Appendix D

Noise & Groundborne Vibration Impact Analysis for Costco Gas Station Project, Seaside CA

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NOISE & GROUNDBORNE VIBRATION IMPACT ANALYSIS

FOR

COSTCO GAS STATION PROJECT

SEASIDE, CA

OCTOBER 2019

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LIST OF COMMON TERMS AND ACRONYMS

ANSI	Acoustical National Standards Institute
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	Decibels
dBA	A-Weighted Decibels
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
Hz	Hertz
in/sec	Inches per Second
L_{dn}	Day-Night Level
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Sound Level
PPV	Peak Particle Velocity
U.S. EPA	United States Environmental Protection Agency
mph	Miles per Hour

INTRODUCTION

This report discusses the existing setting, identifies potential noise and groundborne vibration impacts associated with the implementation of the proposed COSTCO Gas Station. Noise mitigation measures are recommended where the predicted noise and groundborne vibration levels would exceed applicable thresholds of significance.

PROPOSED PROJECT SUMMARY

The proposed project includes construction of a gasoline-dispensing facility. The proposed project site is an approximate 0.97 acre property located at the corner of Del Monte Boulevard and Auto Center Parkway in the City of Seaside. The location of the proposed project site is depicted in Figure 1.

The proposed gasoline-dispensing facility includes an approximate 6,768-square-foot fueling canopy, twelve multi-product dispensers, three 40,000-gallon gasoline underground storage tanks with three remote fill ports, a controller enclosure, and associated site improvements. Typical hours of operation would be from 5:30 a.m. to 10:00 p.m. Construction of the proposed project is anticipated to be completed in a single phase over an approximate four-month period. The proposed project site plan is depicted in Figure 2.

EXISTING SETTING

CONCEPTS AND TERMINOLOGY

ACOUSTIC FUNDAMENTALS

Noise is generally defined as sound that is loud, disagreeable, or unexpected. Sound is mechanical energy transmitted in the form of a wave because of a disturbance or vibration. Sound levels are described in terms of both amplitude and frequency.

Amplitude

Amplitude is defined as the difference between ambient air pressure and the peak pressure of the sound wave. Amplitude is measured in decibels (dB) on a logarithmic scale. For example, a sound source of 65 dB, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). Amplitude is interpreted by the ear as corresponding to different degrees of loudness. Laboratory measurements correlate a 10 dB increase in amplitude with a perceived doubling of loudness and establish a 3 dB change in amplitude as the minimum audible difference perceptible to the average person.

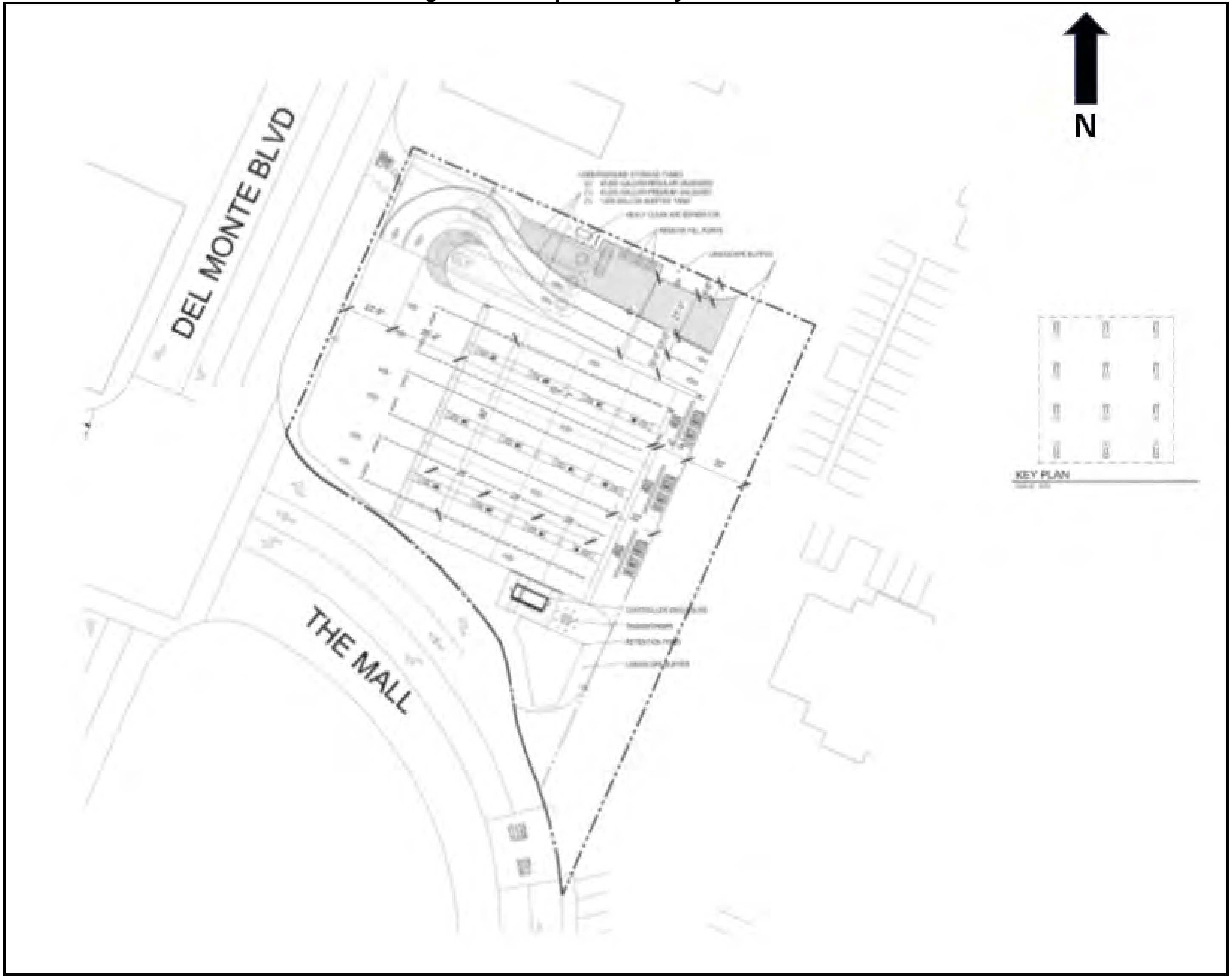
Frequency

The frequency of a sound is defined as the number of fluctuations of the pressure wave per second. The unit of frequency is the Hertz (Hz). One Hz equals one cycle per second. The human ear is not equally sensitive to the sound of different frequencies. For instance, the human ear is more sensitive to sound in the higher portion of this range than in the lower and sound waves below 16 Hz or above 20,000 Hz cannot be heard at all. To approximate the sensitivity of the human ear to changes in frequency, environmental sound is usually measured in what is referred to as "A-weighted decibels" (dBA). On this scale, the normal range of human hearing extends from about 10 dBA to about 140 dBA (U.S. EPA 1971). Common community noise sources and associated noise levels, in dBA, are depicted in Figure 3.

Figure 1. Proposed Project Location

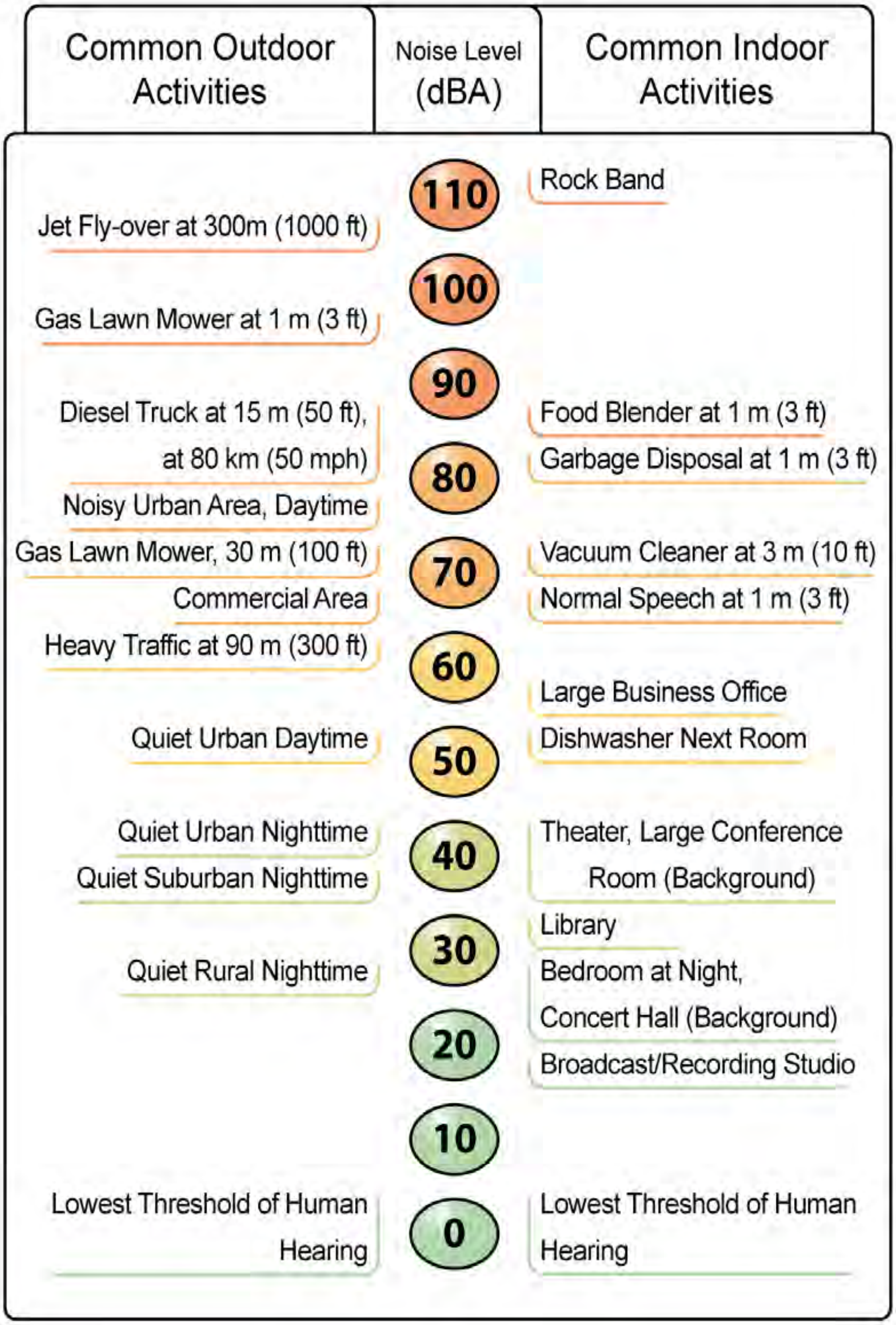
Source: Kittelson and Associates, Inc. 2019

Figure 2. Proposed Project Site Plan



Source: Kittelson and Associates, Inc. 2019

Figure 3. Common Noise Levels



Source: Caltrans 2018

Addition of Decibels

Because decibels are logarithmic units, sound levels 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 a sound level 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 would produce an increase of 5 dB.

Sound Propagation & Attenuation

Geometric Spreading

Sound from a localized source (i.e., a point source) propagates uniformly outward in a spherical pattern. The sound level decreases (attenuates) at a rate of approximately 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 approximately 3 decibels for each doubling of distance from a line source, depending on ground surface characteristics. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receiver, 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 receiver, 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 for soft surfaces results in an overall attenuation rate of 4.5 decibels per doubling of distance from the source.

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.

Shielding by Natural or Human-Made Features

A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. 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 receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in a minimum of 5 dB noise reduction. Taller barriers provide increased noise reduction.

Noise reductions afforded by building construction can vary depending on construction materials and techniques. Standard construction practices typically provide approximately 15 dBA exterior-to-interior noise reductions for building facades, with windows open, and approximately 20-30 dBA with windows closed. The absorptive characteristics of interior rooms, such as carpeted floors, draperies and furniture, can result in further reductions in interior noise.

NOISE DESCRIPTORS

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 sound-pressure level 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 with 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, which is referred to as the "A-weighted" sound level (expressed in units of dBA). 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 environmental noise.

The intensity of environmental noise fluctuates over time, and several descriptors of time-averaged noise levels are typically used. For the evaluation of environmental noise, the most commonly used descriptors are L_{eq}, L_{dn}, CNEL and SEL. The energy-equivalent noise level, L_{eq}, is a measure of the average energy content (intensity) of noise over any given period. Many communities use 24-hour descriptors of noise levels to regulate noise. The day-night average noise level, L_{dn}, is the 24-hour average of the noise intensity, with a 10-dBA "penalty" added for nighttime noise (10 p.m. to 7 a.m.) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to L_{dn} but adds an additional 5-dBA penalty for evening noise (7 p.m. to 10 p.m.) Another descriptor that is commonly discussed is the sound-exposure level, expressed as SEL. The SEL describes a receiver's cumulative noise exposure from a single noise event, which is defined as an acoustical event of short duration (0.5 seconds), such as a backup beeper, the sound of an airplane traveling overhead, or a train whistle. Common noise level descriptors are summarized in Table 1.

Table 1. Common Acoustical Descriptors

Descriptor	Definition
Energy Equivalent Noise Level (L_{eq})	The mean (average) energy noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value (in dBA) is calculated.
Minimum Noise Level (L_{min})	The minimum instantaneous noise level during a specific period of time.
Maximum Noise Level (L_{max})	The maximum instantaneous noise level during a specific period of time.
Day-Night Average Noise Level (DNL or L_{dn})	The DNL was first recommended by the U.S. EPA in 1974 as a "simple, uniform and appropriate way" of measuring long term environmental noise. DNL takes into account both the frequency of occurrence and duration of all noise events during a 24-hour period with a 10 dBA "penalty" for noise events that occur between the more noise-sensitive hours of 10:00 p.m. and 7:00 a.m. In other words, 10 dBA is "added" to noise events that occur in the nighttime hours to account for increases sensitivity to noise during these hours.
Community Noise Equivalent Level (CNEL)	The CNEL is similar to the L_{dn} described above, but with an additional 5 dBA "penalty" added to noise events that occur between the hours of 7:00 p.m. to 10:00 p.m. The calculated CNEL is typically approximately 0.5 dBA higher than the calculated L_{dn}.
Sound Exposure Level (SEL)	The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second.

HUMAN RESPONSE TO NOISE

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases. The acceptability of noise and the threat to public well-being are the basis for land use planning policies preventing exposure to excessive community noise levels.

Unfortunately, there is no completely satisfactory way to measure the subjective effects of noise or of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted: the so-called "ambient" environment. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged.

Regarding increases in A-weighted noise levels, knowledge of the following relationships will be helpful in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived by humans;
- Outside of the laboratory, a change of 3 dB is considered a just-perceivable difference;
- A change in sound level of at least 5 dB is required before any noticeable change in community response would be expected. An increase of 5 dB is typically considered substantial;
- A change of 10 dB is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

Effects of Noise on Human Activities

The extent to which environmental noise is deemed to result in increased levels of annoyance, activity interference, and sleep disruption varies greatly from individual to individual depending on various factors, including the loudness or suddenness of the noise, the information value of the noise (e.g., aircraft overflights, child crying, fire alarm), and an individual's sleep state and sleep habits. Over time, adaptation to noise events and increased levels of noise may also occur. In terms of land use compatibility, environmental noise is often evaluated in terms of the potential for noise events to result in increased levels of annoyance, sleep disruption, or interference with speech communication, activities, and learning. Noise-related effects on human activities are discussed in more detail, as follows:

Speech Communication

For most noise-sensitive land uses, an interior noise level of 45 dB L_{eq} is typically identified for the protection of speech communication in order to provide for 100-percent intelligibility of speech sounds. Assuming a minimum 20-dB reduction in sound level between outdoors and indoors, with windows closed, this interior noise level of 45 dB L_{eq} would equate to an exterior noise level of 65 dBA L_{eq}. For outdoor voice communication, exterior noise levels of 60 dBA L_{eq} allows normal conversation at distances up to 2 meters with 95 percent sentence intelligibility (U.S. EPA 1974.) Based on this information, speech interference begins to become a problem when steady noise levels reach approximately 60 to 65 dBA.

Annoyance & Sleep Disruption

With regard to potential increases in annoyance, activity interference, and sleep disruption, land use compatibility determinations are typically based on the use of the cumulative noise exposure metrics (i.e., CNEL or L_{dn}). Perhaps the most comprehensive and widely accepted evaluation of the relationship between noise exposure and the extent of annoyance was originally developed by Theodore J. Schultz in 1978. In 1978 the research findings of Theodore J. Schultz provided support for L_{dn} as the descriptor for environmental noise. Research conducted by Schultz identified a correlation between the cumulative noise exposure metric and individuals who were highly annoyed by transportation noise. The Schultz curve, expressing this correlation, became a basis for noise standards. When expressed graphically, this relationship is typically referred to as the Schultz curve. The Schultz curve indicates that approximately 13 percent of the population is highly annoyed at a noise level of 65 dBA L_{dn}. It also indicates that the percentage of people describing themselves as being highly annoyed accelerates smoothly between 55 and 70 dBA L_{dn}. A noise level of 65 dBA L_{dn} is a commonly referenced dividing point between lower and higher rates of people describing themselves as being highly annoyed.

The Schultz curve and associated research became the basis for many of the noise criteria subsequently established for federal, state, and local entities. Most federal and state of California regulations and policies related to transportation noise sources establish a noise level of 65 dBA CNEL/L_{dn} as the basic limit of acceptable noise exposure for residential and other noise-sensitive land uses. For instance, with respect to aircraft noise, both the Federal Aviation Administration (FAA) and the State of California have identified a noise level of 65 dBA L_{dn} as the dividing point between normally compatible and normally incompatible residential land use generally applied for determination of land use compatibility. For noise-sensitive land uses exposed to aircraft noise, noise levels in excess of 65 dBA CNEL/L_{dn} are typically considered to result in a potentially significant increase in levels of annoyance.

Allowing for an average exterior-to-interior noise reduction of 20 dB, an exterior noise level of 65 dBA CNEL/L_{dn} would equate to an interior noise level of 45 dBA CNEL/L_{dn}. An interior noise level of 45 dB CNEL/L_{dn} is generally considered sufficient to protect against activity interference at most noise-sensitive land uses, including residential dwellings, and would also be sufficient to protect against sleep interference (U.S. EPA 1974.)

The cumulative noise exposure metric is currently the only noise metric for which there is a substantial body of research data and regulatory guidance defining the relationship between noise exposure, people's reactions, and land use compatibility. However, when evaluating environmental noise impacts involving intermittent noise events, such as aircraft overflights and train pass byes, the use of cumulative noise metrics may not provide a thorough understanding of the resultant impact. The general public often finds it difficult to understand the relationship between intermittent noise events and cumulative noise exposure metrics. In such instances, supplemental use of other noise metrics, such as the L_{eq} or L_{max} descriptor, may be helpful as a means of increasing public understanding regarding the relationship between these metrics and the extent of the resultant noise impact.

AFFECTED ENVIRONMENT

NOISE-SENSITIVE LAND USES

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses.

The nearest noise-sensitive land uses include a hotel located approximately 80 feet to the northeast and residential land uses. The nearest residential land use is located approximately 525 feet to the southwest on California Avenue.

AMBIENT NOISE ENVIRONMENT

To document existing ambient noise levels in the project area, short-term ambient noise measurements were conducted on September 11, 2019, using a Larson Davis Laboratories, Type I, Model 820 integrating sound-level meter. The meter was calibrated before use and is certified to be in compliance with ANSI specifications. Measured ambient daytime noise levels are summarized in Table 2.

Table 2. Summary of Measured Ambient Noise Levels

Location	Monitoring Period	Measured Daytime Noise Levels (dBA)	
		L_{eq}	L_{max}
ST1: Approximately 120 feet north of northeast corner at Del Monte Boulevard and Tioga Avenue intersection	8:19-8:29	74.2	95.9
	15:15-15:35	72.1	90.5
ST2: Northeast corner at Del Monte Boulevard and Auto Center Parkway Intersection	8:15-8:26	71.9	88.2
	15:15-15:35	73.0	93.4
ST3: Approximately 190 feet east of southeast corner at Del Monte Boulevard and Tioga Avenue intersection	8:20-8:40	63.6	81.8
	15:14-15:34	61.2	80.3
ST4: Approximately 225 feet northeast of *northeast corner at Del Monte Boulevard and Auto Center Parkway Intersection*	8:42-9:02	58.8	76.1
	15:40-16:00	59.7	71.5

Ambient noise measurements were conducted on September 11, 2019, using a Larson Davis Laboratories, Type I, Model 820 integrating sound level meter placed at a height of 4.5 feet.

Based on the measurements conducted, daytime average-hourly noise levels in the project vicinity ranged from the upper 50s to mid-70s (in dBA L_{eq}). Ambient noise levels within the project area are predominantly influenced by vehicle traffic on area roadways. Ambient noise levels during the evening and nighttime hours are generally 5-10 dB lower than daytime noise levels.

REGULATORY FRAMEWORK

NOISE

City of Seaside General Plan

The City of Seaside has established policies in the Noise Element of the General Plan to guide the development of new land uses with respect to noise exposure. Table 3 summarizes the City's noise standards for various types of land uses. These noise standards represent the maximum acceptable noise level, are used to determine noise impacts, and are the basis for the development of the land use compatibility guidelines presented in Table 4. As depicted, service stations are considered "normally acceptable" within noise environments up to 70 dBA CNEL (City of Seaside 2004).

City of Seaside Municipal Code

The City of Seaside municipal code, Chapter 9.12, includes standards, prohibitions and exemptions for noise generated by non-transportation noise sources. Accordingly, construction noise is prohibited before 7:00 a.m. or after 7:00 p.m. daily except Saturday, Sunday and holidays when the prohibited time is before 9:00 a.m. and after 7:00 p.m. (City of Seaside 2018).

Table 3. City of Seaside Interior and Exterior Noise Standards for New Development

Land Use	Noise Standards (dBA CNEL)	
	Exterior	Interior
Residential	65	45
Mixed-Use Residential	70	45
Commercial	70	-
Office	70	50
Industrial	75	55
Public Facilities	70	50
Schools	50	50

Source: City of Seaside 2004

Table 4. City of Seaside Noise Standards for Land Use Compatibility

Land Use	Community Noise Exposure (Exterior L_{dn}, dBA)			
	Normally Acceptable	Conditionally Acceptable	Generally Unacceptable	Land Use Discouraged
Residential: Single Family, Multifamily, Duplex	<60	60 – 70	70 – 75	--
Residential: Mobile Homes	<60	60 – 65	65 – 75	--
Transient Lodging – Motels, Hotels	<60	60 – 70	70 – 80	--
Schools, Libraries, Churches, Hospitals, Nursing Homes	<60	60 – 65	65 – 75	--
Auditoriums, Concert Halls, Amphitheaters, Meeting Halls	<60	60 – 70	--	--
Sports Arena, Outdoor Spectator Sports, Amusement Parks	<65	65 – 75	--	--
Playgrounds, Neighborhood Parks	<65	65 – 70	70 – 75	--
Golf Course, Riding Stable, Cemeteries	<70	70 – 75	75 – 85	--
Office and Professional Buildings	<65	65 – 75	75 – 80	--
Commercial Retail, Banks, Restaurants, Theaters	<70	70 – 80	80 – 85	--
Industrial, Manufacturing, Utilities, Wholesale, Service Stations	<70	70 – 85	--	--
Agriculture	<85	--	--	--

Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirement is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
Generally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Land Use Discouraged: New construction or development should generally not be undertaken.
Source: City of Seaside 2004

GROUNDBORNE VIBRATION

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of amplitude and frequency. A person's perception of the vibration will depend on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating. Vibration can be measured in terms of acceleration, velocity, or displacement. Measurements in terms of velocity are expressed as peak particle velocity (PPV) with units of inches per second (in/sec).

There are no federal, state, or local regulatory standards for groundborne vibration. However, Caltrans has developed vibration criteria based on potential structural damage risks and human annoyance. Caltrans-recommended criteria for the evaluation of groundborne vibration levels, with regard to structural damage and human annoyance, are summarized in Table 5. The criteria apply to continuous vibration sources, which include vehicle traffic and most construction activities. All damage criteria for buildings are in terms of ground motion at the buildings' foundations. No allowance is included for the amplifying effects of structural components (Caltrans 2013).

Table 5. Summary of Groundborne Vibration Levels and Potential Effects

Vibration Level (in/sec ppv)	Human Reaction	Effect on Buildings
0.006 - 0.019	Threshold of perception; possibility of intrusion.	Vibrations unlikely to cause damage of any type.
0.08	Vibrations readily perceptible.	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected.
0.10	Level at which continuous vibrations begin to annoy people.	Virtually no risk of "architectural" damage to normal buildings.
0.20	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relatively short periods of vibrations).	Threshold at which there is a risk of "architectural" damage to fragile buildings.
0.3 - 0.6	Vibrations become distinctly perceptible at 0.04 in/sec ppv and considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges.	Potential risk of "architectural" damage may occur at levels above 0.3 in/sec ppv for older residential structures and above 0.5 in/sec ppv for newer structures.

The vibration levels are based on peak particle velocity in the vertical direction for continuous vibration sources, which includes most construction activities.
Source: Caltrans 2013

As indicated in Table 5, the threshold at which there is a risk to normal structures from continuous events is 0.3 in/sec PPV for older residential structures and 0.5 in/sec PPV for newer building construction. With regard to human perception (Table 5), vibration levels would begin to become distinctly perceptible at levels of 0.04 in/sec PPV for continuous events. Continuous vibration levels are considered potentially annoying for people in buildings at levels of 0.2 in/sec PPV.

PROJECT IMPACTS

THRESHOLDS OF SIGNIFICANCE

Criteria for determining the significance of air quality impacts were developed based on information contained in the California Environmental Quality Act Guidelines (CEQA Guidelines, Appendix G). According to those guidelines, a project may have a significant effect on the environment if it would result in the following conditions:

1. Generation of a substantial temporary or permanent increase in ambient noise levels in the project vicinity in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
2. Generation of excessive groundborne vibration or groundborne noise levels.
3. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or private-use airport, would the project expose people residing or working in the project area to excessive noise levels?

METHODOLOGY

Short-Term Construction

Short-term noise impacts associated with construction activities were analyzed based on typical construction equipment noise levels and distances to the nearest noise-sensitive land usage. Noise levels were predicted based on representative off-road equipment noise levels derived from the Federal Highway Administration's (FHWA) *Road Construction Noise Model* based on average equipment usage rates and assuming a noise-attenuation rate of 6 dB per doubling of distance from the source.

Long-term Operation

Noise traffic noise levels were calculated using the FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project. The model was calibrated based on noise measurements conducted for this project. On-site operational noise sources would be primarily associated with vehicles entering and exiting the project site, engines starting, and the opening and closing of vehicle doors. To a lesser extent, pump noise associated with refueling and filling operations would also contribute to operational noise levels. Predicted noise levels for on-site noise sources were calculated using the SoundPlan computer model and FTA-recommended methodologies for vehicle parking/operational activities. To be conservative, predicted noise levels were based on the highest estimated hourly trip-generation rate obtained from the traffic analysis prepared for this project. Average-daily noise levels were calculated based on the highest calculated average-hourly noise level and assuming operational hours of 5:30 a.m. to 10:00 p.m. Predicted operational noise levels at nearby land uses were calculated assuming a noise-attenuation rate of 6 dB per doubling of distance from the source.

Predicted noise levels were compared to applicable City noise standards for determination of impact significance. The *CEQA Guidelines* do not define the levels at which temporary and permanent increases in ambient noise are considered "substantial." As discussed previously in this section, a noise level increase of 3 dBA is barely perceptible to most people, an increase of 5 dBA is readily noticeable, and a difference of 10 dBA would be perceived as a doubling of loudness. For purposes of this analysis, a significant increase in ambient noise levels would be defined as an increase of 3 dBA, or greater, that would exceed the City's applicable noise standards. The City's applicable noise standards are summarized in Table 3. Noise standards for determination of land use compatibility are summarized in Table 4.

Groundborne Vibration

The *CEQA Guidelines* also do not define the levels at which groundborne vibration levels would be considered excessive. For this reason, Caltrans' recommended groundborne vibration thresholds were used for the evaluation of impacts based on increased potential for structural damage and human annoyance, as identified in Table 5. For purposes of this analysis, risks of architectural damage (i.e., minor cracking of plaster walls and ceilings) would be considered potentially significant if construction-generated ground vibration levels at nearby structures would exceed 0.5 in/sec PPV. Ground vibration in excess of 0.2 in/sec PPV would be expected to result in a potential for significant short-term increases in levels of annoyance for occupants of nearby buildings.

***IMPACT 1*:**	***Would the project result in a substantial temporary or permanent increase in ambient noise levels in the project vicinity in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?***

Long-term Permanent Operational Noise Levels

Long-term, permanent increases in ambient noise levels would be primarily associated with potential increases in vehicle traffic on nearby roadways; as well as on-site activities. Noise levels commonly associated with these sources and potential impacts to nearby land uses are discussed as follows:

<u>Vehicular Roadway Traffic</u>

Predicted existing traffic noise levels, with and without the implementation of the proposed project, are summarized in Table 6. In comparison to existing traffic noise levels, the proposed project would result in a predicted increase in traffic noise levels of 0 to 5.13 dBA along area roadways.

Predicted increases in future cumulative traffic noise levels along nearby roadways for the proposed project are summarized in Table 7. Under future cumulative conditions, the proposed project would result in a predicted increase in traffic noise levels of 0 to 4.83 dBA along area roadways.

As noted earlier in this report, changes in ambient noise levels of approximately 3 dBA, or less, are typically not discernible to the human ear and would not be considered to result in a significant impact. Implementation of the proposed project would result in substantial increases (i.e. 3 dBA or greater) in existing and projected future traffic noise levels along Auto Center Parkway. However, predicted noise levels along this roadway segment are not projected to exceed the City's exterior noise standard of 70 dBA CNEL at adjacent commercial land uses. In addition, no noise-sensitive land uses are located along this roadway segment. As a result, this impact would be considered **less than significant.**

Table 6. Predicted Increase in Existing Traffic Noise Levels

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1]			Substantial Increase?[3]	Exceeds City's Noise Standard?[4]	Significant Impact?[5]
	Existing without Project	Existing with Project	Difference[2]			
Del Monte Boulevard north of Tioga Avenue	63.41	63.57	0.16	No	No	No
Del Monte Boulevard south of Tioga Avenue	63.54	63.87	0.33	No	No	No
Auto Center Parkway east of Del Monte Boulevard	51.03	56.17	5.14	Yes	No	No
Tioga Avenue between Del Monte Boulevard and California Avenue	57.42	57.81	0.39	No	No	No
Tioga Avenue west of California Avenue	53.33	53.95	0.62	No	No	No
California Avenue south of Tioga Avenue	53.23	53.23	0	No	No	No

1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.
2. Difference in noise levels reflect the incremental increase attributable to the proposed project.
3. Substantial increase defined as an increase of 3 dB, or greater.
4. Refer to Table 3 for applicable City noise standards. No noise-sensitive land uses (e.g., residential, schools) are located along evaluated roadway segments.
5. A significant increase is defined as a substantial increase in noise levels that would exceed the City's applicable noise standards at nearby land uses.

Table 7. Predicted Increase in Future Traffic Noise Levels

Roadway Segment	Predicted Noise Level at 50 feet from Centerline of Near Travel Lane (dBA CNEL/L_{dn})[1] Future without Project	Future with Project	Difference[2]	Substantial Increase?[3]	Exceeds City's Noise Standard?[4]	Significant Impact?[5]
Del Monte Boulevard north of Tioga Avenue	64.59	64.66	0.07	No	No	No
Del Monte Boulevard south of Tioga Avenue	65.08	65.14	0.06	No	No	No
Auto Center Parkway east of Del Monte Boulevard	51.49	56.31	4.82	Yes	No	No
Tioga Avenue between Del Monte Boulevard and California Avenue	59.6	59.84	0.24	No	No	No
Tioga Avenue west of California Avenue	56.76	57.06	0.3	No	No	No
California Avenue south of Tioga Avenue	57.1	57.1	0	No	No	No

1. Traffic noise levels were calculated using FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77-108), based on data obtained from the traffic analysis prepared for this project.
2. Difference in noise levels reflect the incremental increase attributable to the proposed project.
3. Substantial increase defined as an increase of 3 dB, or greater.
4. Refer to Table 3 for applicable City noise standards. No noise-sensitive land uses (e.g., residential, schools) are located along evaluated roadway segments.
5. A significant increase is defined as a substantial increase in noise levels that would exceed the City's applicable noise standards at nearby land uses.

<u>On-site Operational Activities</u>

On-site stationary noise sources associated with the proposed project would be primarily associated with vehicles entering and exiting the project site, engines starting, and the opening and closing of vehicle doors. To a lesser extent, pump noise associated with refueling and filling operations would also contribute to operational noise levels.

The nearest noise-sensitive receptors include a hotel located approximately 80 feet northeast of the project site, and residential dwellings. The nearest residential dwelling is located approximately 525 feet southeast of the project site, along California Avenue. Predicted operational noise levels at these and other nearby land uses are summarized in Table 8. As shown, predicted operational noise levels at the hotel would range from approximately 57 dBA CNEL at ground-level locations to 59 dBA CNEL at upper-floor locations. Predicted operational noise levels at the nearest residential land use would be approximately 53 dBA CNEL. Predicted operational noise levels at the nearest noise-sensitive land uses would not exceed the City's exterior noise standard of 65 dBA CNEL. Based on the predicted exterior operational noise levels noted above and assuming an average exterior-to-interior noise reduction of 25 dB, predicted interior noise levels at these same land uses would be approximately 34 dBA CNEL, or less, and would not exceed the City's interior noise standard of 45 dBA CNEL. In addition, as noted earlier in this report, ambient noise levels in the project vicinity generally range from the upper 50s to mid-70s and largely influenced by vehicle traffic along area roadways. Likewise, predicted exterior noise levels at nearby commercial land uses would not exceed applicable noise standards. In comparison to existing ambient noise levels, operational noise levels for the proposed facility would be largely masked by vehicle traffic noise emanating from nearby roadways. For these reasons, noise generated by on-site activities would be considered **less than significant**.

Table 8. Predicted Operational Noise Levels at Nearby Land Uses

Nearby Land Uses		Distance from Project Site (feet)	Predicted Noise Level (dBA CNEL/L_{dn})[1]	City's Noise Standard[2]	Exceeds Standards/ Significant Impact?
1	Commercial	45	65.81	70	No
2	Commercial	88	64.84	70	No
3	Hotel – 1st Floor	80	58.44	70	No
3	Hotel – 2nd Floor	80	60.94	70	No
3	Hotel – 3rd Floor	80	61.04	70	No
4	Hotel Pool Area	155	56.24	70	No
5	Commercial	75	65.44	70	No
6	Commercial	83	66.84	70	No
7	Residential	525	54.41	65	No

1. Includes onsite refueling and dispensing activities and vehicle operations. To be conservative, predicted operational noise levels are based on the highest hourly traffic volumes derived from the traffic analysis prepared for this project and applied to the proposed operational hours of the project (5:30 a.m. to 10:00 p.m.). Because traffic volumes for some hours of the day would be less than the maximum assumed for this analysis, predicted average-daily noise levels would likely be less than indicated.
2. Based on the City of Seaside General Plan exterior noise standards (Refer to Table 3).

Short-term Temporary Construction Noise Levels

Construction noise typically occurs intermittently and varies depending upon the nature or phase (e.g., demolition/land clearing, grading, excavation and erection) of the activity. Noise generated by construction equipment, including earthmovers, material handlers, and portable generators, can reach high levels. Noise levels commonly associated with off-road equipment anticipated to be used during project construction are summarized in Table 9.

Table 9. Typical Construction Equipment Noise Levels

Equipment	Typical Noise Level (dBA) at 50 Feet from Source	
	L_{max}	L_{eq}
Air Compressor	78	74
Backhoe	78	74
Concrete Mixer	79	75
Crane, Mobile	81	73
Dozer	82	78
Grader	85	81
Loader	79	71
Paver	77	74
Roller	80	73
Saw	90	83

Source: Based on measured data obtained from the FHWA Roadway Construction Noise Model (FHWA 2008)

As noted in Table 9, instantaneous noise levels generated by individual pieces of off-road equipment typically range from approximately 77 to 90 dBA L_{max} at 50 feet (FHWA 2008). Typical operating cycles may involve 2 minutes of full power, followed by 3 or 4 minutes at lower settings. Based on typical off-road equipment usage rates, average-hourly noise levels for individual equipment would be approximately 83 dBA L_{eq}, or less, at 50 feet. Assuming that multiple pieces of equipment could be operating simultaneously, predicted average-hourly noise levels could reach levels of approximately 85 dBA at 50 feet.

The City has not adopted noise standards that apply to short-term construction activities. However, based on screening noise criteria commonly recommended by federal agencies, construction activities would generally be considered to have a potentially significant impact if average-hourly daytime noise levels would exceed 80 dBA L_{eq} at noise-sensitive land uses, such as residential land uses (FTA 2018). Assuming an average-hourly construction noise level of 85 dBA L_{eq}, predicted noise levels at the nearest residential land uses would be approximately 65 dBA L_{eq} or less when construction activities occur within site boundary. Based on these same assumptions, predicted construction noise levels at Magic Carpet Lodge would be 81 dBA L_{eq} or less. Based on these predicted exterior noise levels and assuming an average exterior-to-interior noise reduction of 25 dBA, with windows closed, predicted interior noise levels would be approximately 40 dBA CNEL at the nearest residential dwelling and 56 dBA L_{eq} or less at the Magic Carpet Lodge. Construction-generated noise levels would not exceed the commonly applied daytime noise standard of 80 dBA L_{eq}. However, because exterior ambient noise levels typically decrease during the late evening and nighttime hours as community activities (e.g., vehicle traffic) decrease, construction activities performed during these more noise-sensitive periods of the day could result in substantial increases in ambient noise levels, which may result in increased levels of annoyance and potential sleep disruption for occupants of nearby residential dwellings and the Magic Carpet Lodge. For these reasons, this impact would be considered ***potentially significant***.

Mitigation Measure 2: The following measures shall be implemented to reduce construction-generated noise levels:

a. Construction activities (excluding activities that would result in a safety concern to the public or construction workers) shall be limited to between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday, and between the hours of 9:00 a.m. and 7:00 p.m. on weekends and legal holidays.
b. Construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds shall be closed during equipment operation.
c. When not in use, all construction equipment shall be turned off and shall not be allowed to idle. Provide clear signage that posts this requirement for workers at the entrances to the site.
d. Construction equipment and haul trucks shall be turned off when not in use.
e. Construction equipment and material staging areas shall be located at the furthest distance possible from nearby residential land uses.
f. To the extent possible, heavy-duty haul truck trips required for project construction should be scheduled during the non-peak hours of the day.

Significance After Mitigation

Implementation of the above mitigation measures would limit construction activities to the less noise-sensitive periods of the day. The use of mufflers would reduce construction equipment noise levels by approximately 10 dBA. Additional measures have also been included to further minimize potential noise impacts to nearby noise-sensitive land uses. With the implementation of the above mitigation measures, this impact would be considered less than significant.

Land Use Compatibility

The City of Seaside General Plan includes noise criteria that can be relied upon to determine the compatibility of noise-sensitive land uses within noise environments. Based on these noise standards, service stations are considered "normally acceptable" within exterior noise environments up to 70 dBA CNEL and "conditionally acceptable" between 70 and 75 dBA CNEL. The nearest major roadways are Del Monte Boulevard, which is located immediately west of the project site, and Auto Center Parkway, which is located adjacent to the southern boundary of the project site. Based on the traffic noise modeling conducted for this project, predicted noise levels at the project site boundaries would be approximately 65 dBA CNEL, or less (refer to Table 7). Predicted on-site noise levels would not exceed the City's "normally acceptable" noise standard of 70 dBA CNEL. This impact would be ***less than significant***.

<u>IMPACT 2</u>: ***Would the project result in the exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?***

Increases in groundborne vibration levels attributable to the proposed project would be primarily associated with short-term construction activities. Groundborne vibration levels associated with representative construction equipment likely to be required during project construction are summarized in Table 10. As depicted, construction-generated vibration levels would range from approximately 0.003 to 0.21 in/sec PPV at 25 feet. The highest vibration levels would be associated with the use of vibratory rollers.

Table 10. Representative Vibration Levels for Construction Equipment

Equipment	Vibration Level at 25 Feet (in/sec, PPV)
Vibratory Roller	0.21
Large Bulldozer	0.089
Loaded Trucks	0.076
Small Bulldozers/Tractors	0.003
Source: FTA 2018	

The nearest existing structures are commercial uses located approximately 45 feet from the project site. In addition, a hotel is located approximately 80 feet from the project site. The nearest residential land use is located approximately 525 feet from the project site. Predicted groundborne vibration levels at these nearby land uses are summarized in Table 11. As shown in Table 11, predicted construction vibration levels at nearby structures would not exceed the minimum recommended criteria for structural damage or human annoyance (0.5 and 0.2 in/sec PPV respectively).

Long-term operational activities associated with the proposed project would involve the occasional use of loaded trucks to refill on-site underground fuel storage tanks. Groundborne vibration levels from loaded fuel trucks would result in a PPV of approximately 0.076 in/sec at 25 feet (Table 10). Predicted groundborne vibration levels at the nearest off-site structures associated with operational activities would not exceed commonly applied thresholds for potential structural damage or human annoyance. As a result, this impact would be considered ***less than significant***.

Table 11. Predicted Groundborne Vibration Levels at Nearby Structures

Nearby Land Uses	Distance from Project Boundary (feet)	Vibration Level (in/sec, PPV)
Commercial	45	0.110
Hotel	80	0.058
Residential	525	0.007
Based on the highest construction equipment vibration levels anticipated for this project (0.21 in/sec ppv).		

IMPACT 3:	***For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels? and For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?***

The nearest airports include the Marina Municipal Airport, which is located approximately 6.2 miles northeast of the project site, and the Monterey Regional Airport, located approximately 1.9 miles to the southeast. Aircraft using the Monterey Regional Airport takeoff and land over Monterey Bay to the west and rural land to the east (City of Seaside 2004). The proposed project is not located within the predicted noise contour zones of these airports. As a result, the proposed project would not subject on-site workers or patrons to potentially hazardous noise conditions associated with aircraft operations nor would implementation of the proposed project affect airport operations. ***No impact***.

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Federal Highway Administration (FHWA).

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U.S. Department of Transportation, Federal Transit Administration (FTA). September 2018. *Transit Noise and Vibration Impact Assessment.*

U.S. Environmental Protection Agency (U.S. EPA). December 31, 1971. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*.

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APPENDIX A
Noise Measurement Surveys

Noise Measurement Survey

Location	Monitoring Period	Measured Daytime Noise Levels (dBA)	
		L_{eq}	L_{max}
ST1: Approximately 120 feet north of northeast corner at Del Monte Boulevard and Tioga Avenue intersection	8:19-8:29	74.2	95.9
	15:15-15:35	72.1	90.5
ST2: Northeast corner at Del Monte Boulevard and Auto Center Parkway Intersection	8:15-8:26	71.9	88.2
	15:15-15:35	73.0	93.4
ST3: Approximately 190 feet east of southeast corner at Del Monte Boulevard and Tioga Avenue intersection	8:20-8:40	63.6	81.8
	15:14-15:34	61.2	80.3
ST4: Approximately 225 feet northeast of *northeast corner at Del Monte Boulevard and Auto Center Parkway Intersection*	8:42-9:02	58.8	76.1
	15:40-16:00	59.7	71.5

Ambient noise measurements were conducted on September 11, 2019, using a Larson Davis Laboratories, Type I, Model 820 integrating sound level meter placed at a height of 4.5 feet.

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APPENDIX B
Traffic Noise Modeling

Scenario/Road Segment	Speed Limit (mph)	ADT	CNEL at 50 feet (dBA)	Distance to 70 CNEL (feet)	Distance to 65 CNEL (feet)	Distance to 60 CNEL (feet)	Distance to 55 CNEL (feet)
Existing							
Del Monte Boulevard north of Tioga Avenue	35	11810	63.41	WRR	59.9	120.5	255.6
Del Monte Boulevard south of Tioga Avenue	35	12170	63.54	WRR	60.9	122.9	260.7
Auto Center Parkway east of Del Monte Boulevard	20	2520	51.03	WRR	WRR	WRR	WRR
Tioga Avenue Between Del Monte Boulevard and California Avenue	25	5340	57.42	WRR	WRR	WRR	89
California Avenue south of Tioga Avenue	25	1780	53.23	WRR	WRR	WRR	WRR
Tioga Avenue west of California Avenue	25	2080	53.33	WRR	WRR	WRR	WRR
Existing Plus Project							
Del Monte Boulevard north of Tioga Avenue	35	12250	63.57	WRR	61.1	123.4	261.8
Del Monte Boulevard south of Tioga Avenue	35	13110	63.87	WRR	63.5	128.9	273.9
Auto Center Parkway east of Del Monte Boulevard	20	8220	56.17	WRR	WRR	WRR	87.1
Tioga Avenue Between Del Monte Boulevard and California Avenue	25	5840	57.81	WRR	WRR	WRR	94.4
California Avenue south of Tioga Avenue	25	1780	53.23	WRR	WRR	WRR	WRR
Tioga Avenue west of California Avenue	25	2400	53.95	WRR	WRR	WRR	53.1
Future							
Del Monte Boulevard north of Tioga Avenue	35	15490	64.59	WRR	70	143.6	305.8
Del Monte Boulevard south of Tioga Avenue	35	17350	65.05	WRR	74.8	154.5	329.7
Auto Center Parkway east of Del Monte Boulevard	20	2800	51.49	WRR	WRR	WRR	WRR
Tioga Avenue Between Del Monte Boulevard and California Avenue	25	8820	59.6	WRR	WRR	WRR	123.8
California Avenue south of Tioga Avenue	25	4340	57.1	WRR	WRR	WRR	77.1
Tioga Avenue west of California Avenue	25	4590	56.76	WRR	WRR	WRR	80.6
Future Plus Project							
Del Monte Boulevard north of Tioga Avenue	35	15740	64.66	WRR	70.6	145.1	309.1
Del Monte Boulevard south of Tioga Avenue	35	17570	65.14	WRR	75.4	155.8	332.5
Auto Center Parkway east of Del Monte Boulevard	20	8500	56.31	WRR	WRR	WRR	88.9
Tioga Avenue Between Del Monte Boulevard and California Avenue	25	9320	59.84	WRR	WRR	60.5	128.3
California Avenue south of Tioga Avenue	25	4340	57.1	WRR	WRR	WRR	77.1
Tioga Avenue west of California Avenue	25	4910	57.06	WRR	WRR	WRR	84.2

WRR=Within Road Right-of-Way