NOISE AND VIBRATION IMPACT ANALYSIS

ENDERLE CENTER PROJECT

CITY OF TUSTIN, CALIFORNIA

LSA

March 2024

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CITY OF TUSTIN, CALIFORNIA

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LIST OF ABBREVIATIONS AND ACRONYMS

APN	Assessor's Parcel Numbers
City	City of Tustin
CNEL	Community Noise Equivalent Level
County	County of Orange
dBA	A-weighted decibel
du/ac	dwelling units per acre
FHWA	Federal Highway Administration
ft	foot/feetFeet
FTA	Federal Transit Administration
GPA	General Plan Amendment
HOD	Housing Overlay District
HVAC	heating, ventilation, and air conditioning
in/sec	inches per second
JWA	John Wayne Airport
L_{dn}	day-night average noise level
L_{eq}	equivalent continuous sound level
L_{max}	maximum instantaneous sound level
PC COM	Planned Community Commercial
PCCB	Planned Community Commercial/ Business
PPV	peak particle velocity
project	Enderle Center Project
RHNA	Regional Housing Needs Allocation
RMS	root-mean-square
sf	square feet

SR-55	State Roue 55
STC	Sound Transmission Class
TMC	Tustin Municipal Code
VdB	vibration velocity decibels
ZC	Zone Change
ZCA	Zoning Code Amendment

INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and reduction measures associated with the Enderle Center Project (project) in Tustin, California. This report is intended to satisfy the City of Tustin (City) requirement for a project-specific noise impact analysis by examining the impacts of the project site and evaluating noise reduction measures that the project may require.

PROJECT LOCATION

The 11.8-acre project site consists of Assessor's Parcel Numbers (APNs) 401-251-04, -06; 401-252-05, -06, -08, -09, -10; and 401-253-04 and -03. The project site is generally bounded on the north by 17th Street; on the east by Enderle Center Drive and the eastern property line of properties fronting Enderle Center Drive; to the south by Vandenberg Lane; and to the west by State Roue 55 (SR-55), including properties west of Yorba Street. The project location is shown in Figure 1.

The Enderle Center is currently developed with 87,136 square feet (sf) of commercial business uses, including 28,750 sf of restaurant use, 39,960 sf of retail and service use, 18,426 sf of office use, and surface parking lots. The site also includes ornamental landscaping along the perimeter and throughout the parking areas. See Figure 2.

The project site has a General Plan land use designation of Planned Community Commercial/ Business (PCCB) and a zoning designation of Planned Community Commercial (PC COM). The PCCB land use designation provides opportunities for a variety of miscellaneous retail, professional office, and service-oriented business activities. The PC COM zoning is intended to allow diversification of the relationships of various buildings, structures and open spaces in planned building groups while ensuring substantial compliance with the housing district regulations and other provisions of the Planned Community District zone.

PROJECT DESCRIPTION

The City of Tustin prepared the 2021–2029 Housing Element of its General Plan in accordance with Government Code Section 65580 et seq. The City is required by State law to periodically update its Housing Element, a mandatory component of the City's General Plan. The update to the Housing Element covers the Sixth Cycle planning period from October 15, 2021, to October 15, 2029.

The Housing Element is the City's housing policy and planning document that identifies housing needs and constraints, and sets forth goals, policies, and programs that address the future housing needs for all income levels over an eight-year planning period that coincides with a Regional Housing Needs Allocation (RHNA). During the Housing Element process, the City assessed a number of properties and areas throughout the community that would be able to accommodate the City's assigned RHNA. Of the Housing Element inventory sites, Enderle Center (the project site) was identified as necessary for rezoning under Housing Element Program 1.1f to allow for high density residential/mixed use development.

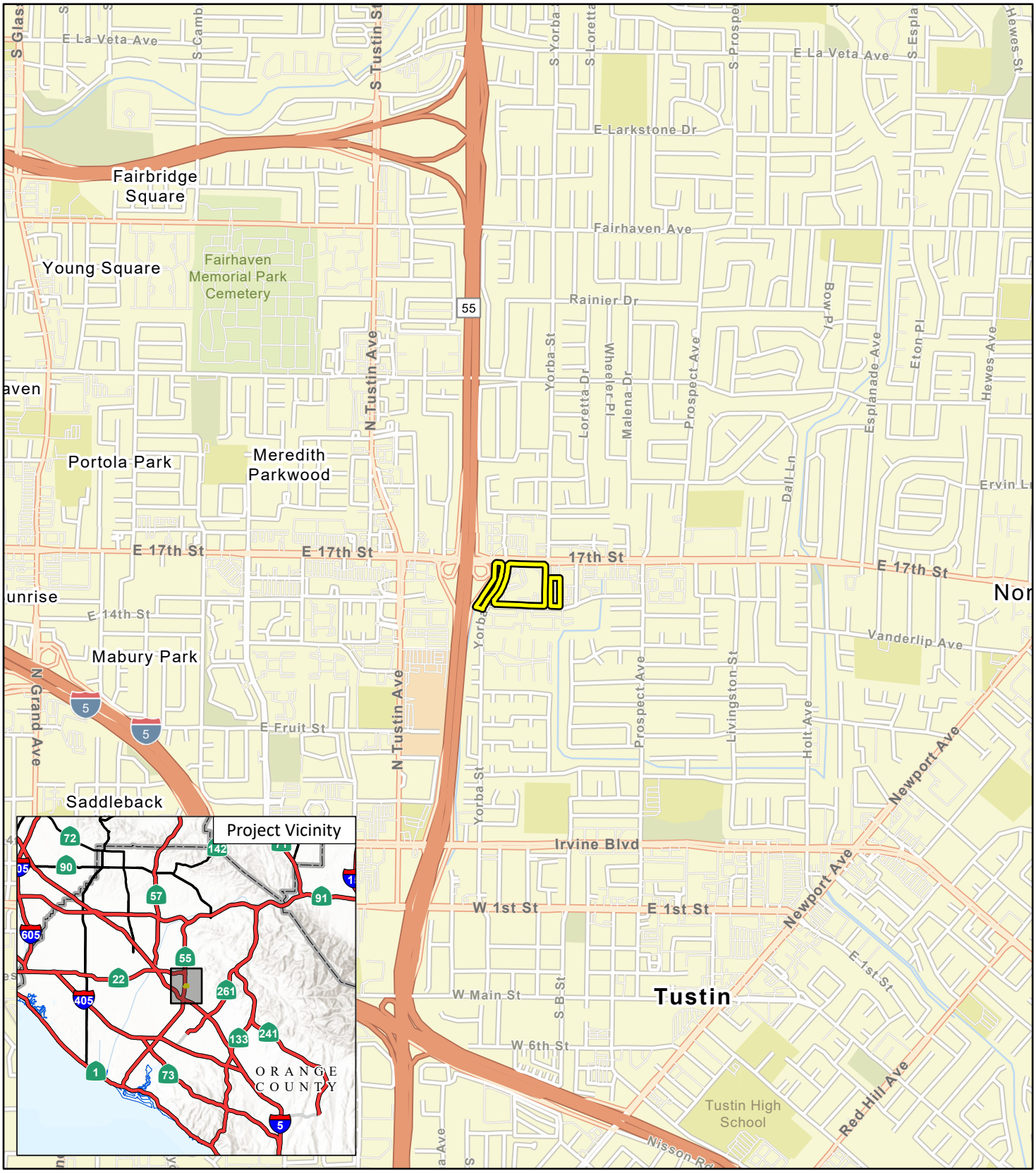

FIGURE 1

Enderle Center Project

Regional Project Location

SOURCE: Esri World Street Map (2024)

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LSA

Project Location

FIGURE 2

N

0 100 200
FEET

SOURCE: Google Maps (2023)

Enderle Center Project

Project Site

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Pursuant to Housing Element Program 1.1f, the City is proposing an overlay zone (overlay district) for the project site. To accommodate this, a General Plan Amendment (GPA) is needed to allow a Housing Overlay District (residential uses) within Planned Community Commercial/Business land use designations; a Zoning Code Amendment (ZCA) to establish Housing Overlay Districts (overlay zone) in conjunction with the Planned Community Commercial Districts (base zone); and a Zone Change (ZC) that amends the City's zoning map to apply a Housing Overlay District (HOD) to the project site. The proposed HOD would allow for residential development with a maximum density of 59 dwelling units per acre (du/ac) over a maximum development area of 7 acres.

The Housing Element identified the Enderle Center as having capacity for 413 housing units. The anticipated development density was determined through the Housing Element process, and is a conservative estimate based on development trends in nearby communities. The anticipated development does not rely on the demolition of any existing building, but rather focuses on areas used for surface parking. No development is proposed as part of this project.

During the Housing Element process, the City identified the Enderle Center as a suitable commercial site for rezoning to allow mixed-use development, which would introduce the opportunity to allow higher density housing in either horizontal or vertical mixed-use development on the site. This would be accomplished with a Housing Overlay Zone. The proposed project includes a GPA to amend the City's existing General Plan to create a Housing Overlay Zone and establish that the overlay zone will be applied within, and be consistent with, the Planned Community Commercial Business land use designation. The GPA will amend the text within the Land Use Element to clarify the purpose and function of the Housing Overlay Zone, and describe how the Housing Overlay Zone implements the General Plan goals and policies.

Residential uses are currently not allowed on the project site. Upon approval of the Housing Overlay Zone, the project site could accommodate 413 units over approximately 7 acres of developable land within the existing 11.8-acre site. The anticipated development over 7 acres would take place on underutilized asphalt parking lot areas, and not require demolition of any existing buildings. Parking displaced as a result of redevelopment would be accommodated by vertical parking structures located within the proposed development.

Roadways and utilities may be required to support development of future residential construction within the project site. However, specific infrastructure improvements required to support residential development within the Enderle Center are not known at this time and will not be known until a development project is proposed.

EXISTING LAND USES IN THE PROJECT AREA

The project site is surrounded primarily by residential, commercial, and office uses. The areas adjacent to the project site include the following uses:

- **North:** Commercial uses opposite of 17th Street
- **East:** Commercial and office uses opposite of Enderle Center Drive
- **South:** Residential uses opposite of Vandenberg Lane
- **West:** Commercial and office uses opposite of SR-55

The closest sensitive receptors to the project site are residential uses, located approximately 70 feet south of the project's site boundary.

NOISE AND VIBRATION FUNDAMENTALS

CHARACTERISTICS OF SOUND

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a sound wave, which results in the tone's range from high to low. Loudness is the strength of a sound, and it describes a noisy or quiet environment; it is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the reception characteristics of the human ear. Sound intensity is the average rate of sound energy transmitted through a unit area perpendicular to the direction in which the sound waves are traveling. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

MEASUREMENT OF SOUND

Sound intensity is measured with the A-weighted decibel (dBA) scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound, similar to the human ear's de-emphasis of these frequencies. Decibels (dB), unlike the linear scale (e.g., inches or pounds), are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 dB is 10 times more intense than 0 dB, 20 dB is 100 times more intense than 0 dB, and 30 dB is 1,000 times more intense than 0 dB. Thirty decibels (30 dB) represents 1,000 times as much acoustic energy as 0 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the sound's loudness. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound levels dissipate exponentially with distance from their noise sources. For a single point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dB for each doubling of distance in a hard site environment. Line source sound levels decrease 4.5 dB for each doubling of distance in a relatively flat environment with absorptive vegetation.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous

sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and Community Noise Equivalent Level (CNEL) or the day-night average noise level (L_{dn}) based on A-weighted decibels. CNEL is the time-weighted average noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noises occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the relaxation. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable. The City of Tustin uses the CNEL noise scale for long-term traffic noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level (L_{max}), which is the highest sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by L_{max}, which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. It is often used together with another noise scale, or noise standards in terms of percentile noise levels, in noise ordinances for enforcement purposes. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level. Half the time the noise level exceeds this level, and half the time it is less than this level. The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first category includes audible impacts, which are increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 dB and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category includes changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to sound levels higher than 85 dBA. Exposure to high sound levels affects the entire system, with prolonged sound exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of sound exposure above 90 dBA would result in permanent cell damage. When the sound level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of sound is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by a feeling of pain in the ear (i.e., the threshold of pain). A sound level of 160–165 dBA will result in dizziness or a loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed areas.

Table A lists definitions of acoustical terms, and Table B shows common sound levels and their sources.

Table A: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of sound measurement that denotes the ratio between two quantities that are proportional to power; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in 1 second (i.e., the number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. (All sound levels in this report are A-weighted unless reported otherwise.)
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels that are equaled or exceeded by a fluctuating sound level 1%, 10%, 50%, and 90% of a stated time period, respectively.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time-varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dBA to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dBA to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dBA to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time. Usually a composite of sound from many sources from many directions, near and far; no particular sound is dominant.
Intrusive	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, and tonal or informational content, as well as the prevailing ambient noise level.

Source: Sources: (1) Technical Noise Supplement (Caltrans 2013); (2) Transit Noise and Vibration Impact Assessment Manual (FTA 2018).
Caltrans = California Department of Transportation
FTA = Federal Transit Administration

Table B: Common Sound Levels and Their Noise Sources

Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Evaluations
Near Jet Engine	140	Deafening	128 times as loud
Civil Defense Siren	130	Threshold of Pain	64 times as loud
Hard Rock Band	120	Threshold of Feeling	32 times as loud
Accelerating Motorcycle at a Few Feet Away	110	Very Loud	16 times as loud
Pile Driver; Noisy Urban Street/Heavy City Traffic	100	Very Loud	8 times as loud
Ambulance Siren; Food Blender	95	Very Loud	—
Garbage Disposal	90	Very Loud	4 times as loud
Freight Cars; Living Room Music	85	Loud	—
Pneumatic Drill; Vacuum Cleaner	80	Loud	2 times as loud
Busy Restaurant	75	Moderately Loud	—
Near Freeway Auto Traffic	70	Moderately Loud	Reference level
Average Office	60	Quiet	One-half as loud
Suburban Street	55	Quiet	—
Light Traffic; Soft Radio Music in Apartment	50	Quiet	One-quarter as loud
Large Transformer	45	Quiet	—
Average Residence without Stereo Playing	40	Faint	One-eighth as loud
Soft Whisper	30	Faint	—
Rustling Leaves	20	Very Faint	—
Human Breathing	10	Very Faint	Threshold of Hearing
—	0	Very Faint	—

Source: Compiled by LSA (2021).

FUNDAMENTALS OF VIBRATION

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may not be discernible, but without the effects associated with the shaking of a building there is less adverse reaction. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items sitting on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile-driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 feet (ft) from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft (FTA 2018). When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne vibration from street traffic would not exceed the impact criteria; however, construction of the project could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne noise is not likely to be a problem because noise arriving via the normal airborne path will usually be greater than ground-borne noise.

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for train-induced ground-borne vibration to cause even cosmetic building damage, it is not uncommon for construction processes such as blasting and pile-driving to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize the potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as

$$L_v = 20 \log_{10} [V/V_{ref}]$$

where "L_v" is the vibration velocity in decibels (VdB), "V" is the RMS velocity amplitude, and "V_{ref}" is the reference velocity amplitude, or 1 x 10^{-6} inches/second (in/sec) used in the United States.

REGULATORY SETTING

APPLICABLE NOISE STANDARDS

The applicable noise standards governing the project site include the criteria in the City's Noise Element of the General Plan (Noise Element) and Section 8.24 of the City of Tustin Municipal Code (TMC).

California Code of Regulations

Interior noise levels for residential habitable rooms are regulated by Title 24 of the California Code of Regulations California Noise Insulation Standards. Title 24, Chapter 12, Section 1206.4, of the 2019 California Building Code requires that interior noise levels attributable to exterior sources not exceed 45 CNEL in any habitable room. A habitable room is a room used for living, sleeping, eating, or cooking. Bathrooms, closets, hallways, utility spaces, and similar areas are not considered habitable rooms for this regulation (Title 24 California Code of Regulations, Chapter 12, Section 1206.4).

City of Tustin

Noise Element of the General Plan

The City's General Plan Noise Element (City of Tustin 2012) has established exterior and interior noise standards as shown in Table C. These noise standards apply to approved land uses for which mitigation may be required to achieve the City's noise standards. As shown in Table C, the City has a noise standard of 65 dBA CNEL for exterior habitable areas and a 45 dBA CNEL noise standard for interior habitable areas for residential land uses.

Table C: City of Tustin Interior and Exterior Noise Standards

Land Use	Noise Standards[1]	
	Interior[2,3]	Exterior
Residential: Single-family, multifamily, duplex, mobile home	45 dBA CNEL	65 dBA CNEL[4]
Residential: Transient lodging, hotels, motels, nursing homes, hospitals	45 dBA CNEL	65 dBA CNEL[4]
Private offices, church sanctuaries, libraries, board rooms, conference rooms, theaters, auditoriums, concert halls, meeting rooms, etc.	45 dBA $L_{eq}(12)$	--
Schools	45 dBA $L_{eq}(12)$	67 dBA $L_{eq}(12)$[5]
General offices, reception, clerical, etc.	50 dBA $L_{eq}(12)$	-
Bank lobby, retail store, restaurant, typing pool, etc.	55 dBA $L_{eq}(12)$	-
Manufacturing, kitchen, warehousing, etc.	65 dBA $L_{eq}(12)$	-
Parks, playgrounds	-	65 dBA CNEL[5]
Golf courses, outdoor spectator sports, amusement parks	-	70 dBA CNEL

Source: Noise Element, Tustin General Plan (City of Tustin 2012).

1 CNEL: Community Noise Equivalent Level. $L_{eq}(12)$: The A-weighted equivalent sound level averaged over a 12-hour period (usually the hours of operation).

2 Noise standard with windows closed. Mechanical ventilation shall be provided per UBC requirements to provide a habitable environment.

3 Indoor environment excluding bathrooms, toilets, closets, and corridors.

4 Outdoor environment limited to rear yard of single-family homes, multifamily patios, and balconies (with a depth of 6 feet or more) and common recreation areas.

5 Outdoor environment limited to playground areas, picnic areas, and other areas of frequent human use.

dBA = A-weighted decibels

UBC = Uniform Building Code

Municipal Code

Article 4, Chapter 6 of the City's Municipal Code (City of Tustin 2022) establishes the maximum permissible noise level that may intrude into a neighbor's property. The Noise Ordinance establishes noise level standards for various land use categories affected by stationary noise sources. Land use categories in the City are defined by five noise zones, as listed below. Table D provides the City's maximum noise standard based on the noise zone, the location of the noise (exterior/interior), and the time period.

Noise Zone 1: All residential properties

Noise Zone 2: All commercial properties

Noise Zone 3: All industrial properties

Noise Zone 4: All special properties such as hospitals, convalescent homes, public and institutional schools, libraries and churches

Noise Zone 5: All mixed-use properties.

Article 4, Chapter 6 of the City's Municipal Code limits the erection, demolition, alteration, repair, excavation, grading, paving or construction of any building or site to between the hours of 7:00 a.m. and 8:00 p.m. Monday through Friday and 9:00 a.m. and 5:00 p.m. on Saturdays. Construction is prohibited on Sundays and City-observed federal holidays. Trucks, vehicles and equipment that are making or are involved with material deliveries, loading or transfer of materials, equipment service, maintenance of any devices or appurtenances to any construction project in Tustin shall not be operated on or adjacent to said sites outside of the approved hours for construction activity.

Table D: City of Tustin Maximum Noise Level Standards

Noise Zone	Exterior/ Interior	Time Period	L_{50} (30 mins)	L_{25} (15 mins)	L_8 (5 mins)	L_2 (1 min)	L_{max} (Anytime)
1	Exterior	7:00 AM to 10:00 PM	55	60	65	70	75
		10:00 PM to 7:00 AM	50	55	60	65	70
	Interior	7:00 AM to 10:00 PM	—	—	55	60	65
		10:00 PM to 7:00 AM	—	—	45	50	55
2	Exterior	Anytime	60	65	70	75	80
3	Exterior	Anytime	70	75	80	85	90
4	Exterior	Anytime	55	60	65	70	75
5	Exterior	Anytime	60	65	70	75	80

Source: Municipal Code (City of Tustin 2018).
Note: It shall be unlawful for any person at any location within the incorporated area of the City of Tustin to create any noise or to allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, when the foregoing causes the noise level, when measured on any other property to exceed. In the event the alleged offensive noise consists of impact noise, simple tone, speech, music, or any combination thereof, each of the above noise levels shall be reduced by 5 dBA. In the event the ambient noise level exceeds any of the first four noise limit categories, the cumulate period applicable to said category shall be increased to reflect said ambient noise level. In the event the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under said category shall be increased to reflect the maximum ambient noise level.
dBA = A-weighted decibels
L_{max} = maximum instantaneous noise level
min/mins = minute/minutes

In addition, construction activities may be permitted outside of those limitations in the case of urgent necessity or upon a finding that such approval would not adversely impact adjacent properties and the health, safety and welfare of the community if a temporary exception is granted in writing by the Building Official for private property or by the Director of Public Works for public properties or their authorized representatives. All temporary waiver requests shall be made in writing and shall include the specific times, dates, and locations requested and a description of the type of activity that is proposed. In granting a temporary exception, conditions may be imposed on construction activities to protect the health, safety, and welfare of the community. Any approval granted may be summarily revoked by the Building Official or Director of Public Works at the sole discretion of each official.

Federal Transit Administration

Because the City does not have construction noise level limits, construction noise was assessed using criteria from the Federal Transit Administration's (FTA) 2018 *Transit Noise and Vibration Impact Assessment Manual* (FTA Manual). Table E shows the FTA's General Assessment Construction Noise Criteria based on the composite noise levels per construction phase.

Table E: General Assessment Construction Noise Criteria

Land Use	Daytime 1-hour L_{eq} (dBA)	Nighttime 1-hour L_{eq} (dBA)
Residential	90	80
Commercial	100	100
Industrial	100	100

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
dBA = A-weighted decibels L_{eq} = equivalent continuous sound level

APPLICABLE VIBRATION STANDARDS

Federal Transit Administration

Vibration standards included in the 2018 FTA Manual are used in this analysis for ground-borne vibration impacts on human annoyance. The criteria for environmental impacts from ground-borne vibration and noise are based on the maximum levels for a single event. Table F provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table F: Interpretation of Vibration Criteria for Detailed Analysis

Land Use	Max L_v (VdB)[1]	Description of Use
Workshop	90	Vibration that is distinctly felt. Appropriate for workshops and similar areas not as sensitive to vibration.
Office	84	Vibration that can be felt. Appropriate for offices and similar areas not as sensitive to vibration.
Residential Day	78	Vibration that is barely felt. Adequate for computer equipment and low-power optical microscopes (up to 20×).
Residential Night and Operating Rooms	72	Vibration is not felt, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power microscopes (100×) and other equipment of low sensitivity.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
[1] As measured in 1/3-octave bands of frequency over the frequency range 8 to 80 hertz.
FTA = Federal Transit Administration L_V = velocity in decibels
VdB = vibration velocity decibels Max = maximum

Table G lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA Manual. FTA guidelines show that a vibration level of up to 0.5 in/sec in PPV is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For non-engineered timber and masonry buildings, the construction building vibration damage criterion is 0.2 in/sec in PPV.

Table G: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
Reinforced concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry buildings	0.20
Buildings extremely susceptible to vibration damage	0.12

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
FTA = Federal Transit Administration PPV = peak particle velocity
in/sec = inch/inches per second

OVERVIEW OF THE EXISTING NOISE ENVIRONMENT

The primary existing noise sources in the project area are transportation facilities such as Yorba Street, 17th Street, Vandenberg Lane, and Enderle Center Drive and surrounding commercial and office uses.

AMBIENT NOISE MEASUREMENTS

Long-Term Noise Measurements

Long-term (24-hour) noise level measurements were conducted on January 23 and 24, 2024, using two (2) Larson Davis Spark 706RC Dosimeters. Table H provides a summary of the measured hourly noise levels and calculated CNEL level from the long-term noise level measurements. As shown in Table H, the calculated CNEL levels range from 66.9 dBA CNEL to 73.7 dBA CNEL. Hourly noise levels at surrounding sensitive uses are as low as 50.4 dBA L_{eq} during nighttime hours and 66.8 dBA L_{eq} during daytime hours. Long-term noise monitoring survey sheets are provided in Appendix A. Figure 3 shows the long-term monitoring locations.

Table H: Long-Term 24-Hour Ambient Noise Monitoring Results[1]

Location		Daytime Noise Levels[1] (dBA L_{eq})	Evening Noise Levels[2] (dBA L_{eq})	Nighttime Noise Levels[3] (dBA L_{eq})	Daily Noise Levels (dBA CNEL)
LT-1	14122 Paseo Verde, Tustin, CA 92780. Located in the front yard of a home on a tree, approximately 60 feet away from the Vandenberg Lane centerline.	64.7-66.8	61.9-64.9	50.4-62.3	66.9
LT-2	14032 Enderle Center Drive, #102, Tustin, CA 92780. Located south of an office building in the parking lot on a light pole, approximately 120 feet away from the Enderle Center Drive centerline.	65.8-68.8	69.4-69.8	62.4-69.2	73.7

Source: Compiled by LSA (2024).
Note: Noise measurements were conducted from January 23 and 24, 2024, starting at 2:00 p.m.
[1] Daytime Noise Levels = noise levels during the hours from 7:00 a.m. to 7:00 p.m.
[2] Evening Noise Levels = noise levels during the hours from 7:00 p.m. to 10:00 p.m.
[3] Nighttime Noise Levels = noise levels during the hours from 10:00 p.m. to 7:00 a.m.
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level
CNEL = Community Noise Equivalent Level

EXISTING AIRCRAFT NOISE

Aircraft flyovers may be audible on the project site due to aircraft activity in the vicinity. The nearest airport to the project is John Wayne Airport (JWA), a commercial airport 5.5 miles to the south. The project site is outside the 60 dBA CNEL noise contour of JWA based on the JWA Airport 2022 Annual Community Noise Equivalent Level Contours (County of Orange 2022). Additionally, there are no helipads or private airstrips within 2 miles of the project area. Due to the distance of the project site from the nearest airport, impacts related to aircraft operations are not further discussed in this analysis.

LSA

LEGEND

Project Site Boundary

LT-1 Long-term Noise Monitoring Location

0 100 200

FEET

SOURCE: Google Earth (2024)

I:ESL2201.76\G\Noise_Locs.ai (3/28/2024)

FIGURE 3

Enderle Center

Noise Monitoring Locations

PROJECT IMPACTS

SHORT-TERM CONSTRUCTION NOISE IMPACTS

Two types of short-term noise impacts could occur during the construction of the proposed project. First, construction crew commutes and the transport of construction equipment and materials to the site for the proposed project would incrementally increase noise levels on access roads leading to the site. Although there would be a relatively high single-event noise-exposure potential causing intermittent noise nuisance (passing trucks at 50 ft would generate up to 84 dBA L_{max}), the effect on longer-term ambient noise levels would be small when compared to existing daily traffic volumes on 17th Street. Because construction-related vehicle trips would not approach existing daily traffic volumes, traffic noise would not increase by 3 dBA CNEL. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment. Therefore, short-term, construction-related impacts associated with worker commute and equipment transport to the project site would be less than significant.

The second type of short-term noise impact is related to noise generated during demolition, excavation, grading, and building erection on the project site. 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. Table I lists typical construction equipment noise levels recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receptor, taken from the FHWA *Roadway Construction Noise Model* (FHWA 2006).

In addition to the reference maximum noise level, the usage factor provided in Table I is used to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right)$$

where: $L_{eq}(equip)$ = L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period.

E.L. = noise emission level of the particular piece of equipment at a reference distance of 50 ft.

U.F. = usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time.

D = distance from the receiver to the piece of equipment.

Table I: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)[1]	Maximum Noise Level (L_{max}) at 50 Feet[2]
Auger Drill Rig	20	84
Backhoes	40	80
Compactor (ground)	20	80
Compressor	40	80
Cranes	16	85
Dozers	40	85
Dump Trucks	40	84
Excavators	40	85
Flat Bed Trucks	40	84
Forklift	20	85
Front-end Loaders	40	80
Graders	40	85
Impact Pile Drivers	20	95
Jackhammers	20	85
Paver	50	77
Pickup Truck	40	55
Pneumatic Tools	50	85
Pumps	50	77
Rock Drills	20	85
Rollers	20	85
Scrapers	40	85
Tractors	40	84
Trencher	50	80
Welder	40	73

Source: FHWA Roadway Construction Noise Model User's Guide, Table 1 (FHWA 2006).
Note: Noise levels reported in this table are rounded to the nearest whole number.
[1] Usage factor is the percentage of time during a construction noise operation that a piece of construction equipment is operating at full power.
[2] Maximum noise levels were developed based on Specification 721.560 from the Central Artery/Tunnel program to be consistent with the City of Boston's Noise Code for the "Big Dig" project.
FHWA = Federal Highway Administration
L_{max} = maximum instantaneous sound level

Each piece of construction equipment operates as an individual point source. Using the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Leq\ (composite) = 10 * \log_{10}\left(\sum_{1}^{n} 10^{\frac{Ln}{10}}\right)$$

Using the equations from the methodology above, the reference information in Table I, and the construction equipment list provided, the composite noise level of each construction phase was calculated. The project construction composite noise levels at a distance of 50 ft would range from 74 dBA L_{eq} to 88 dBA L_{eq} with the highest noise levels occurring during the site preparation and grading phases.

Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Leq\ (at\ distance\ X) = Leq\ (at\ 50\ feet) - 20 * \log_{10}\left(\frac{X}{50}\right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA.

Table J shows the nearest sensitive uses to the project site, their distance from the center of construction activities, and composite noise levels expected during construction. These noise level projections do not take into account intervening topography or barriers. Construction equipment calculations are provided in Appendix B.

Table J: Potential Construction Noise Impacts at Nearest Receptor

Receptor (Location)	Composite Noise Level (dBA L_{eq}) at 50 ft[1]	Distance (ft)	Composite Noise Level (dBA L_{eq})
Residential (South)	88	380	70
Commercial / Office (East)		380	70
Commercial / Office (North)		440	69
Commercial / Office (West)		515	67

Source: Compiled by LSA (2024).

[1] The composite construction noise level represents the grading phase which is expected to result in the greatest noise level as compared to other phases.

dBA L_{eq} = average A-weighted hourly noise level

ft = foot/feet

While construction noise will vary, it is expected that composite noise levels during construction at the nearest off-site sensitive uses to the south would reach 70 dBA L_{eq}. These predicted noise levels would only occur when all construction equipment is operating simultaneously; and therefore, are assumed to be rather conservative in nature. While construction-related short-term noise levels have the potential to be higher than existing ambient noise levels in the project area under existing conditions, the noise impacts would no longer occur once project construction is completed.

As stated above, noise impacts associated with construction activities are regulated by the City's noise ordinance. The proposed project will be required to comply with the construction hours specified in the City's Noise Ordinance, which states that construction activities are allowed between 7:00 a.m. and 8:00 p.m., Monday through Friday, and between 9:00 a.m. and 5:00 p.m. on Saturdays. Construction is prohibited on Sundays and City-observed federal holidays.

As it relates to off-site uses, construction-related noise impacts would remain below the 90 dBA L_{eq} and 100 dBA L_{eq} 1-hour construction noise level criteria as established by the FTA for residential and commercial land uses, respectively, for the average daily conditions as modeled from the center of the project site, and therefore, they would be considered less than significant. Best construction practices presented at the end of this analysis shall be implemented to minimize noise impacts to surrounding receptors.

SHORT-TERM CONSTRUCTION VIBRATION IMPACTS

This construction vibration impact analysis discusses the level of human annoyance using vibration levels in VdB and assesses the potential for building damages using vibration levels in PPV (in/sec). This is because vibration levels calculated in RMS are best for characterizing human response to building vibration, while vibration level in PPV is best for characterizing potential for damage.

Table K shows the PPV and VdB values at 25 ft from the construction vibration source. As shown in Table K, bulldozers and other heavy-tracked construction equipment (expected to be used for this project) generate approximately 0.089 PPV in/sec or 87 VdB of ground-borne vibration when measured at 25 ft, based on the FTA Manual. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project construction boundary (assuming the construction equipment would be used at or near the project setback line).

Table K: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L_V at 25 ft	
	PPV (in/sec)	L_V (VdB)[1]
Pile Driver (Impact), Typical	0.644	104
Pile Driver (Sonic), Typical	0.170	93
Vibratory Roller	0.210	94
Hoe Ram	0.089	87
Large Bulldozer[2]	**0.089**	**87**
Caisson Drilling	0.089	87
Loaded Trucks[2]	**0.076**	**86**
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
[1] RMS vibration velocity in decibels (VdB) is 1 µin/sec.
[2] Equipment shown in **bold** is expected to be used on site.
µin/sec = microinches per second
ft = foot/feet
FTA = Federal Transit Administration
in/sec = inch/inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

The formulae for vibration transmission are provided below, and Tables L and M below provide a summary of off-site construction vibration levels.

$$L_vdB\ (D) = L_vdB\ (25\ ft) - 30\ Log\ (D/25)$$

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

As shown in Table F, above, the threshold at which vibration levels would result in annoyance would be 78 VdB for daytime residential uses. As shown in Table G, the FTA guidelines indicate that for a non-engineered timber and masonry building, the construction vibration damage criterion is 0.2 in/sec in PPV.

Table L: Potential Construction Vibration Annoyance Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (VdB) at 25 ft[1]	Distance (ft) [2]	Vibration Level (VdB)
Residential (South)	87	380	52
Commercial / Office (East)		380	52
Commercial / Office (North)		440	50
Commercial / Office (West)		515	48

Source: Compiled by LSA (2024).
[1] The reference vibration level is associated with a large bulldozer, which is expected to be representative of the heavy equipment used during construction.
[2] The reference distance is associated with the average condition, identified by the distance from the center of construction activities to surrounding uses.
ft = foot/feet
VdB = vibration velocity decibels

Table M: Potential Construction Vibration Damage Impacts at Nearest Receptor

Receptor (Location)	Reference Vibration Level (PPV) at 25 ft[1]	Distance (ft)[2]	Vibration Level (PPV)
Residential (South)	0.089	70	0.019
Commercial / Office (East)		20	0.124
Commercial / Office (North)		140	0.007
Commercial / Office (West)		95	0.012

Source: Compiled by LSA (2024).
[1] The reference vibration level is associated with a large bulldozer, which is expected to be representative of the heavy equipment used during construction.
[2] The reference distance is associated with the peak condition, identified by the distance from the perimeter of construction activities to surrounding structures.
ft = foot/feet
PPV = peak particle velocity

Based on the information provided in Table L, vibration levels are expected to approach 52 VdB at the closest residential uses located south of the project site, which is below the 78 VdB threshold for annoyance.

The closest structure to the project site is the commercial use to the east of site, approximately 20 ft from the limits of construction activity. It is expected that vibration levels generated by dump trucks and other large equipment that would operate near the property line would generate ground-borne vibration levels of up to 0.124 PPV (in/sec) at the closest structure to the project site. This vibration level would not exceed the 0.2 PPV (in/sec) threshold considered safe for non-engineered timber and masonry buildings. All other structures are further away and would experience lower vibration levels. Therefore, vibration impacts would be less than significant. Because construction activities are regulated by the City's Municipal Code, which states that construction, maintenance, or demolition activities are allowed between the hours of 7:00 a.m. to 8:00 p.m., Monday through Friday, and 9:00 a.m. to 5:00 p.m. on Saturdays and City-observed federal holidays, vibration impacts would not occur during the more sensitive nighttime hours.

LONG-TERM OFF-SITE TRAFFIC NOISE IMPACTS

The guidelines included in the FHWA Highway Traffic Noise Prediction Model (FHWA-RD-77 108) were used to evaluate highway traffic-related noise conditions along roadway segments in the project vicinity. This model requires various parameters, including traffic volumes, vehicle mix, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The resultant noise levels are weighted and summed over 24-hour periods to determine the CNEL values. Table N provides the traffic noise levels for the opening year and future year with and without project scenarios. These noise levels represent the worst-case scenario, which assumes no shielding is provided between the traffic and the location where the noise contours are drawn.

The without and with project scenario traffic volumes were obtained from the Traffic Impact Analysis (EPD Solutions Inc. 2024). Appendix C provides the specific assumptions used in developing these noise levels and model printouts. Table N shows that the increase in project-related traffic noise would be no greater than 2.9 dBA. Noise level increases less than 3 dBA are not perceptible to the human ear in an outdoor environment. Therefore, traffic noise impacts from project-related traffic on off-site sensitive receptors would be less than significant, and no mitigation measures are required.

LONG-TERM TRAFFIC-RELATED VIBRATION IMPACTS

The proposed project would not generate vibration levels related to on-site operations. In addition, vibration levels generated from project-related traffic on the adjacent roadways are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Vibration levels generated from project-related traffic on the adjacent roadways would be less than significant, and no mitigation measures are required.

LONG-TERM STATIONARY NOISE IMPACTS

Adjacent off-site land uses would be potentially exposed to stationary-source noise impacts from sources which include on-site heating, ventilation, and air conditioning (HVAC) equipment, and truck deliveries and loading and unloading activities. It is expected that on-site stationary noise sources would meet the City of Tustin maximum noise level standards as presented previously in Table D.

Once proposed uses are determined and final site plans are available, a Final Acoustical Report would be required to confirm the noise level exposure from stationary sources to off-site sensitive land uses and to identify any specific mitigation measures necessary to achieve an exterior noise level below the City's noise standards.

Table N: Traffic Noise Levels Without and With Proposed Project

Roadway Segment	Existing		Opening Year – No Project		Opening Year – With Project			Future Year – No Project		Future Year – With Project		
	ADT	CNEL (dBA) 50 ft from Centerline of Nearest Lane	ADT	CNEL (dBA) 50 ft from Centerline of Nearest Lane	ADT	CNEL (dBA) 50 ft from Centerline of Nearest Lane	Increase from Baseline Conditions (dBA)	ADT	CNEL (dBA) 50 ft from Centerline of Nearest Lane	ADT	CNEL (dBA) 50 ft from Centerline of Nearest Lane	Increase from Baseline Conditions (dBA)
17th St between SR-55 SB Ramps & SR-55 NB Ramps	39,346	68.9	39,802	68.9	44,963	69.5	0.6	41,852	69.2	47,013	69.7	0.5
17th St between SR-55 NB Ramps & Carroll Way-Yorba St South	38,861	68.8	39,155	68.9	46,611	69.6	0.7	40,478	69.0	47,934	69.7	0.7
17th St between Carroll Way-Yorba St South & Yorba St North-Enderle Center Dr	34,006	68.3	34,151	68.3	39,312	68.9	0.6	34,801	68.4	39,963	69.0	0.6
Yorba St between 17th St & Vandenberg Ln	5,174	60.6	5,607	60.9	10,768	63.8	2.9	7,555	62.2	12,716	64.5	2.3
Enderle Center Dr between 17th St & Vandenberg Ln	3,197	53.6	3,453	53.9	6,320	56.6	2.7	4,604	55.2	7,471	57.3	2.1

Source: Compiled by LSA (2024).
Note: Shaded cells indicate roadway segments adjacent to the project site.
ADT = average daily traffic
CNEL= Community Noise Equivalent Level
dBA = A-weighted decibels
ft = foot/feet

LAND USE COMPATIBILITY

The dominant source of noise in the project vicinity is traffic noise from roadways in the vicinity of the project.

EXTERIOR NOISE ASSESSMENT

Based on the monitoring results shown in Table H, the existing measured noise levels at the project site closest to Enderle Center Drive, approximately 120 ft away from the Enderle Center Drive centerline, is 73.7 dBA CNEL. Exterior living areas of residential units, which are either shared spaces, access points to the units, or balconies that are less than 6 ft deep, are not considered as exterior living areas. However, once site plans are available, a Final Acoustical Report would be required to confirm any proposed exterior noise sensitive areas would experience noise levels less than 65 dBA CNEL and to identify any noise reduction features to the exterior living areas, if necessary.

INTERIOR NOISE ASSESSMENT

As discussed above, the California Code of Regulations and the City's Noise Element state that an interior noise level standard of 45 dBA CNEL or less is required for all noise-sensitive rooms. Based on the expected future exterior noise levels closest to Enderle Center Drive and 17th Street approaching 74 dBA CNEL, a minimum noise reduction of 29 dBA would be required.

Based on reference information from transmission loss test reports for various Milgard windows (Milgard 2008), the necessary reduction can be achieved with standard building construction and upgraded windows with Sound Transmission Class (STC) ratings of 30–35, depending on the window-to-glass ratio, at the lots closest to Enderle Center Drive and 17th Street. For all other lots farther from 17th Street and Enderle Center Drive, standard building construction along with standard windows, typically in the STC 25–28 range, interior noise levels of 45 dBA CNEL or less would be achieved.

Once final plans are available to detail the exterior wall construction and a window manufacturer has been chosen, a Final Acoustical Report would be required to confirm the reduction capability of the exterior façades and to identify any specific upgrades necessary to achieve an interior noise level of 45 dBA CNEL or below.

BEST CONSTRUCTION PRACTICES AND DESIGN REQUIREMENTS

In addition to compliance with the City's Municipal Code allowed hours of construction of 7:00 a.m. to 8:00 p.m., Monday through Friday, and 9:00 a.m. to 5:00 p.m. on Saturdays and City-observed federal holidays, the following best construction practices would further minimize construction noise impacts:

- The project construction contractor shall equip all construction equipment, fixed or mobile, with properly operating and maintained noise mufflers consistent with manufacturer's standards.
- The project construction contractor shall locate staging areas away from off-site sensitive uses during the later phases of project development.
- The project construction contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site whenever feasible.

REFERENCES

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Federal Highway Administration (FHWA). 2006. *Roadway Construction Noise Model User's Guide.* January. Washington, D.C. Website: https://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/rcnm.pdf (accessed March 2024).

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Milgard. 2008. Various Transmission Loss Reports.

APPENDIX A

NOISE MONITORING SHEETS

Noise Measurement Survey – 24 HR

Project Number: ESL2201.76
Project Name: Enderle Project

Test Personnel: Kevin Nguyendo
Equipment: Spark 706RC (SN:206)

Site Number: LT-1 Date: 1/24/24

Time: From 2:00 p.m. To 2:00 p.m.

Site Location: 14122 Paseo Verde, Tustin, CA 92780. Located in the front yard of a home on a tree.

Primary Noise Sources: Traffic on Vandenberg Lane.

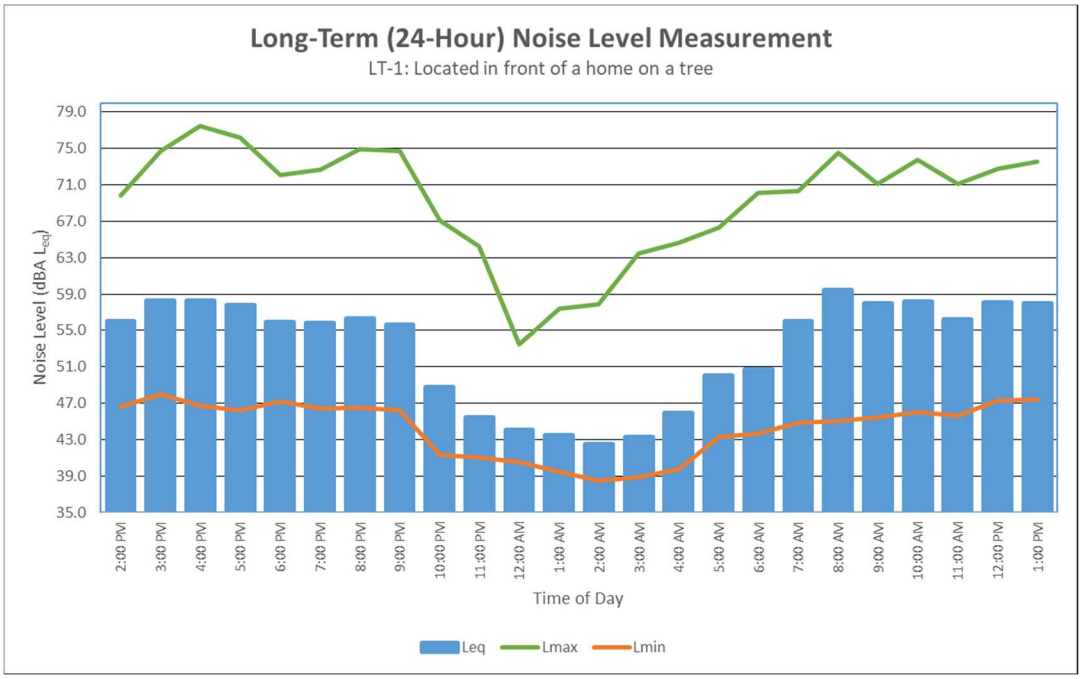
Comments: Approximately 72 inch tall retaining wall around residential community.

Photo:

Long-Term (24-Hour) Noise Level Measurement Results at LT-1

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
2:00 PM	1/24/24	56.0	69.8	46.6
3:00 PM	1/24/24	58.2	74.7	48.0
4:00 PM	1/24/24	58.2	77.5	46.7
5:00 PM	1/24/24	57.7	76.2	46.2
6:00 PM	1/24/24	55.9	72.1	47.2
7:00 PM	1/24/24	55.8	72.7	46.4
8:00 PM	1/24/24	56.3	74.9	46.5
9:00 PM	1/24/24	55.6	74.7	46.2
10:00 PM	1/24/24	48.7	67.1	41.3
11:00 PM	1/24/24	45.4	64.2	41.0
12:00 AM	1/25/24	44.1	53.5	40.5
1:00 AM	1/25/24	43.5	57.4	39.5
2:00 AM	1/25/24	42.5	57.9	38.5
3:00 AM	1/25/24	43.3	63.5	38.9
4:00 AM	1/25/24	45.9	64.6	39.8
5:00 AM	1/25/24	50.0	66.3	43.3
6:00 AM	1/25/24	50.7	70.1	43.7
7:00 AM	1/25/24	56.0	70.3	44.8
8:00 AM	1/25/24	59.4	74.5	45.0
9:00 AM	1/25/24	57.9	71.1	45.4
10:00 AM	1/25/24	58.1	73.7	46.0
11:00 AM	1/25/24	56.2	71.1	45.6
12:00 PM	1/25/24	58.1	72.8	47.3
1:00 PM	1/25/24	58.0	73.5	47.4

Source: Compiled by LSA Associates, Inc. (2024).
dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level
L_{min} = minimum measured sound level



Noise Measurement Survey – 24 HR

Project Number: ESL2201.76
Project Name: Enderle Project

Test Personnel: Kevin Nguyendo
Equipment: Spark 706RC (SN:814)

Site Number: LT-2 Date: 1/24/24

Time: From 2:00 p.m. To 2:00 p.m.

Site Location: 14032 Enderle Center Dr #102, Tustin, CA 92780. Located south of an office building in the parking lot on a light pole.

Primary Noise Sources: Traffic on Enderle Center Drive and Vandenberg Lane.

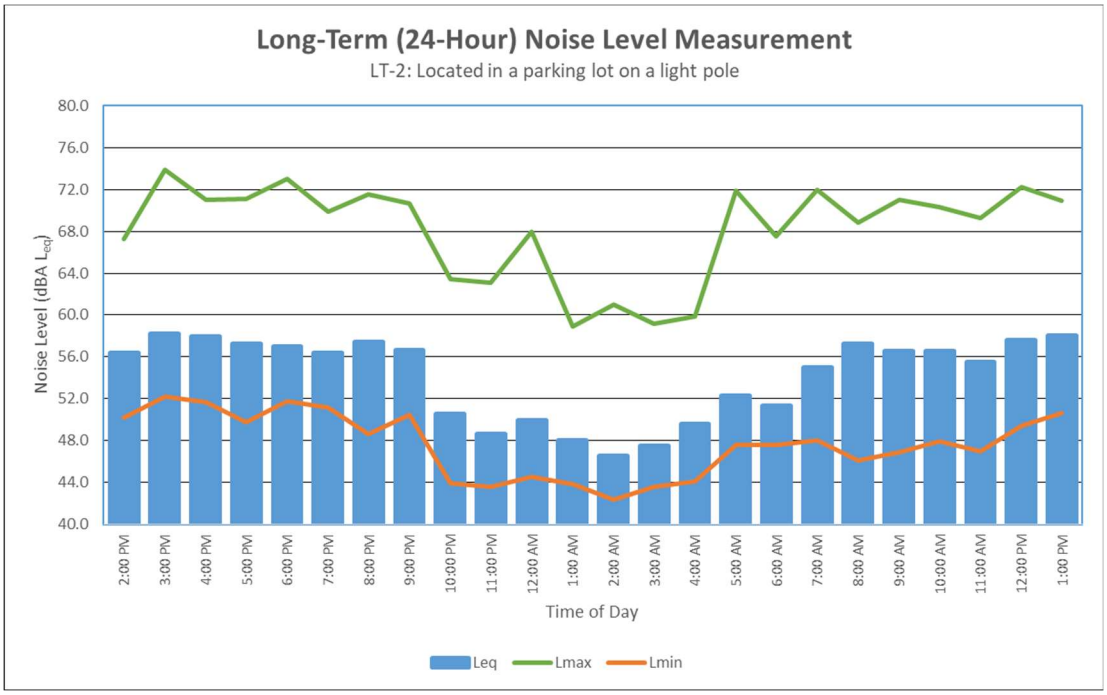
Comments:

Photo:

Long-Term (24-Hour) Noise Level Measurement Results at LT-2

Start Time	Date	Noise Level (dBA)		
		L_{eq}	L_{max}	L_{min}
2:00 PM	1/24/24	56.4	67.3	50.2
3:00 PM	1/24/24	58.2	73.9	52.2
4:00 PM	1/24/24	57.9	71.0	51.7
5:00 PM	1/24/24	57.3	71.1	49.8
6:00 PM	1/24/24	57.0	73.0	51.8
7:00 PM	1/24/24	56.4	69.9	51.2
8:00 PM	1/24/24	57.4	71.5	48.6
9:00 PM	1/24/24	56.6	70.7	50.5
10:00 PM	1/24/24	50.5	63.4	43.9
11:00 PM	1/24/24	48.6	63.1	43.6
12:00 AM	1/25/24	50.0	68.0	44.5
1:00 AM	1/25/24	48.0	58.9	43.8
2:00 AM	1/25/24	46.5	61.0	42.4
3:00 AM	1/25/24	47.5	59.2	43.6
4:00 AM	1/25/24	49.5	59.9	44.1
5:00 AM	1/25/24	52.3	71.9	47.6
6:00 AM	1/25/24	51.4	67.5	47.6
7:00 AM	1/25/24	54.9	72.0	48.0
8:00 AM	1/25/24	57.2	68.8	46.1
9:00 AM	1/25/24	56.5	71.0	46.9
10:00 AM	1/25/24	56.6	70.3	47.9
11:00 AM	1/25/24	55.5	69.3	47.0
12:00 PM	1/25/24	57.6	72.2	49.4
1:00 PM	1/25/24	58.0	70.9	50.6

Source: Compiled by LSA Associates, Inc. (2024).
dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level
L_{min} = minimum measured sound level



APPENDIX B

CONSTRUCTION NOISE LEVEL CALCULATIONS

Construction Calculations

Phase: Demolition

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Concrete Saw	1	90	20	50	0.5	90	83
Excavator	3	81	40	50	0.5	81	82
Dozer	2	82	40	50	0.5	82	81
					Combined at 50 feet	**91**	**87**
					Combined at Receptor 373 feet	**69**	**70**
					Combined at Receptor 350 feet	**69**	**71**
					Combined at Receptor 505 feet	**66**	**68**

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Dozer	3	82	40	50	0.5	82	83
Tractor	4	84	40	50	0.5	84	86
					Combined at 50 feet	**86**	**88**
					Combined at Receptor 373 feet	**69**	**70**
					Combined at Receptor 350 feet	**69**	**71**
					Combined at Receptor 505 feet	**66**	**68**

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Excavator	**2**	81	40	50	0.5	81	80
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Scraper	2	84	40	50	0.5	84	83
Tractor	2	84	40	50	0.5	84	83
					Combined at 50 feet	**90**	**88**
					Combined at Receptor 373 feet	**73**	**71**
					Combined at Receptor 350 feet	**74**	**72**
					Combined at Receptor 505 feet	**70**	**68**

Phase:Building Construstion

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Crane	1	81	16	50	0.5	81	73
Man Lift	3	75	20	50	0.5	75	73
Generator	1	81	50	50	0.5	81	78
Tractor	3	84	40	50	0.5	84	85
Welder / Torch	1	74	40	50	0.5	74	70
					Combined at 50 feet	**86**	**81**
					Combined at Receptor 373 feet	**69**	**63**
					Combined at Receptor 350 feet	**69**	**64**
					Combined at Receptor 505 feet	**66**	**61**

Phase:Paving

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Paver	2	77	50	50	0.5	77	77
All Other Equipment > 5 HP	2	85	50	50	0.5	85	85
Roller	2	80	20	50	0.5	80	76
					Combined at 50 feet	**87**	**86**
					Combined at Receptor 373 feet	**69**	**69**
					Combined at Receptor 350 feet	**70**	**69**
					Combined at Receptor 505 feet	**67**	**66**

Phase:Architectural Coating

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Compressor (air)	1	78	40	50	0.5	78	74
					Combined at 50 feet	**78**	**74**
					Combined at Receptor 373 feet	**61**	**57**
					Combined at Receptor 350 feet	**61**	**57**
					Combined at Receptor 505 feet	**58**	**54**

Sources: RCNM

[1]- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level

APPENDIX C

FHWA TRAFFIC NOISE MODEL PRINTOUTS

TABLE Existing -01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 SB Ramps & SR-55 NB Ramps
NOTES: Enderle Center Project - Existing

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 39346 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.89

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
83.6	158.4	330.1	705.9

TABLE Existing -02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 NB Ramps & Carroll Way-Yorba St South
NOTES: Enderle Center Project - Existing

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 38861 SPEED (MPH): 40 GRADE: .5

	TRAFFIC DISTRIBUTION PERCENTAGES		
	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.83

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
83.1	157.2	327.5	700.1

TABLE Existing -03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between Carroll Way-Yorba St South & Yorba St North-Enderle Center Dr
NOTES: Enderle Center Project - Existing

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 34006 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.25

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
78.2	144.9	300.1	640.8

TABLE Existing -04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Yorba St between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Existing

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 5174 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 60.58

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	91.6	185.7

TABLE Existing -05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Enderle Center Dr between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Existing

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 3197 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 53.60

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	71.6

TABLE Opening Year - No Project -01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 SB Ramps & SR-55 NB Ramps
NOTES: Enderle Center Project - Opening Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 39802 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.94

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
84.1	159.5	332.6	711.3

TABLE Opening Year - No Project -02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 NB Ramps & Carroll Way-Yorba St South
NOTES: Enderle Center Project - Opening Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 39155 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.86

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
83.4	157.9	329.1	703.6

TABLE Opening Year - No Project -03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between Carroll Way-Yorba St South & Yorba St North-Enderle Center Dr
NOTES: Enderle Center Project - Opening Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 34151 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.27

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
78.3	145.3	301.0	642.6

TABLE Opening Year - No Project -04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Yorba St between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Opening Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 5607 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 60.93

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	95.9	195.6

TABLE Opening Year - No Project -05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Enderle Center Dr between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Opening Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 3453 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 53.94

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	74.5

TABLE Opening Year - With Project -01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 SB Ramps & SR-55 NB Ramps
NOTES: Enderle Center Project - Opening Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 44963 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.46

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
89.2	171.9	360.3	771.3

TABLE Opening Year - With Project -02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 NB Ramps & Carroll Way-Yorba St South
NOTES: Enderle Center Project - Opening Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 46611 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.62

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
90.8	175.8	368.9	790.0

TABLE Opening Year - With Project -03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between Carroll Way-Yorba St South & Yorba St North-Enderle Center Dr
NOTES: Enderle Center Project - Opening Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 39312 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.88

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
83.6	158.3	329.9	705.5

TABLE Opening Year - With Project -04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Yorba St between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Opening Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 10768 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.77

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	73.0	142.4	299.3

TABLE Opening Year - With Project -05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Enderle Center Dr between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Opening Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6320 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 56.56

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	104.5

TABLE Future Year - No Project -01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 SB Ramps & SR-55 NB Ramps
NOTES: Enderle Center Project - Future Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 41852 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.15

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
86.1	164.5	343.7	735.4

TABLE Future Year - No Project -02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 NB Ramps & Carroll Way-Yorba St South
NOTES: Enderle Center Project - Future Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 40478 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.01

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
84.8	161.1	336.3	719.3

TABLE Future Year - No Project -03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between Carroll Way-Yorba St South & Yorba St North-Enderle Center Dr
NOTES: Enderle Center Project - Future Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 34801 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.35

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
79.0	147.0	304.7	650.7

TABLE Future Year - No Project -04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Yorba St between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Future Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 7555 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 62.23

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	61.5	114.4	237.3

TABLE Future Year - No Project -05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Enderle Center Dr between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Future Year - No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 4604 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 55.19

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	0.0	87.0

TABLE Future Year - With Project -01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 SB Ramps & SR-55 NB Ramps
NOTES: Enderle Center Project - Future Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 47013 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.66

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
91.2	176.8	371.0	794.5

TABLE Future Year - With Project -02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between SR-55 NB Ramps & Carroll Way-Yorba St South
NOTES: Enderle Center Project - Future Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 47934 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.74

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
92.1	178.9	375.8	804.8

TABLE Future Year - With Project -03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: 17th St between Carroll Way-Yorba St South & Yorba St North-Enderle Center Dr
NOTES: Enderle Center Project - Future Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 39963 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 45 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.95

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
84.2	159.9	333.5	713.2

TABLE Future Year - With Project -04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Yorba St between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Future Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 12716 SPEED (MPH): 40 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 64.49

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	79.7	158.1	333.9

TABLE Future Year - With Project -05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 03/04/2024
ROADWAY SEGMENT: Enderle Center Dr between 17th St & Vandenberg Ln
NOTES: Enderle Center Project - Future Year - With Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 7471 SPEED (MPH): 25 GRADE: .5

TRAFFIC DISTRIBUTION PERCENTAGES

	DAY	EVENING	NIGHT
AUTOS	75.51	12.57	9.34
M-TRUCKS	1.56	0.09	0.19
H-TRUCKS	0.64	0.02	0.08

ACTIVE HALF-WIDTH (FT): 35 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 57.29

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	61.9	115.5
