 and Figure 6-1 summarize the results of the long-term monitoring.

Table 6-2. Summary of Long-Term Monitoring at Location LT-1

Date	Time	Leq
September 27, 2022	13:00:00	66.9
September 27, 2022	**14:00:00**	**67.4**
September 27, 2022	15:00:00	65.4
September 27, 2022	16:00:00	61.3
September 27, 2022	17:00:00	59.2
September 27, 2022	18:00:00	58.6
September 27, 2022	19:00:00	57.4
September 27, 2022	20:00:00	57
September 27, 2022	21:00:00	55.7
September 27, 2022	22:00:00	53.3
September 27, 2022	23:00:00	51.1
September 28, 2022	0:00:00	48.7
September 28, 2022	1:00:00	46.6
September 28, 2022	2:00:00	46.5
September 28, 2022	3:00:00	48
September 28, 2022	4:00:00	48.2
September 28, 2022	5:00:00	48.8
September 28, 2022	6:00:00	53.2
September 28, 2022	7:00:00	54.7
September 28, 2022	8:00:00	57.1
September 28, 2022	9:00:00	61
September 28, 2022	10:00:00	64.6
September 28, 2022	11:00:00	65.6
September 28, 2022	12:00:00	66.7

Note: Worst noise hour noise level is bolded.

Figure 6-1. Long-Term Monitoring at Location LT-1, September 27-28, 2022



TNM 2.5 was used to compare measured traffic noise levels to modeled noise levels at field measurement locations. Table 6-3 compares measured and modeled noise levels at each measurement location (see Figure 5-1). The predicted sound levels are within 2 dB of the measured sound levels and are, therefore, considered to be in reasonable agreement with the measured sound levels. Therefore, no further adjustment of the model was necessary.

Table 6-3. Comparison of Measured to Predicted Sound Levels in the TNM Model

Measurement Position	Measured Sound Level (dBA)	Predicted Sound Level (dBA)	Measured minus Predicted (dB)
ST-1 (PM)	61.1	59.3	+1.8
ST-1 (AM)	63.3	61.4	+1.9
ST-2 (PM)	67.8	67.8	0.0
ST-2 (AM)	69.2	68.5	+0.7
ST-3 (PM)	62.4	64.4	- 2.0
ST-3 (AM)	64.6	65.2	-0.6
ST-4 (PM)	61.0	61.6	-0.6
ST-4 (AM)	62.1	63.2	-1.1

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

7.1. Future Noise Environment and Impacts

Table B-1 in Appendix B summarizes the traffic noise modeling results for existing conditions and design-year conditions with and without the project. Predicted design-year traffic noise levels with the Project are compared to existing conditions and to design-year no-project conditions. The comparison to existing conditions is included in the analysis to identify traffic noise impacts as defined under 23 CFR 772. The comparison to no-project 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.

Modeling results in Table B-1 indicate the following:

1.1.1 Area A (M1 and M2)

The traffic noise modeling results in Table B-1 indicate that traffic noise levels at residential and commercial uses in Area A are predicted to be in the range of 65 to 67 dBA L_{eq}(h) in the design-year. The results also indicate that the increase in noise between existing conditions and the design-year is predicted to be 0 dB to 1dB increase. This increase is attributable to the vehicular increase from regional growth as well as the reconfiguration of the Oakville Cross Road intersection, which would marginally decrease the distance between sensitive land uses and vehicular traffic. Because the predicted noise levels in the design-year are not predicted to approach or exceed the noise abatement criterion (67 dBA L_{eq}[h]) at Activity Category B land use, traffic noise impacts are not predicted in Area A, and noise abatement is not considered for this area.

1.1.2 Area B (M24)

The traffic noise modeling results in Table B-1 indicate traffic noise levels at the commercial property is predicted to be 59 dBA L_{eq}(h) in the design-year at Activity Category E land use. The results also indicate the noise level between existing conditions and the design-year is predicted to have a 3 dB decrease. The decrease is due to the design change of the roadway being shifted away from this site. The area is mainly used for agricultural purposes Activity Category F. The predicted noise level at the Oakville Pump office (Activity Category E) in the design-year are not predicted to approach or exceed the noise abatement criterion (72 dBA L_{eq}[h]) at Activity Category E land use, traffic noise impacts are not predicted in Area B, and noise abatement is not considered for this area.

1.1.3 Area C (M3 through M12)

The traffic noise modeling results in Table B-1 indicate traffic noise levels at residences in Area C are predicted to be in the range of 57 to 65 dBA L_{eq}(h) in the design-year at Activity Category B land uses. The results also indicate that the increase in noise between existing conditions and the design-year is predicted to be 0 dB to 2dB increase. This increase is attributable to the vehicular increase from regional growth. Because the predicted noise levels in the design-year are not predicted to approach or exceed the noise abatement criterion (67 dBA L_{eq}[h]) at Activity Category B land use, traffic noise impacts are not predicted in Area C, and noise abatement is not considered for this area.

1.1.4 Area D (M14 through M23)

The traffic noise modeling results in Table B-1 indicate traffic noise levels at residences in Area D are predicted to be in the range of 56 to 65 dBA L_{eq}(h) in the design-year at Activity Category B land uses. The results also indicate that the increase in noise between existing conditions and the design-year is predicted to be 0 dB to 1dB increase. This increase is attributable to the vehicular increase from regional growth. Because the predicted noise levels in the design-year are not predicted to approach or exceed the noise abatement criterion (67 dBA L_{eq}[h]) at Activity Category B land use, traffic noise impacts are not predicted in Area D, and noise abatement is not considered for this area.

7.2. Preliminary Noise Abatement Analysis

Noise abatement is considered where noise impacts are predicted in areas of frequent human use that would benefit from a lowered noise level. According to 23 CFR 772(13)(c) and 772(15)(c), federal funding may be used for the following abatement measures:

- Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way.

- Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations.
- Alteration of horizontal and vertical alignments.
- Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise.
- Noise insulation of Activity Category D land use facilities listed in Table 1. Post-installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

There are no modeling sites that approach or exceeds the noise abatement criterion (67 dBA L_{eq}[h]) at Activity Category B or C land use, and therefore, no abatement is considered at this time.

Chapter 8. Construction Noise

During construction of the Project, noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. Noise associated with construction is controlled by Caltrans Standard Specification Section 14-8.02, "Noise Control," which states the following:

> Do not exceed 86 dBA L_{max} at 50 feet from the job site activities from 9 p.m. to 6 a.m.
>
> Equip an internal combustion engine with the manufacturer-recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

Table 8-1 summarizes noise levels produced by construction equipment that is commonly used on roadway construction projects. Construction equipment is expected to generate noise levels ranging from 80 to 90 dB at a distance of 50 feet, and noise produced by construction equipment would be reduced over distance at a rate of about 6 dB per doubling of distance.

Table 8-1. Construction Equipment Noise

Equipment	Maximum Noise Level (dBA at 50 feet)
Scrapers	85
Bulldozers	85
Heavy Trucks	84
Backhoe	80
Pneumatic Tools	85
Concrete Pump	82
Grader	85
Roller	85
Concrete Saw	90
Excavator	85
Front End Loader	80

Source: Federal Transit Administration, 2006. See also:
http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

No adverse noise impacts from construction are anticipated because construction would be conducted in accordance with Caltrans Standard Specifications Section 14.8-02 Noise Control, which states "Control and monitor noise resulting from work activities. Do not exceed 86 dBA Lmax at 50 feet from the job site from 9:00 p.m. to 6:00 a.m." Construction noise would be short-term, intermittent, and overshadowed by local traffic noise.

Chapter 9. References

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Appendix A Traffic Data

This appendix contains tables presenting the traffic data for existing conditions, design-year conditions without the project, and design-year conditions with the project for each alternative.

Tables A-1 through A-3 show the traffic used for TNM modeling.

Table A-1. Traffic Data for Existing Conditions

	Segment	Number of Lanes	Total Volume PM Peak Hour Volume	Auto		Medium Trucks		Heavy Trucks		Speed
				%	Volume	%	Volume	%	Volume	
Mainline										
SR 29 Northbound	South of Oakville Cross Road	1	656	96.7%	634	1.65%	11	1.65%	11	50/50/50
SR 29 Northbound	North of Oakville Cross Road	1	663	96.8%	642	1.6%	11	1.6%	11	50/50/50
SR 29 Southbound	North of Oakville Cross Road	1	1,057	96.7%	1022	1.65%	18	1.65%	17	50/50/50
SR 29 Southbound	South of Oakville Cross Road	1	1,103	96.8%	1,068	1.6%	18	1.6%	17	50/50/50
Surface Streets										
Oakville Cross Road Eastbound	East of SR 29	1	65	92.3%	99	4.6%	3	3.1%	2	25/25/25
Oakville Cross Road Westbound	East of SR 29	1	98	98.0%	96	1.0%	1	1.0%	1	25/25/25

Table A-2. Traffic Data for Design Year No-Project Conditions

	Segment	Number of Lanes	Total Volume PM Peak Hour Volume	Auto		Medium Trucks		Heavy Trucks		Speed
				%	Volume	%	Volume	%	Volume	
Mainline										
SR 29 Northbound	South of Oakville Cross Road	1	805	96.5%	777	1.65%	14	1.65%	14	50/50/50
SR 29 Northbound	North of Oakville Cross Road	1	815	96.8%	789	1.6%	13	1.6%	13	50/50/50
SR 29 Southbound	North of Oakville Cross Road	1	1,290	96.7%	1,247	1.65%	22	1.65%	21	50/50/50
SR 29 Southbound	South of Oakville Cross Road	1	1,355	96.8%	1312	1.6%	22	1.6%	21	50/50/50
Surface Streets										
Oakville Cross Road Eastbound	East of SR 29	1	85	92.3%	77	3.85%	4	3.85%	4	25/25/25
Oakville Cross Road Westbound	East of SR 29	1	140	97.0%	90	1.5%	2	1.5%	2	25/25/25

Table A-3. Traffic Data for Design Year with Project Conditions

	Segment	Number of Lanes	Total Volume PM Peak Hour Volume	Auto		Medium Trucks		Heavy Trucks		Speed
				%	Volume	%	Volume	%	Volume	
Mainline										
SR 29 Northbound	South of Oakville Cross Road	1	1,160	91.5%	1,062	5.2%	61	3.0%	34	50/50/50
SR 29 Northbound	North of Oakville Cross Road	1	1,143	91.5%	1,046	5.2%	61	3.0%	34	50/50/50
SR 29 Southbound	North of Oakville Cross Road	1	1,145	91.6%	1,049	4.8%	55	3.1%	35	50/50/50
SR 29 Southbound	South of Oakville Cross Road	1	1,174	91.6%	1,075	4.8%	56	3.1%	37	50/50/50
Surface Streets										
Oakville Cross Road Eastbound	East of SR 29	1	108	91.2%	99	5.3%	6	3.5%	4	25/25/25
Oakville Cross Road Westbound	East of SR 29	1	98	91.8%	90	5.1%	5	3.1%	3	25/25/25

Appendix B Predicted Future Noise Levels and Noise Barrier Analysis

Table B-1. Predicted Future Noise and Barrier Analysis

Receptor I.D.	Area	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level L_{eq}(h), dBA	SR-29 Future Worst Hour Noise Levels – L_{eq}(h), dBA: Design Year Noise Level without Project L_{eq}(h), dBA	Design Year Noise Level with Project 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	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
M1	A	-	Residential	1	7962 St Helena Hwy	65	65	65	0	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M2	A	-	Commercial	None	7856 St Helena Hwy	66	67	67	1	0	E (72)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M24	B		Commercial	None	7855 St Helena Hwy	62	62	59	0	-3	E (72)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M3	C	-	Residential	1	1183 Oakville Cross Rd	55	57	57	2	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M4	C	-	Residential	1	1185 Oakville Cross Rd	55	57	57	2	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M5	C	-	Residential	1	1187 Oakville Cross Rd	55	57	57	2	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M6	C	-	Residential	1	7816 St Helena Hwy	57	58	58	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M7	C	-	Residential	1	7814 St Helena Hwy	61	61	61	0	0	B (67))	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M8	C	-	Residential	1	7812 St Helena Hwy	61	62	62	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M9	C	-	Residential	1	7798-A St Helena Hwy	63	64	64	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M10	C	-	Residential	1	7800 St Helena Hwy	63	64	64	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M11	C	-	Residential	1	7798-B St Helena Hwy	55	56	56	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Receptor I.D.	Area	Barrier I.D.	Land Use	Number of Dwelling Units	Address	Existing Noise Level $L_{eq}(h)$, dBA	SR-29 Future Worst Hour Noise Levels – $L_{eq}(h)$, dBA						Noise Prediction with Barrier, Barrier Insertion Loss (I.L.), and Number of Benefited Receptors (NBR)																	
							Design Year Noise Level without Project $L_{eq}(h)$, dBA	Design Year Noise Level with Project $L_{eq}(h)$, 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	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
M12	C	-	Residential	1	7744 St Helena Hwy	62	62	62	0	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M13	C	-	Residential	1	7738 St Helena Hwy	64	65	65	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M14	D	-	Residential	1	7837 St Helena Hwy	60	61	60	1	-1	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M15	D	-	Residential	1	7831 St Helena Hwy	60	60	60	0	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M16	D	-	Residential	1	7825 St Helena Hwy	62	63	63	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M17	D	-	Residential	1	7765 St Helena Hwy	61	62	62	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M18	D	-	Residential	1		56	57	57	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M19	D	-	Residential	1		55	56	56	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M20	D	-	Residential	1	7763 St Helena Hwy	59	60	60	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M21	D	-	Residential	1	7759 St Helena Hwy	60	60	60	0	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M22	D	-	Residential	1	7757 St Helena Hwy	59	60	60	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M23	D	-	Residential	1	7735 St Helena Hwy	64	65	65	1	0	B (67)	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Note: All NAC are exterior unless note. A/E= Future noise conditions approach or exceed the Noise Abatement Criteria; SI = Substantial Increase

[a] Minimum height needed to break the line of sight between 11.5-foot truck stack and first row receptors.

Appendix C Supplemental Data

wsp

FIELD MEASUREMENT DATA SHEET

Project Name: SR29-Oakville Cross Rd **Job #** ______

SITE IDENTIFICATION: ST-1 **OBSERVER(s):** Michael Lieu / Adelicia Johnson
START DATE & TIME: 9/27/2022 **END DATE & TIME:** 9/28/2022
ADDRESS: 1118 Oakville Cross Road (1) 9/27 1:55 PM -15 min (2) 9/28 9:10 AM
GPS coordinates:

ID

TEMP: 80 °F HUMIDITY: 0 % R.H. WIND: **(CALM)** LIGHT MODERATE VARIABLE
WINDSPEED: 0-5 MPH DIR: N NE E SE S **(SW)** W NW STEADY GUSTY ____ MPH
SKY: **(CLEAR)** SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ______

Weather

INSTRUMENT: BK2238 **TYPE:** (1) 2 **SERIAL #:** 2160297
CALIBRATOR: LD CAL200 **SERIAL #:** 3415
CALIBRATION CHECK: **PRE-TEST** 93.9 **dBA SPL** **POST-TEST** 94.0 **dBA SPL** **WINDSCREEN** Y
SETTINGS: **A-WEIGHTED (SLOW) FAST FRONTAL RANDOM ANSI OTHER:** ______

	Rec #	Start Time / End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
PM-	9/27	1:55 / 2:10	61.6	87.2	37.8	39.5	43.5	62.5	
AM	9/28	9:10am 9:25	63.3	84.2	39.3	44.5	53.0	66.5	
		/							
		/							

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): **TRAFFIC AIRCRAFT RAIL INDUSTRIAL (AMBIENT) OTHER**
ROADWAY TYPE: 1 Lane each direction
COUNT DURATION: 15 **-MINUTE** **SPEED (mph)** **#2 COUNT:** AM **SPEED (mph)**

PM

	NB / (EB)	SB / (WB)	Speed NB EB	Speed SB WB	#2 NB / (EB)	#2 SB / (WB)	Speed NB EB	Speed SB WB
AUTOS:	19	19	25	25	10	18	25	25
MED. TRUCKS:	3	1	↓	↓	2	4	↓	↓
HVY TRUCKS:					2	1		
BUSES:								
MOTORCYCLES:								

SPEED ESTIMATED BY: **RADAR / DRIVING / OBSERVER**

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS**
OTHER:

Source Info and Traffic Counts

TERRAIN: **HARD SOFT MIXED FLAT OTHER:**
PHOTOS:
OTHER COMMENTS / SKETCH:

Main line SR 29 Traffic

9/27 PM -15 min

	NB	SB
C	148	190
MT	14	9
HT	6	11
B	1	0

9/28 AM

	NB	SB
C	192	143
MT	11	10
HT	12	6
B	1	1

Description / Sketch

Field Measurement Site 1

wsp

FIELD MEASUREMENT DATA SHEET

Project Name: SR29-Oakville Cross Rd **Job #** ______

SITE IDENTIFICATION: ST-2 **OBSERVER(s):** Michael Cien / Adelicia Johnson
START DATE & TIME: 9/27/2022 **END DATE & TIME:** 9/28/2022
ADDRESS: 7800 St Helena Hwy
Adjacent to property
① PM – 2:15 – 2:30 PM 9/27
GPS coordinates: ② AM – 9:40 – 9:55 AM 9/28

ID

TEMP: 80 °F HUMIDITY: 0 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 0–5 MPH DIR: N NE E SE (S SW) W NW STEADY GUSTY ____ MPH
SKY: (CLEAR) SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ______

Weather

INSTRUMENT: BK2238 **TYPE:** (1) 2 **SERIAL #:** 2160297
CALIBRATOR: LD CAL200 **SERIAL #:** 3415
CALIBRATION CHECK: **PRE-TEST** 94.0 **dBA SPL POST-TEST** 94.0 **dBA SPL WINDSCREEN** Y
SETTINGS: **A-WEIGHTED (SLOW) FAST FRONTAL RANDOM ANSI OTHER:** ______

	Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
9/27 PM		2:15	2:30	67.8	84.0	43.1	53.5	63.5	69.5	
9/28 AM		9:40	9:55	~~69.5~~	86.3	36.0	52.5	65.0	71.0	
				69.2						

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): **TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER**
ROADWAY TYPE: SR 29 – 45-55 mph
COUNT DURATION: 15 -MINUTE

	PM 9/27 (NB) / EB	(SB) / WB	SPEED (mph) NB EB	SB WB	#2 COUNT: AM 9/28 NB / EB	SB / WB	SPEED (mph) NB EB	SB WB
AUTOS:	150	195	45-55	45-55	197	137	45-55	45-55
MED. TRUCKS:	10	6	↓	↓	~~10~~ 9	10	↓	↓
HVY TRUCKS:	4	9	↓	↓	10	6	↓	↓
BUSES:	1	0	↓	↓	1	1	↓	↓
MOTORCYCLES:								

SPEED ESTIMATED BY: **RADAR / DRIVING / OBSERVER**

OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS**
OTHER:

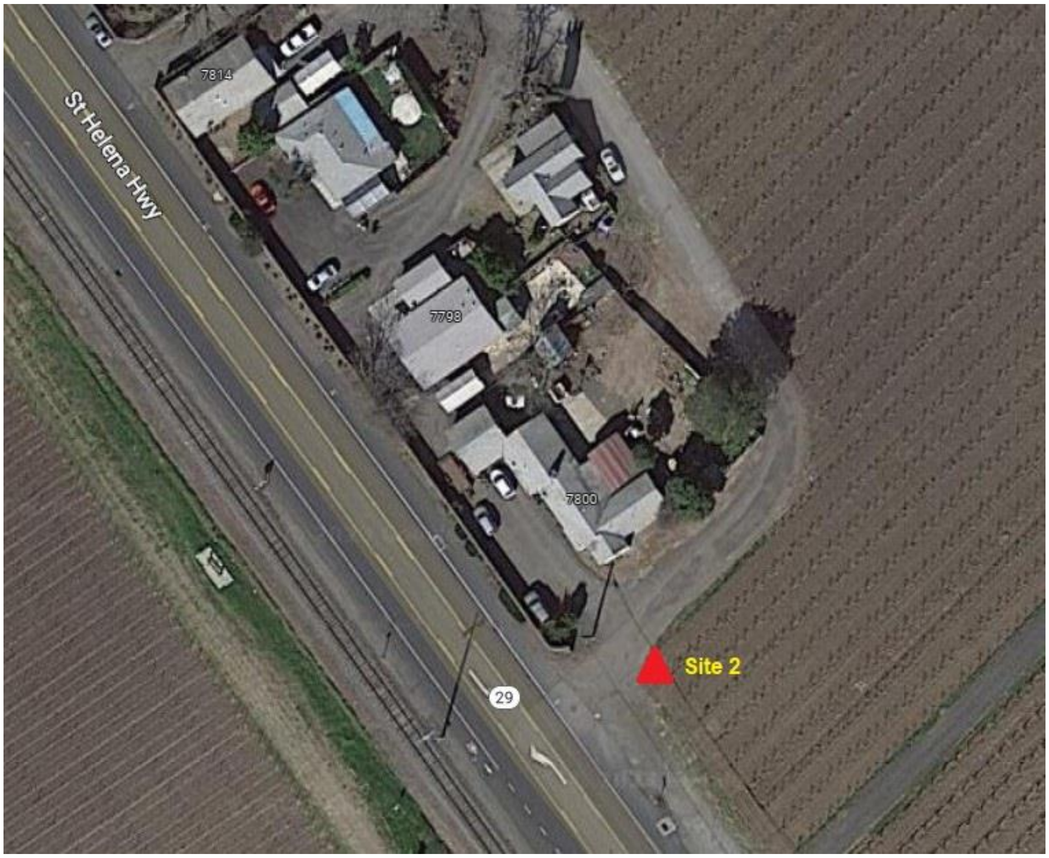
Source Info and Traffic Counts

TERRAIN: **(HARD) SOFT MIXED FLAT OTHER:**
PHOTOS:
OTHER COMMENTS / SKETCH:

- Adjacent to Residential homes;
- Homes below grade of Roadway
- ≈6 ft wall along prop line/ROW

Description / Sketch

Field Measurement Site 2



wsp

FIELD MEASUREMENT DATA SHEET

Project Name: SR29 Oakville Cross Rd Job #

ID

SITE IDENTIFICATION: ST-3 OBSERVER(s): Michael Lieu / Adelicia Johnson

START DATE & TIME: 9/27/2022 END DATE & TIME: 9/28/2022

ADDRESS: Vineyard across from 7788 St Helena Hwy

Pm 9/27 2:35-2:50Pm

Am 9/28 10:00-10:15Am

GPS coordinates:

Weather

TEMP: 80 °F HUMIDITY: 0 % R.H. WIND: CALM (LIGHT) MODERATE VARIABLE

WINDSPEED: 0-5 MPH DIR: N NE E SE (S SW) W NW STEADY GUSTY ____ MPH

SKY: (CLEAR) SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ____

Acoustic Measurements

INSTRUMENT: BK 2238 TYPE: (1) 2 SERIAL #: ~~2160297~~ ~~21609~~ 2160297

CALIBRATOR: LD CAL200 SERIAL #: 3415

CALIBRATION CHECK: PRE-TEST 94.0 dBA SPL POST-TEST 94.0 dBA SPL WINDSCREEN Y

SETTINGS: A-WEIGHTED (SLOW) FAST FRONTAL RANDOM ANSI OTHER: ____

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}	
9/27 Pm	2:35	2:50	62.4	81.6	44.2	53.0	58.5	63.0	
9/28 Am	10:00	10:15	64.6	81.3	42.9	53.0	60.0	64.5	

COMMENTS:

Source Info and Traffic Counts

PRIMARY NOISE(S): (TRAFFIC) AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER

ROADWAY TYPE: SR 29 - 45-50 mph

COUNT DURATION: 15 -MINUTE

	Pm 9/27 (NB) / EB	(SB) / WB	SPEED (mph) NB EB / SB WB		#2 COUNT: Am 9/28 (NB) / EB	(SB) / WB	SPEED (mph) NB EB / SB WB	
AUTOS:	151	187	45-50		197	110		
MED. TRUCKS:	5	11	↓	↓	10	12	40-50	
HVY TRUCKS:	4	5	↓	↓	7	6	↓	↓
BUSES:	0	1	↓	↓	1	0	↓	↓
MOTORCYCLES:	0	0			0	0		

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER NOISE SOURCES: distant AIRCRAFT overhead / RUSTLING LEAVES / distant BARKING DOGS / BIRDS / distant CHILDREN PLAYING / distant TRAFFIC / distant LANDSCAPING / distant TRAINS

OTHER:

Description / Sketch

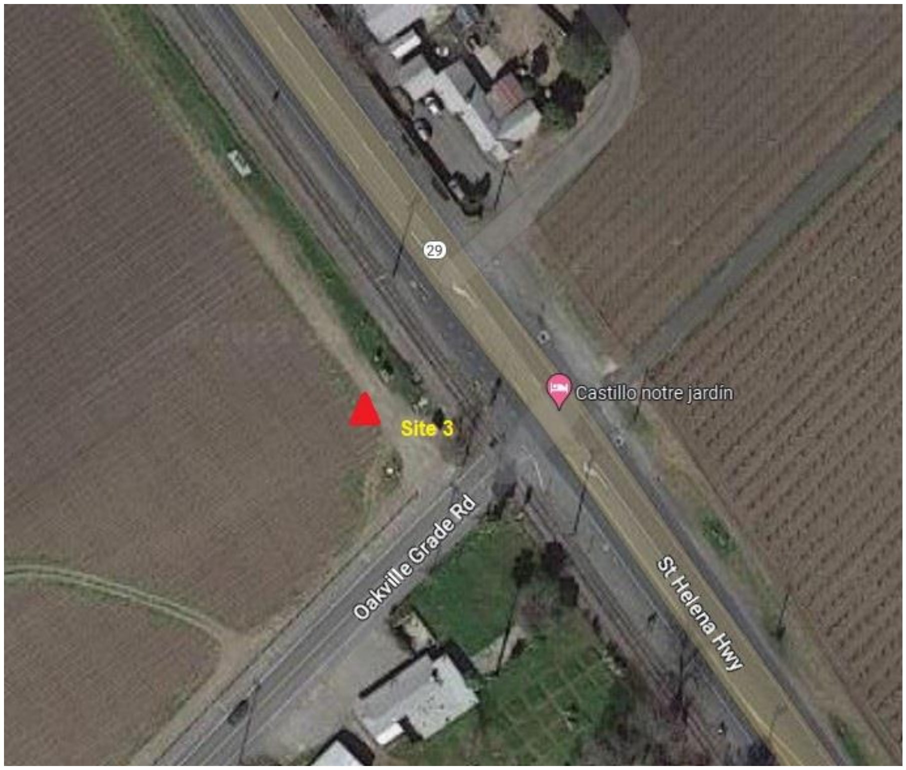
TERRAIN: (HARD) SOFT MIXED FLAT OTHER:

PHOTOS:

OTHER COMMENTS / SKETCH:

measurements

Field Measurement Site 3



wsp

FIELD MEASUREMENT DATA SHEET

Project Name: SR29 Oakville Cross Rd **Job #**

SITE IDENTIFICATION: ST-3 **OBSERVER(s):** Michael Lien / Adelicia Johnson
START DATE & TIME: 9/27/2022 **END DATE & TIME:** 9/28/2022
ADDRESS: Vineyard across from 7788 St Helena Hwy
Pm 9/27 2:35-2:50 Pm
Am 9/28 10:00-10:15 Am
GPS coordinates:

ID

TEMP: 80 °F HUMIDITY: 0 % R.H. WIND: CALM (**LIGHT**) MODERATE VARIABLE
WINDSPEED: 0-5 MPH DIR: N NE E SE (**S SW**) W NW STEADY GUSTY ____ MPH
SKY: (**CLEAR**) SUNNY DARK PARTLY CLOUDY OVRCST FOG DRIZZLE RAIN Other: ________

Weather

INSTRUMENT: BK2238 **TYPE:** (**1**) 2 **SERIAL #:** ~~2160297~~ ~~21609~~ 2160297
CALIBRATOR: LD CAL200 **SERIAL #:** 3415
CALIBRATION CHECK: **PRE-TEST** 94.0 **dBA SPL** **POST-TEST** 94.0 **dBA SPL** **WINDSCREEN** Y
SETTINGS: **A-WEIGHTED** (**SLOW**) **FAST FRONTAL RANDOM ANSI OTHER:**

Rec #	Start Time	End Time	L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}
9/27 Pm	2:35	2:50	62.4	81.6	44.2	53.0	58.5	63.0
9/28 Am	10:00	10:15	64.6	81.3	42.9	53.0	60.0	64.5

COMMENTS:

Acoustic Measurements

PRIMARY NOISE(S): (**TRAFFIC**) **AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER**
ROADWAY TYPE: SR 29 – 45-50 mph
COUNT DURATION: 15 **-MINUTE** **SPEED (mph)** **#2 COUNT:** Am 9/28 **SPEED (mph)**

Pm 9/27	(NB) / EB	(SB) / WB	SPEED NB EB / SB WB	#2 (NB) / EB	#2 (SB) / WB	SPEED NB EB / SB WB
AUTOS:	151	187	45-50	197	110	
MED. TRUCKS:	5	11	↓	10	12	40-50
HVY TRUCKS:	4	5	↓	7	6	↓
BUSES:	0	1	↓	1	0	↓
MOTORCYCLES:	0	0		0	0	

SPEED ESTIMATED BY: **RADAR / DRIVING / OBSERVER**

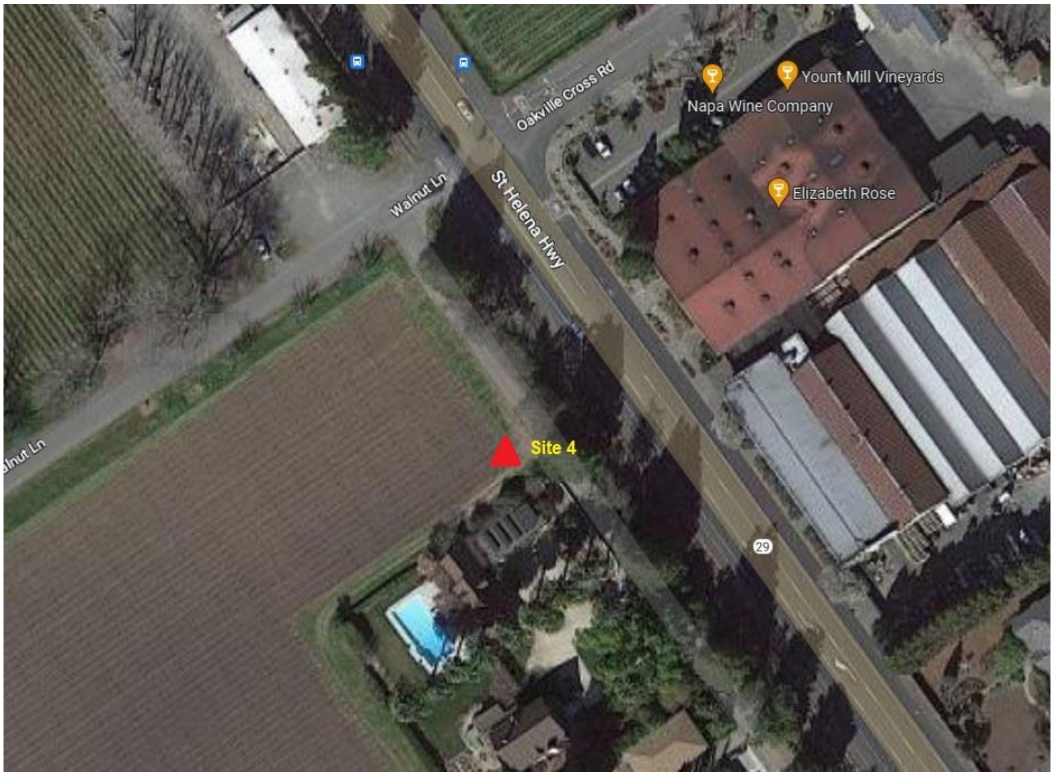
OTHER NOISE SOURCES: distant **AIRCRAFT** overhead / **RUSTLING LEAVES** / distant **BARKING DOGS** / **BIRDS**
distant **CHILDREN PLAYING** / distant **TRAFFIC** / distant **LANDSCAPING** / distant **TRAINS**
OTHER:

Source Info and Traffic Counts

TERRAIN: (**HARD**) **SOFT MIXED FLAT OTHER:**
PHOTOS:
OTHER COMMENTS / SKETCH:

Description / Sketch

Field Measurement Site 4



CERTIFICATE OF CALIBRATION
27607-1
FOR BRÜEL & KJÆR
SOUND LEVEL METER

Model **2238**

Serial No. **2160297**
ID No. **N/A**

With Microphone Model **4188**

Serial No. **2407350**

Customer: **WSP USA**
Orange, CA 92868

P.O. No. **19012023-BK2238**

was tested and met factory specifications at the points tested and as outlined in ANSI S1.4-1983 Type 1; IEC 651-1979 Type 1; IEC-61672-3:2006 Class 1

on **17 FEB 2022**

BY **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specification.
Re-calibration due on: **17 FEB 2023**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	1051	1777523	27 SEP 2022	27 SEP 2023
B&K	2636	1423390	02 JAN 2023	02 JAN 2024
B&K	4226	3274134	30 NOV 2022	30 NOV 2023
B&K	4231	1770857	07 SEP 2022	07 SEP 2023
HP	34401A	3146A74093	11 MAY 2022	11 MAY 2024
HP	3458A	2823A07179	23 AUG 2022	23 AUG 2023

Performed in Compliance with ANSI, NCSL Z-540-1, 1994
and ISO 17025, ISO 9001:2015 Certification NQA No. 11252
*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" condition.

Reference Test Procedure: **ACCT Procedure 2238 Version 2.1.0.** (Rev. Aug 2013)
Brüel & Kjær Factory Service Instructions**: 2238**

Temperature	Relative Humidity	Barometric Pressure
23°C	**34** %	**991.61** hPa

Note: This calibration report shall not be reproduced, except in full, without written consent by Odin Metrology, Inc.

Signed: Harold Lynch

ODIN METROLOGY, INC.

CALIBRATION OF BRÜEL & KJÆR INSTRUMENTS
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405

Odin Metrology, Inc.
Calibration of Sound & Vibration Instruments

Certificate Number: **26916-1**

Certificate of Calibration for Larson Davis Calibrator

This calibration is performed by comparison with measurement reference standard instruments:

Type No.	4134
Serial No.	1315901
Calibrated by	HL
Cal Date	16 FEB 2022
Due Date	16 FEB 2023

a) Estimated uncertainty of comparison: ± **0.05** dB
b) Estimated uncertainty of calibration service for standard pistonphone: ± **0.06** dB
c) Total uncertainty: $\sqrt{a^2 + b^2}$ = ± **0.08** dB
d) Expanded uncertainty (coverage factor *k* = 2 for 95% confidence level): = ± **0.16** dB

This acoustic calibrator has been calibrated using standards with values traceable to the National Institute of Standards and Technology. This calibration is traceable to NIST Test Number **683/289533-17.**

CONDITION OF TEST		
Ambient Pressure	**997.74**	hPa
Temperature	**23**	°C
Relative Humidity	**27**	%
Date of Calibration	**17 FEB 2022**	
Re-calibration due on	**17 FEB 2023**	

The calibration of this acoustic calibrator was performed using a test system conforming to the requirements of ANSI/NCSLZ540-1, 1994, ISO 17025, and ISO 9001-2015, Certification NQA No. 11252.

Calibration procedure: **OM-P-1001-Acoustic_Calibrator, Rev. 1.0 20130522.**

Calibration performed by

Harold Lynch, Service Manager

Calibrator type	**CAL150**
Serial no.	**0337**
Submitted by	**WSP USA** **Orange, CA 92868**
Purchase order no.	**Project# 7330**
Asset no.	**N/A**

This calibrator has been found to perform **within** the specifications listed below at the normalized conditions stated.

SPL produced in coupler terminated by a loading volume of a ½" microphone	94.0 ± 0.3 dB 114 ± 0.3 dB
Frequency	1,000 Hz ± 1%
Distortion	< 2%
At 1,013 hPa, 23°C, and 65% relative humidity	

PERFORMANCE AS RECEIVED		
Frequency	**1000.0**	Hz
SPL (94 dB)	**94.08**	dB
SPL (114 dB)	**114.10**	dB
Distortion (at 114 dB)	**0.4**	%
Battery Voltage	**7.5**	V

Was adjustment performed? **No**
Were batteries replaced? **Yes**

FINAL PERFORMANCE		
Frequency	**1000.0**	Hz
SPL (94 dB)	**94.08**	dB
SPL (114 dB)	**114.10**	dB
Distortion (at 114 dB)	**0.4**	%

Note: This calibrator was **within** manufacturer's specifications as received.

ODIN METROLOGY, INC.
3533 OLD CONEJO ROAD, SUITE 125
THOUSAND OAKS, CA 91320
PHONE: (805) 375-0830; FAX: (805) 375-0405

CERTIFICATE OF CALIBRATION
26916-3
FOR LARSON DAVIS PRECISION INTEGRATING SOUND LEVEL METER

Model **712** | Serial No. **0218**
ID No. **N/A**
With Microphone Model **N/A** | Serial No. **B10868**

Customer: **WSP USA**
Orange, CA 92868

P.O. No. **Project# 7330**

was tested to Larson Davis specifications at the points tested and as outlined in ANSI S1.4-1983 Type 2: IEC 651-1979 Type 2

on **18 FEB 2022** **BY** **HAROLD LYNCH**
Service Manager

As received and as left condition: Within Specifications.
Re-calibration due on: **18 FEB 2023**

Certified References*

Mfg.	Type	Serial No.	Cal Date	Due Date
B&K	4134	1315901	16 FEB 2022	16 FEB 2023
B&K	4226	3274134	30 NOV 2021	30 NOV 2022
HP	34401A	3146A48348	16 OCT 2021	16 OCT 2022

Calibration System operates in conformance to ANSI/ NCSL Z540-1, 1994 and ISO 17025, ISO 9001:2015 Certification NQA No. 11252

*References are traceable to NIST (National Institute of Standards and Technology).

Note: For calibration data see enclosed pages.
The data represent both "as found" and "as left" conditions.

Reference Test Procedure: **Odin Metrology Procedure for Larson Davis 712.**

Uncertainty of Reference 4226 in Pressure:
31.5 Hz-4k Hz: ± .20 dB 4k Hz-8k Hz: ± .25 dB
Uncertainty of ANSI Type 2 S.L.M.: 31.5 Hz-2k Hz: ± 2 dB
2k Hz-4k Hz: ± 2.5 dB 4k Hz-5k Hz: ± 3.0 dB 5k Hz-6.3k Hz: ± 3.5 dB 6.3k Hz-8k Hz: ± 4.5 dB
Uncertainty Ratio: > 4:1

Temperature	Relative Humidity	Barometric Pressure
23°C	**27** %	**997.33** hPa

Signed: Harold Lynch

ODIN METROLOGY, INC.
CALIBRATION OF SOUND & VIBRATION INSTRUMENTATION
3533 OLD CONEJO ROAD, SUITE 125 THOUSAND OAKS CA 91320
PHONE: (805) 375-0830 FAX: (805) 375-0405