Appendix F:

Noise Report

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Memorandum

Date:	July 31, 2025
To:	Ed Noriega, Mark Thomas & Company, Inc.
From:	Philip Ault, Director of Noise and Air Quality, FirstCarbon Solutions
Subject:	Noise Impacts Analysis for the Proposed Fournier Road Improvement Project in the Town of Mariposa, California

At the request of Mark Thomas & Company, Inc. (project applicant), FirstCarbon Solutions (FCS), prepared this memorandum to summarize the noise impact analysis findings for the proposed Fournier Road Improvement Project (proposed project) in the Town of Mariposa in Mariposa County, California.

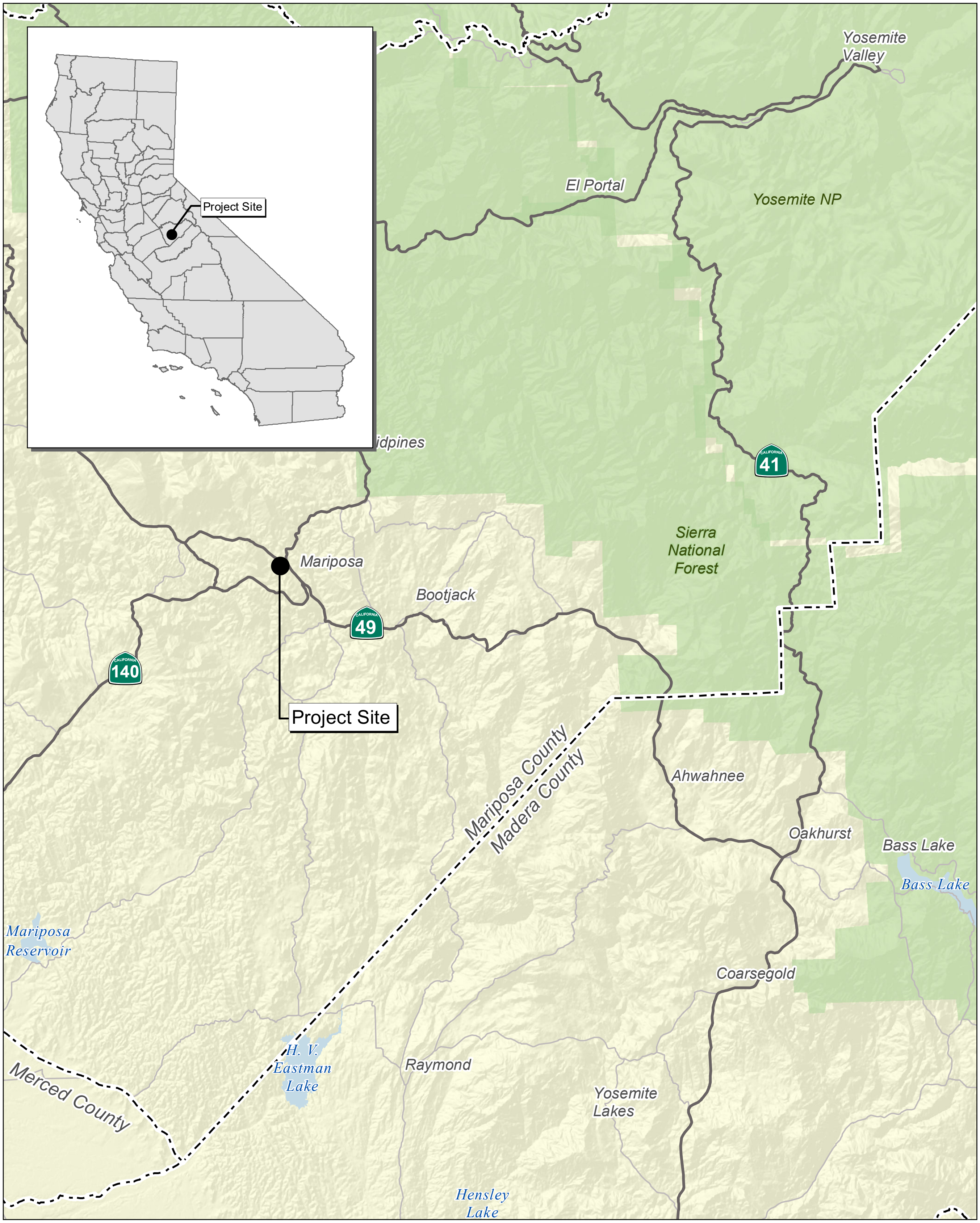
PROJECT DESCRIPTION

The proposed project is located along Fournier Road, beginning approximately 200 feet south of Antone Road and extending northeast to Joe Howard Street. Fournier Road is a two-way, 15-foot-wide roadway located in the southwest portion of the Town of Mariposa (Exhibit 1). Fournier Road consists of two lanes and is mostly unstriped except for a 100-foot section of striping near its intersection with Joe Howard Street. Fournier Road intersects Joe Howard Street approximately 75 feet south of State Route (SR) 49 (Exhibit 2). Fournier Road crosses over Mariposa Creek at a low-water crossing near the southern portion of the project site (Exhibit 2). The existing 18-inch culvert is undersized and contributes to roadway overtopping during storm events.

The project site is approximately 0.23 mile long and would consist primarily of roadway widening and associated improvements. The project site is 1.93 acres, including 0.47 acre of ground disturbance and 1.01 acres of street improvements (Exhibit 3). Proposed improvements would span the entire 0.23-mile length of the roadway and would include widening Fournier Road to two 12-foot travel lanes, construction of a sidewalk, curb and gutter, detention basin, and a bridge, as well as on-street parking adjacent to the cemetery. The proposed project would also include grading, right-of-way dedication, and relocation of utilities including water, sewer, storm drain, fiber optic, and electrical facilities. A cemetery driveway would be realigned to address safety concerns near the intersection of Fournier Road and Joe Howard Street. A total of 36 trees would be removed.

To accommodate roadway widening and the construction of a sidewalk along the southeast side of Fournier Road, fill-slope conform grading would be required throughout most of the project length. The roadway widening would require additional right-of-way dedication from the cemetery. The proposed detention basin would accommodate increased runoff from new impervious surfaces created by the roadway widening.

The purpose of the proposed widening and associated improvements on Fournier Road is to provide a more resilient route for residents to reach SR-49 during climate events. The proposed bridge would be designed so the water surface elevation upstream and downstream of the bridge would be equal to or lower than the water surface elevation shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM). The proposed improvements would address the roadway overtopping during storm events and improve evacuation conditions for occupants of several nearby housing developments and the Hyatt Hotel, providing increased access to SR-49. The proposed project is predominantly funded by the California Transportation Commission (CTC) for the Local Transportation Climate Adaptation Program (LTCAP). The California Department of Transportation (Caltrans) is the Lead Agency.



Source: Census 2000 Data, The California Spatial Information Library (CaSIL).

Exhibit 1
Regional Location Map

Source: ESRI Aerial Imagery. Mark Thomas, 05/29/2025, updated 06/05/2025.

Exhibit 2
Local Vicinity Map

Source: Google Earth Pro Aerial Imagery. Mark Thomas, 05/29/2025, updated 06/05/2025.

Exhibit 3
Site Plan

NOISE AND VIBRATION FUNDAMENTALS

A summary of the fundamentals of noise and vibration is provided as Attachment A to this document.

SETTING AND REGULATORY FRAMEWORK

Federal Regulations

Currently, no federal noise standards directly regulate environmental noise associated with temporary construction activities or the long-term operations of development projects.

Federal Transit Administration

Though not regulatory in nature, vibration impact criteria for buildings and other structures have been established by the Federal Transit Authority (FTA) as building and structural damages are generally the foremost concern when evaluating the impacts of construction-related vibrations. For the evaluation of the proposed project's construction-related vibration impacts, the following FTA vibration impact criteria, shown in Table 1, are used given the absence of applicable federal, State, and County standards specific to temporary construction activities and their potential to result in building and structural damages.[1]

Table 1: Federal Transit Administration Construction Vibration Impact Criteria

Building Category	PPV (in/sec)
I. Reinforced Concrete, Steel, or Timber (no plaster)	0.5
II. Engineered Concrete and Masonry (no plaster)	0.3
III. Nonengineered Timber and Masonry Buildings	0.2
IV. Buildings Extremely Susceptible to Vibration Damage	0.12
Notes: PPV = peak particle velocity VdB = vibration measured as root mean square (rms) velocity in decibels of 1 microinch per second Source: Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September.	

The FTA has also established criteria for the assessment of construction noise impacts. The FTA's day and nighttime criteria are shown in Table 2. To be discussed later, the County has adopted these criteria for assessment of the proposed project's construction noise impacts. According to the FTA, exceedances of these criteria may result in adverse community reaction.

[1] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual.

Table 2: Federal Transit Administration Construction Noise Impact Criteria

Land Use	$L_{eq\ equipment\ (8hr)}$	
	Day	Night
Residential	80	70
Commercial	85	85
Industrial	90	90

Notes:
$L_{eq\ equipment\ (8hr)}$ = equipment noise level in L_{eq} over an 8-hour time period. The analysis assumes that the L_{eq} over this time period would be approximately equal to the L_{eq} over a single construction workday, from start to finish of that day's activities.

Source: Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. Detailed Analysis Construction Noise Criteria. September.

State Regulations

2017 General Plan Guidelines

The State of California's 2017 General Plan Guidelines propose county and city standards for acceptable exterior noise levels based on land use. These standards are incorporated into land use planning processes to prevent or reduce noise and land use incompatibilities. The State's suggested compatibility considerations between various land uses and exterior noise levels are not regulatory in nature but are recommendations intended to aid communities in determining their own noise-acceptability standards.

Local Regulations

The project site is located in the Town of Mariposa in Mariposa County, California. The County addresses noise in the County of Mariposa General Plan (General Plan) Noise Element and in the County Municipal Code. The standards for all noise sources are based upon the Community Noise Equivalent (CNEL)/day-night average noise level (L_{dn}) descriptor.

County of Mariposa General Plan

The General Plan Noise Element provides goals and policies to guide compatible land uses and the incorporation of noise attenuation measures for new uses to protect people living and working in the Town from an excessive noise environment. The County's applicable policies include the following Policies and Implementation Measures (IMs):

Goal 15-1 **Preserve the quality of life in Mariposa County by controlling noise at its source**

Policy 15.1a Control noise at its source.

IM 15.1a(1) A noise ordinance should be considered to define the standards for the County.

IM 15.1a(2) County development standards shall require means of controlling noise at its source as opposed to imposing mitigation as the means of offsetting noise impacts.

IM 15.1a(3) The County shall develop and implement standards that will reduce vibration from construction activities to a level that is less than perceptible at adjacent property lines.

Goal 15-2 **Protect County residents from the harmful and annoying effects of exposure to excessive noise**.

Policy 15-2a Siting and construction of facilities intended for noise-sensitive uses shall comply with the noise reduction standards of applicable State building codes

IM 15-2a(1) The State building standards for the proper insulation of new dwellings for noise reduction shall be enforced.

Policy 15-2b New projects with extensive noise potential shall incorporate mitigation measures.

IM 15-2b(1) Where proposed nonresidential land uses are likely to produce excessive noise levels at existing or planned noise-sensitive uses, an acoustical analysis shall be required as part of the project review process. An acoustical analysis should:

- Be prepared by a person qualified in environmental noise assessment and architectural acoustics,
- Include representative noise level measurements to adequately describe local conditions,
- Recommend appropriate mitigation to achieve compliance with the adopted policies and standards,
- Estimate noise exposure after the prescribed mitigation measures have been implemented, and
- Describe a post -project mitigation measure effectiveness assessment program.

IM 15-2b(2) Noise created by new transportation noise sources shall be mitigated.

Policy 15-2c Ensure that new development does not produce noise levels that create an unacceptable noise environment in those existing areas of the County where the noise environment is deemed acceptable, and also in those locations deemed noise-sensitive.

Mariposa County Short-term Noise Ordinance and Permanent Noise Standards

Mariposa County currently does not have an adopted noise ordinance.

Existing Noise Conditions

Ambient Noise

The project site is located on Fournier Road and is bounded by Creekside Terrace apartments to the north, residential homes to the west, a cemetery of the east, and commercial buildings to the north and east. The dominant noise source in the project vicinity includes traffic from Fournier Road.

THRESHOLDS OF SIGNIFICANCE AND IMPACT ANALYSIS

Thresholds of Significance

According to California Environmental Quality Act (CEQA) Guidelines, Appendix G, to determine whether impacts related to noise and vibration are significant environmental effects, the following questions are analyzed and evaluated.

Would the proposed project:

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

b) Generate excessive groundborne vibration or groundborne noise levels?

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 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?

Substantial Noise Increase in Excess of Standards

Construction Noise

For purposes of this analysis, a significant impact would occur if construction activities would result in a substantial temporary increase in ambient noise levels in excess of the County's applicable noise standards.

While the County does not establish substantial temporary noise level increase thresholds for construction activities, this analysis uses the noise limits established by the FTA to identify the potential for impacts due to substantial temporary construction noise. The FTA identifies construction noise limits in the Transit Noise and Vibration Impact Assessment Manual.[2] During daytime hours, a significant

[2] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September.

temporary increase would be an increase in excess of the average daily noise levels of 80 A-weighted decibel (dBA) equivalent noise level over an 8-hour time period ($L_{eq(8\text{-}hour)}$) as measured at a receiving residential land use and 85 dBA $L_{eq(8\text{-}hour)}$ as measured at a receiving commercial land use.

On-site Construction Noise Impact

Construction is anticipated to last 4 to 6 months. Construction is completed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the site and, therefore, the noise levels surrounding the site as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full-power operation followed by 3 or 4 minutes at lower power settings. Impact equipment, such as impact pile drivers, are not planned to be used during construction of this proposed project.

The loudest phase of construction is typically the site preparation and grading phase, as that is when the loudest pieces of heavy construction equipment would operate. For example, the maximum noise level generated by each grader is assumed to be 85 dBA maximum noise/sound level (L_{max}) at 50 feet from this equipment. Each front-end loader would also generate 80 dBA L_{max} at 50 feet. The maximum noise level generated by each backhoe is approximately 80 dBA L_{max} at 50 feet.

A conservative but reasonable assumption is that this equipment would operate simultaneously and continuously over at least a 1-hour period in the vicinity of the closest existing residential receptors but would move linearly over the project site as they perform their earthmoving operations, spending a relatively short amount of time adjacent to any one receptor. A characteristic of sound is that each doubling of sound sources with equal strength increases a sound level by 3 dBA. Assuming that each piece of construction equipment operates at some distance from the other equipment, a reasonable worst-case combined noise level during this phase of construction would be 90 dBA L_{max} at a distance of 50 feet from the acoustic center of a construction area. The acoustical center reference is used because construction equipment must operate at some distance from one another on a project site and the combined noise level as measured at a point equidistant from the sources (acoustic center) would be the worst-case maximum noise level. These operations would be expected to result in a reasonable worst-case hourly average of 84 dBA L_{eq} at a distance of 50 feet from the acoustic center of a construction area. These worst-case construction noise levels would only occur during the site preparation phase of development.

The closest residential noise-sensitive receptor to the project site is a single-family residential building located directly west of the project site. The façade of this building would be located approximately 65 feet from the acoustic center of construction activity where multiple pieces of heavy construction equipment would potentially operate simultaneously at the project site. At this distance, relative worst-case hourly average construction noise levels would attenuate to approximately 83 dBA $_{Lmax}$, intermittently, and could have an hourly average of up to 79 dBA L_{eq}. These reasonable worst-case construction noise levels would only occur periodically throughout the day while construction equipment operates along the nearest project boundaries. Additionally, these noise levels would drop off at a rate of 6 dBA per doubling of distance as the equipment moves over the project site. Therefore, the calculated reasonable worst-case 8-hour average noise level for construction, assuming construction equipment moves over the project site, would be 73 dBA $L_{eq(8\text{-hour})}$ as measured at the nearest residential receptor. The calculation spreadsheet with detailed modeling assumptions is provided in Attachment B.

Therefore, these calculated reasonable worst-case construction noise levels would not exceed the FTA's average daily thresholds of 80 dBA $L_{eq(8\text{-hour})}$ as measured at the nearest residential receptors and 85 dBA $L_{eq(8\text{-hour})}$ as measured at the nearest commercial receptors. Therefore, the proposed project would not result in substantial temporary increase in ambient noise levels at off-site sensitive receptors above established standards and construction noise impacts on sensitive receptors in the project vicinity would be **less than significant.**

Operational Noise Impacts

Mobile Source Noise Impacts

A significant impact would occur if project-generated traffic would result in a substantial increase in ambient noise levels compared with those that would exist without the proposed project. The proposed project involves improvements to the existing Fournier Road (as described in the project description above) and does not include construction of a new roadway, extension of the road, or any new land uses that would generate traffic. The purpose of the proposed project is to address overtopping during storm events and improve emergency access for existing nearby residential developments and the Hyatt Hotel. These improvements would not induce new vehicle trips beyond existing conditions nor would it move the roadway alignment closer to sensitive receptors to a degree that would result in any measurable change in traffic noise levels. Therefore, there is no potential for the project to generate an increase in traffic noise levels in the project vicinity.

In addition, the proposed project would not introduce any operational stationary noise sources such as mechanical equipment or other infrastructure that would generate noise after construction is complete. Therefore, the proposed project would not result in a substantial temporary or permanent increase in ambient noise levels from operational sources in the project vicinity and the impact would be **less than significant.**

EXCESSIVE GROUNDBORNE VIBRATION LEVELS

Construction Vibration Impacts

The County's policies and ordinances do not establish a numeric threshold for construction vibration impacts. Therefore, for the purposes of this analysis, a significant impact would occur if project construction activities would expose existing structures in the project vicinity to groundborne vibration levels in excess of the FTA's vibration impact criteria identified in Table 1.

Of the variety of equipment used during construction, the large vibratory rollers that are anticipated to be used in the site preparation phase of construction would produce the greatest groundborne vibration levels. Large vibratory rollers produce groundborne vibration levels ranging up to 0.210 inch per second (in/sec) peak particle velocity (PPV) at 25 feet from the operating equipment.

The nearest off-site structure is located approximately 65 feet west from the nearest construction footprint where small vibratory rollers would potentially operate. At this distance, groundborne vibration levels would range up to 0.05 in/sec PPV from operation of the types of equipment that would produce the highest vibration levels. This is well below the FTA's construction vibration damage criteria of 0.2 in/sec PPV for this type of structure, a building of nonengineered timber and masonry construction. As a result, construction of the proposed project would not expose nearby buildings to groundborne vibration levels in excess of their applicable FTA damage criteria and this impact would be **less than significant.**

Operational Vibration Impacts

Implementation of the proposed project would not include any permanent sources that would expose persons in the project vicinity to groundborne vibration levels that could be perceptible without instruments at any receiving property line. In addition, there are no existing significant permanent sources of groundborne vibration in the project vicinity to which the proposed project would be exposed. Therefore, project operational groundborne vibration level impacts would be **less than significant.**

EXCESSIVE NOISE LEVELS FROM AIRPORT ACTIVITY

A significant impact would occur if the proposed project would expose people residing or working in the project area to excessive noise levels for a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport.

The closest airport to the project site is Mariposa-Yosemite Airport, located approximately 3.4 miles northwest of the project site. Because of the distance to the airports and the orientation of the runways, the project site lies outside of the 60 dBA CNEL noise contours. Although aircraft noise is occasionally audible on the project site, nearby airport activity would not expose people residing or working near the project site to excessive noise levels. Furthermore, this is a roadway improvement project and does not introduce any new sensitive receptors. Therefore, implementation of the proposed project would not expose persons residing or working in the project vicinity to noise levels from airport activity that would be in excess of normally acceptable standards for the proposed land use development, and **no impact would occur.**

CONCLUSION

Based on the project understanding described above, the proposed project would result in less than significant impacts related to noise and vibration. Thank you for the opportunity to conduct this noise impact analysis. Please feel free to contact Phil Ault (559.930.6191 or pault@fcs-intl.com) should you have any questions.

Sincerely,

Philip Ault, Director of Noise and Air Quality
FirstCarbon Solutions
2999 Oak Road, Suite 250
Walnut Creek, CA 94597

Attachment A: Fundamentals of Noise
Attachment B: Noise Modeling Data

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Attachment A:

Fundamentals of Noise

NOISE AND VIBRATION FUNDAMENTALS

Characteristics of Noise and Descriptors

Sound can be described in terms of its loudness (amplitude) and frequency (pitch). The standard unit of measurement for sound is the decibel, abbreviated dB. Because the human ear is not equally sensitive to sound at all frequencies, the A-weighted scale (dBA) is used to reflect the normal hearing sensitivity range of the human ear. Table 1 provides examples of A-weighted noise levels from common sources. Although the terms “sound” and “noise” are often used synonymously, noise is commonly defined as sound that is either loud, unpleasant, unexpected, or undesired.[1] Because decibels are logarithmic units, they cannot be simply added or subtracted. For example, two cars each producing 60 dBA of noise would not produce a combined 120 dBA.

Table 1: A-Weighted Decibel Scale

Common Noise Sources	Sound Level, dBA
Near Jet Engine	130
Rock and Roll Band	110
Jet Flyover at 1,000 feet	100
Power Motor	90
Food Blender	80
Living Room Music	70
Human Voice at 3 feet	60
Residential Air Conditioner at 50 feet	50
Bird Calls	40
Quiet Living Room	30
Average Whisper	20
Rustling Leaves	10

Notes:
These noise levels are approximations intended for general reference and information use. They do not meet the standard required for detailed noise analysis but are provided for the reader to gain a rudimentary concept of various noise levels.
Source: Cowan, James P. 1993. Handbook of Environmental Acoustics.

Table 2 briefly defines common noise measurement descriptors and other sound terminology used in this memorandum.

1 California Department of Transportation (Caltrans). 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol.

Table 2: Sound Terminology

Term	Definition
Sound	A vibratory disturbance created by a vibrating object which, when transmitted by pressure waves through a medium such as air, can be detected by a receiving mechanism such as the human ear or a microphone.
Noise	Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
Ambient Noise	The composite of noise from all sources near and far in a given environment.
Decibel (dB)	A unitless measure of sound on a logarithmic scale which represents the squared ratio of sound pressure amplitude to a reference sound pressure. The reference pressure is 20 micropascals, representing the threshold of human hearing (0 dB).
A-Weighted Decibel (dBA)	An overall frequency-weighted sound level that approximates the frequency response of the human ear.
Equivalent Noise Level (L_{eq})	The average sound energy occurring over a specified time period. In effect, L_{eq} is the steady-state sound level that in a stated period would contain the same acoustical energy as the time-varying sound that actually occurs during the same period.
Maximum and Minimum Noise Levels (L_{max} and L_{min})	The maximum or minimum instantaneous sound level measured during a measurement period.
Day-Night Level (DNL or L_{dn})	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m. (nighttime).
Community Noise Equivalent Level (CNEL)	The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the A-weighted sound levels occurring between 7:00 p.m. and 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring between 10:00 p.m. and 7:00 a.m.
Statistical Descriptor (L_X)	L_X is used to represent the noise level exceeded X% of a specified time period. For example, L_{90} represents the noise level that is exceeded 90% of a specified time period. L_{90} is commonly used to represent ambient or background steady-state noise levels.
Source: Data compiled by FirstCarbon Solutions (FCS) 2024.	

Effects of Environmental Noise

The degree to which noise can impact an environment ranges from levels that interfere with speech and sleep to levels that can cause adverse health effects. Most human response to noise is subjective. Factors that influence individual responses may include the intensity, frequency, and pattern of noise;

the amount of background or existing noise present; and the nature of work or human activity that is exposed to intruding noise.

According to the National Institute of Health (NIH), extended or repeated exposure to sounds at or above 85 dB can cause hearing loss. Sounds of 75 dBA or less, even after continuous and repeated exposure, are unlikely to cause hearing loss.[2] The World Health Organization (WHO) reports that adults should not be exposed to sudden "impulse" noise events of 140 dB or greater. For children, this limit is 120 dB.[3]

Exposure to elevated nighttime noise levels can disrupt sleep, leading to increased levels of fatigue and decreased work or school performance. For the preservation of healthy sleeping environments, the WHO recommends that continuous interior noise levels should not exceed 30 dBA L_{eq} and that individual noise events of 45 dBA or higher be limited.[4]

Some epidemiological studies have shown a weak association between long-term exposure to noise levels of 65 to 70 dBA L_{eq} or greater and cardiovascular effects, including ischemic heart disease and hypertension. However, at this time, the relationship is largely inconclusive.

It is generally accepted that people with normal hearing sensitivity can barely perceive a 3 dBA change in noise levels, though if changes occur to the character of a sound (i.e., changes to the frequency content), then changes less than 3 dBA may be more noticeable.[5] Changes of 5 dBA may be readily perceptible, and changes of 10 dBA are perceived as a doubling in loudness.[6] However, few people are highly annoyed by daytime noise levels below 55 dBA.[7]

Loud noises, such as those from construction activities, can interfere with peoples' abilities to effectively communicate via speech, as well as other activities, resulting in annoyance or inconvenience. The EPA has found that a home interior noise level of 45 dBA L_{eq} generally protects speech and communication by providing 100 percent intelligibility of speech sounds.[8] Other common daily activities that may be disrupted by elevated interior noise levels include watching television, listening to music, or activities requiring concentration (such as reading). The EPA has determined that, given the preservation of an indoor noise level associated with 100 percent speech intelligibility (i.e., 45 dBA L_{eq}), the average community reaction is not evident and "7 dBA below levels associated with significant complaints and threats of legal action." Any complaints and annoyance are dependent on "attitude and other non-level related factors."

Noise Attenuation

Generally speaking, noise levels decrease, or "attenuate," as distances from noise sources to receivers increases. For each doubling of distance, noise from stationary or small, localized sources, commonly

[2] National Institute of Health (NIH), National Institute on Deafness and Other Communication. www.nidcd.nih.gov/health/noise-induced-hearing-loss.
[3] World Health Organization (WHO). 1999. Guidelines for Community Noise.
[4] Ibid.
[5] California Department of Transportation (Caltrans). 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol.
[6] Ibid.
[7] World Health Organization (WHO). 1999. Guidelines for Community Noise.
[8] United States Environmental Protection Agency (EPA). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.

referred to as "point sources," may attenuate at a rate of 6 dBA for each doubling of distance. This attenuation is referred to as the inverse square law. For example, if a point source emits a noise level of 80 dBA at a reference distance of 50 feet, its noise level would be approximately 74 dBA at a distance of 100 feet, 68 dBA at a distance of 200 feet, etc. Noise emitted by "line" sources, such as highways, attenuates at the rate of 3 dBA for each doubling of distance.[9]

Factors such as ground absorption and atmospheric effects may also affect the propagation of noise. In particular, ground attenuation by non-reflective surfaces, such as soft dirt or grass, may contribute to increased attenuation rates of up to an additional 8-10 dBA per doubling of distance.[10]

Noise is most audible when traveling by direct line of sight, an unobstructed visual path between a noise source and a receiver. Barriers that break the line of sight between noise sources and receivers, such as walls and buildings, can greatly reduce source noise levels by allowing noise to reach receivers by diffraction only. Barriers can reduce source noise levels by up to 20 dBA, though it is generally infeasible for temporary barriers to reduce source noise levels by more than 15 dBA.[11] In cases where the noise path from source to receiver is direct but grazes the top of a barrier, noise attenuation of up to 5 dBA may still occur.[12]

Characteristics of Vibration and Descriptors

Vibration is an oscillatory motion that can be described in terms of displacement, velocity, and acceleration.[13] Unlike noise, vibration is not a common environmental issue, as it is unusual for vibration from vehicle sources to be perceptible. Common sources of vibration may include trains, construction activities, and certain industrial operations.

Table 3 briefly defines common vibration measurement descriptors and other terminology used in this analysis.

Table 3: Vibration Terminology

Term	Definition
Peak Particle Velocity (PPV)	PPV is commonly used to describe and quantify vibration impacts to buildings and other structures. PPV levels represent the maximum instantaneous peak of a vibration signal and are generally measured in inches per second (in/sec).
Vibration Decibels (VdB)	The vibration velocity level in decibel scale.
Source: Data compiled by FirstCarbon Solutions (FCS) 2024.	

[9] California Department of Transportation (Caltrans). 2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol.
[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment.

Effects of Vibration

High levels of vibration may cause damage to buildings or even physical personal injury. However, vibration levels rarely affect human health outside the personal operation of certain construction equipment or industrial tools. Instead, most people consider environmental vibration to be an annoyance that may affect concentration or disturb sleep. Background vibration in residential areas is usually not perceptible, and perceptible indoor vibrations are generally caused by sources within buildings themselves, such as slamming doors or heavy footsteps. Vibration from traffic on smooth roadways is rarely perceptible, even from larger vehicles such as buses or trucks.[14] The threshold of human perception of vibration is approximately 0.01-0.02 in/sec peak particle velocity (PPV).[15]

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[14] California Department of Transportation (Caltrans). 2020. Transportation and Construction Vibration Guidance Manual.

[15] Ibid.

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Attachment B:

Noise Modeling Data

Mobile Construction Activity Noise Calculation

Receiving residential land use

Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage factor[1]	Distance to Receptor [2]	Ground Effect[3]	Shielding (dBA)[4]	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
Grader	85	1	40	65	1	0	82.7	77.6	57574468.1
Excavator	85	1	40	115	1	0	77.8	70.2	10396244.47
Dozer	85	1	40	115	1	0	77.8	70.2	10396244.47
Front End Loader	80	1	40	115	1	0	72.8	65.2	3287581.162
Backhoe	80	1	40	115	1	0	72.8	65.2	3287581.162
						Lmax[5]	83	Leq	79

Notes:
[1] Percentage of time activity occurs each hour based on FHWA usage factors
[2] Distance assumes one piece of equipment adjacent to project boundary and others at the closest reasonable operating distance away
[3] Soft ground terrain between project site and receptor.
[4] Shielding due to terrain or structures
[5] Calculated Lmax is the loudest value.

Distance to Receptor (feet)	8 Hour Average Calculation	Time	Hourly Leq	Leq'	0.1*Leq	antiLog
	Night	12:00 AM	0.0	10.0	1	10
		1:00 AM	0.0	10.0	1	10
		2:00 AM	0.0	10.0	1	10
		3:00 AM	0.0	10.0	1	10
		4:00 AM	0.0	10.0	1	10
		5:00 AM	0.0	10.0	1	10
		6:00 AM	0.0	10.0	1	10
	Day	7:00 AM	0.0	0.0	0	1
65		8:00 AM	79.3	79.3	7.929123093	84942119.35
115		9:00 AM	75.8	75.8	7.57707679	37763895.72
165		10:00 AM	71.1	71.1	7.106718478	12785522.42
215		11:00 AM	67.6	67.6	6.761854931	5779029.761
Lunch break		12:00 PM	0.0	0.0	0	1
265		1:00 PM	64.9	64.9	6.489432689	3086261.271
315		2:00 PM	62.6	62.6	6.264238649	1837547.818
365		3:00 PM	60.7	60.7	6.072291717	1181113.728
415		4:00 PM	59.1	59.1	5.905026021	803574.2667
		5:00 PM	0.0	0.0	0	1
Notes: *Equipment is measured as operating		6:00 PM	0.0	0.0	0	1
across the project site	Evening	7:00 PM	0.0	5.0	0.5	3.16227766
		8:00 PM	0.0	5.0	0.5	3.16227766
		9:00 PM	0.0	5.0	0.5	3.16227766
	Night	10:00 PM	0.0	10.0	1	10
		11:00 PM	0.0	10.0	1	10
				Sum		148179167.8
				Sum/8		18522395.98
				Log10(Sum/8)		7.267697164
				10*Log10(Sum/8)		72.67697164
				8 Hour Average		73

Receiving residential land use

Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage factor[1]	Distance to Receptor [2]	Ground Effect[3]	Shielding (dBA)[4]	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
Grader	85	1	40	115	1	0	77.8	70.2	10396244.47
Excavator	85	1	40	115	1	0	77.8	70.2	10396244.47
Dozer	85	1	40	115	1	0	77.8	70.2	10396244.47
Front End Loader	80	1	40	115	1	0	72.8	65.2	3287581.162
Backhoe	80	1	40	115	1	0	72.8	65.2	3287581.162
								Leq	76

Receiving residential land use

Equipment Description	Reference (dBA) 50 ft Lmax	Quantity	Usage factor[1]	Distance to Receptor [2]	Ground Effect[3]	Shielding (dBA)[4]	Calculated (dBA) Lmax	Calculated (dBA) Leq	Energy
Grader	85	1	40	165	1	0	74.6	65.5	3519801.497
Excavator	85	1	40	165	1	0	74.6	65.5	3519801.497
Dozer	85	1	40	165	1	0	74.6	65.5	3519801.497
Front End Loader	80	1	40	165	1	0	69.6	60.5	1113058.964
Backhoe	80	1	40	165	1	0	69.6	60.5	1113058.964
								Leq	71

Receiving residential land use									
	Reference (dBA) 50 ft		Usage	Distance to	Ground	Shielding	Calculated (dBA)		
Equipment Description	Lmax	Quantity	factor[1]	Receptor [2]	Effect[3]	(dBA)[4]	Lmax	Leq	Energy
Grader	85	1	40	215	1	0	72.3	62.0	1590943.016
Excavator	85	1	40	215	1	0	72.3	62.0	1590943.016
Dozer	85	1	40	215	1	0	72.3	62.0	1590943.016
Front End Loader	80	1	40	215	1	0	67.3	57.0	503100.3559
Backhoe	80	1	40	215	1	0	67.3	57.0	503100.3559
								Leq	68

Receiving residential land use									
	Reference (dBA) 50 ft		Usage	Distance to	Ground	Shielding	Calculated (dBA)		
Equipment Description	Lmax	Quantity	factor[1]	Receptor [2]	Effect[3]	(dBA)[4]	Lmax	Leq	Energy
Grader	85	1	40	265	1	0	70.5	59.3	849634.9766
Excavator	85	1	40	265	1	0	70.5	59.3	849634.9766
Dozer	85	1	40	265	1	0	70.5	59.3	849634.9766
Front End Loader	80	1	40	265	1	0	65.5	54.3	268678.1706
Backhoe	80	1	40	265	1	0	65.5	54.3	268678.1706
								Leq	65

Receiving residential land use									
	Reference (dBA) 50 ft		Usage	Distance to	Ground	Shielding	Calculated (dBA)		
Equipment Description	Lmax	Quantity	factor[1]	Receptor [2]	Effect[3]	(dBA)[4]	Lmax	Leq	Energy
Grader	85	1	40	315	1	0	69.0	57.0	505869.3222
Excavator	85	1	40	315	1	0	69.0	57.0	505869.3222
Dozer	85	1	40	315	1	0	69.0	57.0	505869.3222
Front End Loader	80	1	40	315	1	0	64.0	52.0	159969.9257
Backhoe	80	1	40	315	1	0	64.0	52.0	159969.9257
								Leq	63

Receiving residential land use									
	Reference (dBA) 50 ft		Usage	Distance to	Ground	Shielding	Calculated (dBA)		
Equipment Description	Lmax	Quantity	factor[1]	Receptor [2]	Effect[3]	(dBA)[4]	Lmax	Leq	Energy
Grader	85	1	40	365	1	0	67.7	55.1	325155.7295
Excavator	85	1	40	365	1	0	67.7	55.1	325155.7295
Dozer	85	1	40	365	1	0	67.7	55.1	325155.7295
Front End Loader	80	1	40	365	1	0	62.7	50.1	102823.2699
Backhoe	80	1	40	365	1	0	62.7	50.1	102823.2699
								Leq	61

Receiving residential land use									
	Reference (dBA) 50 ft		Usage	Distance to	Ground	Shielding	Calculated (dBA)		
Equipment Description	Lmax	Quantity	factor[1]	Receptor [2]	Effect[3]	(dBA)[4]	Lmax	Leq	Energy
Grader	85	1	40	415	1	0	66.6	53.4	221220.6755
Excavator	85	1	40	415	1	0	66.6	53.4	221220.6755
Dozer	85	1	40	415	1	0	66.6	53.4	221220.6755
Front End Loader	80	1	40	415	1	0	61.6	48.4	69956.12002
Backhoe	80	1	40	415	1	0	61.6	48.4	69956.12002
								Leq	59

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