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MEMORANDUM

DATE: September 7, 2021

TO: Matthew Gevergiz, Frontier Enterprises

FROM: Jason Lui, Associate/Senior Noise Specialist

SUBJECT: Noise and Vibration Impact Analysis for the Mango and South Highland Townhomes Project in Fontana, California (LSA Project No. FTR2102)

INTRODUCTION

This noise and vibration impact analysis has been prepared to evaluate the potential noise and vibration impacts and reduction measures associated with the Mango and South Highland Townhomes Project (project) in Fontana, California. This memorandum is intended to satisfy the City of Fontana's (City) requirements and the California Environmental Quality Act for a project-specific noise and vibration impact analysis by examining the impacts of the proposed uses on the project site and evaluating the reduction measures that the project requires. All references cited in this memorandum are included in Attachment A.

Project Location

The project site is at the southwest corner of the intersection of South Highland and Mango Avenues within the Walnut Village Specific Plan (WVSP) in Fontana, California. Figure 1 shows the regional and project location (all figures are provided in Attachment B of this document).

Project Description

The project would develop 107 townhomes with 214 garages, 56 guest parking stalls, and 16,050 square feet of community open space on a net 6.45-acre site. The project would also include the construction of 6-foot-high perimeter block walls. The proposed project site is currently designated "Community Commercial" under the City of Fontana General Plan and is zoned "Specific Plan." Within the WVSP, the project site is in Planning Area 1 "The Corner", an area originally planned for the development of, "…retail and specialty uses." The proposed project anticipates processing of a General Plan Amendment, a Specific Plan Amendment (SPA), and a zone change (ZC) to allow the development of residential uses on the project site.

The tentative construction schedule would begin in May 2022 until completion between June 2023 and December of 2023, a duration of 13 to 19 months. For the purposes of this analysis, a conservative construction schedule of 13 months was applied. Figure 2 shows the site plan.

CHARACTERISTICS OF SOUND

Sound is increasing to such disagreeable levels in the environment that it can threaten quality of life. 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 wave resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and 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 refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. 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 through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level deemphasizes 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, which is a scale based on powers of 10.

For example, 10 decibels 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 loudness of the sound. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels generate from a source, and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. 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; however, line source noise in a relatively flat environment with absorptive vegetation decreases 4.5 dB for each doubling of distance.

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 (dBA). CNEL is the time-varying 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 evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable. The City uses the CNEL noise scale for long-term noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum noise level (L_{max}), which is the highest exponential time-averaged 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, audible impacts, refers to increases in noise levels noticeable to humans. Audible increases in noise levels generally involve a change of 3 dB or greater because that level has been found to be barely perceptible in exterior environments. The second category, potentially audible impacts, refers to a change in the noise level between 1 and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category involves changes in noise level 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 noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise 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 noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear, even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear (the threshold of pain). A sound level of 160–165 dBA will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying, less developed area. 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 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., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter deemphasizes 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.
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 PM to 10:00 PM and after the addition of 10 dBA to sound levels occurring in the night between 10:00 PM and 7:00 AM.
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 PM and 7:00 AM.
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 at 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, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.

Source: *Handbook of Acoustical Measurements and Noise Control* (Harris 1991).

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	—
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 Associates, Inc. (2015).

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 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 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 vibration velocity decibels (VdB) 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 earth-moving equipment), steel-wheeled trains, and occasional traffic on rough roads. Ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 feet from the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 feet (see the Federal Transit Administration's [FTA] 2018 *Transit Noise and Vibration Impact Assessment Manual*). 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 will not exceed the impact criteria; however, construction of a 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 cosmetic building damage, it is not uncommon for heavy-duty construction processes (e.g., 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 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 Lv is the VdB, "V" is the RMS velocity amplitude, and "Vref" is the reference velocity amplitude, or 1×10^{-6} inches/second (in/sec) used in the United States.

REGULATORY SETTING

Federal Regulations

Federal Transit Administration

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

The criteria for environmental impact from ground-borne vibration and noise are based on the maximum levels for a single event. Table D lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). FTA guidelines show that a vibration level of up to 102 VdB (equivalent to 0.50 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 94 VdB (0.20 in/sec in PPV).

Table C: Interpretation of Vibration Criteria for Detailed Analysis

Land Use	Maximum 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 20X).
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 (100X) and other equipment of low sensitivity.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

[1] As measured in ⅓-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

Table D: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)	Approximate L_V (VdB)[1]
Reinforced concrete, steel, or timber (no plaster)	0.50	102
Engineered concrete and masonry (no plaster)	0.30	98
Non-engineered timber and masonry buildings	0.20	94
Buildings extremely susceptible to vibration damage	0.12	90

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

[1] RMS vibration velocity in decibels (VdB) is 1 µin/sec.

µin/sec = microinches per second
FTA = Federal Transit Administration
in/sec = inches per second
L_v = vibration velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square'
VdB = vibration velocity decibels

State Regulations

Title 24

The State's Noise Insulation Standards (California Building Code/California Code of Regulations Title 24, Part 2) establishes standards for interior noise attributable to outside noise sources and requires the preparation of acoustical studies wherever a residential building is proposed within the 60 dBA CNEL noise contour created by a freeway, expressway, parkway, major street, thoroughfare, rail line, rail transit line, or industrial noise source. The acoustical study must show that the building has been designed to limit the intrusion of exterior noise such that interior noise levels do not exceed 45 dBA CNEL.

Local Regulations

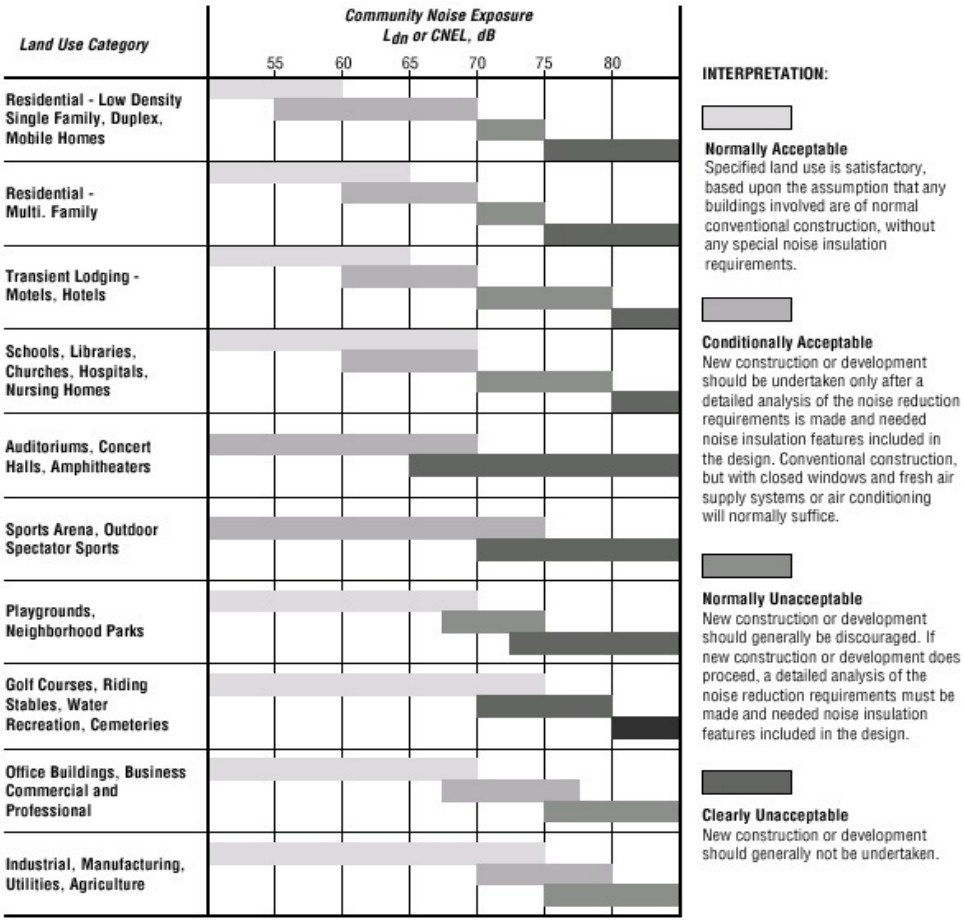
City of Fontana

Noise and Safety Element of the General Plan. The Noise and Safety Element in Fontana Forward General Plan Update 2015–2035 (City of Fontana 2018) lists the policies and actions required to meet the City's noise-related goals. The following lists the applicable goals, policies, and actions for the project.

- **Goal 1:** The City of Fontana protects sensitive land uses from excessive noise by diligent planning through 2035.
    - **Policies:** New sensitive land uses shall be prohibited in incompatible areas.
        - Where sensitive uses are to be placed along transportation routes, mitigation shall be provided to ensure compliance with state-mandated noise levels.
        - Noise spillover or encroachment from commercial, industrial, and educational land uses shall be minimized into adjoining residential neighborhoods or noise-sensitive uses.
    - **Actions:**
        - The following uses shall be considered noise-sensitive and discouraged in areas in excess of 65 dBA CNEL: residential uses, hospitals, rest homes, long-term-care facilities, and mental-care facilities.
- **Goal 3:** Fontana's residents are protected from negative effects of "spillover" noise.
    - **Policy:** Residential land uses and areas identified as noise-sensitive shall be protected from excessive noise from non-transportation sources including industrial, commercial, and residential activities and equipment.
    - Actions**:**
        - Projects located in commercial areas shall not exceed stationary source noise standards at the property line of proximate residential or commercial uses.
        - Industrial uses shall not exceed commercial or residential stationary source noise standards at the most proximate land uses.
        - Non-transportation noise shall be considered in land use planning decisions.
        - Construction shall be performed as quietly as feasible when performed in proximity to residential or other noise-sensitive land uses.

To achieve Goal 1, the proposed project was assessed using the City's exterior noise standard of 65 dBA CNEL and the Land Use Noise Compatibility, shown in Table E. As shown in Table E, a noise level of up to 65 dBA CNEL is the upper limit of what is considered a "normally acceptable" noise environment for multifamily residential uses, whereas noise levels between 60 and 70 dBA CNEL are considered "conditionally acceptable." New development should generally be discouraged within the "unacceptable" category. However, if new development does proceed, a detailed analysis of the noise reduction requirements must be made, and the design must include necessary noise insulation features.

Table E: Land Use Noise Compatibility



Source: General Plan Guidelines: 2017 Update, Appendix D—Noise Element Guidelines (OPR 2017).

To achieve Goal 3, the proposed project was assessed based on the requirements and noise standards in the City's Municipal Code (City of Fontana 2021), discussed below.

Municipal Code. Section 18-63(b) of the City's Municipal Code (City of Fontana 2021) states:

Noises that are loud, excessive, impulsive, or intrusive sound or noise that annoys or disturbs persons of ordinary sensibilities from a distance of 50 feet or more from the edge of the property, structure, or unit in which the source is located, are declared to be in violation of this article, but such enumeration shall not be deemed to be exclusive. Applicable noises that are prohibited under this section include the following:

- **Construction or Repairing of Buildings or Structures:** The erection (including excavating), demolition, alteration or repair of any building or structure other than between the hours of 7:00 a.m. and 6:00 p.m. on weekdays and between the hours of 8:00 a.m. and 5:00 p.m. on Saturdays, except in case of urgent necessity in the interest of public health and safety, and then only with a permit

> from the building inspector, which permit may be granted for a period not to exceed three days or less while the emergency continues and which permit may be renewed for periods of three days or less while the emergency continues. If the building inspector should determine that the public health and safety will not be impaired by the erection, demolition, alteration or repair of any building or structure or the excavation of streets and highways within the hours of 6:00 p.m. and 7:00 a.m., and if he shall further determine that loss or inconvenience would result to any party in interest, he may grant permission for such work to be done on weekdays within the hours of 6:00 p.m. and 7:00 a.m., upon application being made at the time the permit for the work is awarded or during the progress of the work.

Section 30-469 of the City's Municipal Code (City of Fontana 2021) has established daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) exterior noise standard of 65 dBA for activities conducted in residential-zoning districts to protect residents from annoying or potentially harmful environmental conditions.

Section 30-470 of the City's Municipal Code (City of Fontana 2021) was used to evaluate potential vibration impacts from project operations. This section limits operational vibration levels that are created or caused to be created any activity that causes a vibration that can be felt beyond the property line with or without the aid of an instrument. Because the City does not specify the vibration level that can be felt, this analysis uses a vibration perception threshold of 65 VdB from the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

Walnut Village Specific Plan. The Master Environmental Impact Report for the WVSP requires a detailed acoustical analysis to identify specific impacts and reduction measures for land uses adjacent to State Route 210 (SR-210) (Foothill Freeway) that are anticipated to exceed normally acceptable noise levels based on State Land Use Noise Compatibility Guidelines. Reduction measures available include special design and construction of barriers, e.g. walls and/or earthen berms between structures and the noise source.

EXISTING SETTING

Sensitive Land Uses in the Project Vicinity

Existing land uses within the project area include residences and commercial uses. Single-family residences are east of the project site across Mango Avenue and immediately south of the project site. Commercial uses are to the north and northwest across South Highland Avenue.

Overview of the Existing Noise Environment

The primary existing noise sources in the project area are transportation facilities. Traffic on SR-210, South Highland Avenue, Mango Avenue, and other local streets contribute to the ambient noise levels in the project vicinity. Noise from motor vehicles is generated by engines, the interaction between the tires and the road, and the vehicles' exhaust systems.

Ambient Noise Measurements

Short-Term Noise Measurements

Short-term (20-minute) noise level measurements were conducted on July 20, 2021, using Larson Davis Model 831 Type 1 sound level meter. Table F shows the results of the short-term noise level measurements along with a description of the measurement locations and noise sources that occurred during the measurement. As shown in Table F, the measured average noise level south of the project site is 50.3 dBA L_{eq}, and the instantaneous maximum noise level is 60.4 dBA L_{max}. Figure 3, Noise Monitoring Locations, shows the short-term monitoring location.

Table F: Short-Term Ambient Noise Level Measurements

Monitor No.	Location	Date	Start Time	Noise Level (dBA)			Noise Source(s)
				L_{eq}	L_{max}	L_{min}	
ST-1	17052 Prospect Avenue, approximately 20 ft to the north from the property wall	7/20/21	9:24 a.m.	50.3	60.4	46.5	Traffic on SR-210 and South Highland Avenue. Faint and occasional traffic on Mango Avenue. Some aircraft noise.

Source: Compiled by LSA Associates, Inc. (2021).

dBA = A-weighted decibel
L_{eq} = equivalent continuous sound level
L_{max} = maximum instantaneous noise level
L_{min} = minimum instantaneous noise level
SR = State Route

Long-Term Noise Measurements

Three long-term (24-hour) noise level measurements were conducted on July 20, 2021, using Larson Davis Spark 706RC dosimeters. Tables G, H, and I show the hourly L_{eq}, L_{max}, and L_{min} results from the long-term noise level measurements, and Table J summarizes the results of the long-term noise level measurement along with a description of the measurement locations and noise sources that occurred during the measurements. As shown in Table J, the calculated CNEL levels at LT-1, LT-2, and LT-3 were 73.9, 72.8, and 72.3 dBA. In addition, noise levels ranged from 62.8 to 72.3 dBA L_{eq} at LT-1, 59.0 to 71.9 dBA L_{eq} at LT-2, and 59.0 to 70.9 dBA L_{eq} at LT-3. Figure 3 shows the long-term monitoring locations.

Existing Aircraft Noise

Ontario International Airport and Flabob Airport are 9.9 miles (mi) southwest and 10.0 mi south of the project site, respectively. The Compatibility Policy Map: Noise Impact Zones from the *LA/Ontario International Airport Land Use Compatibility Plan* (City of Ontario 2011) shows that the project site is outside the 60 to 65 dBA CNEL noise contour. Also, the noise compatibility contours for the Flabob Airport in the *Riverside County Airport Land Use Compatibility Plan* (Riverside County Airport Land Use Commission 2004) show that the project site is outside the 55 dBA CNEL noise contour. Also, there are no private airstrips or helipads within 2 mi of the project site.

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

Start Time		Date	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
1	11:00 AM	7/20/21	69.1	88.3	59.1
2	12:00 PM	7/20/21	68.6	82.5	58.7
3	1:00 PM	7/20/21	70.2	91.6	58.3
4	2:00 PM	7/20/21	70.7	89.2	60.5
5	3:00 PM	7/20/21	71.5	90.7	63.1
6	4:00 PM	7/20/21	72.1	86.2	63.7
7	5:00 PM	7/20/21	72.3	92.8	61.7
8	6:00 PM	7/20/21	70.5	90.8	61.4
9	7:00 PM	7/20/21	70.1	89.9	61.0
10	8:00 PM	7/20/21	68.9	86.5	60.8
11	9:00 PM	7/20/21	68.9	87.5	59.0
12	10:00 PM	7/20/21	67.4	83.0	57.1
13	11:00 PM	7/20/21	65.8	81.9	53.4
14	12:00 AM	7/21/21	63.7	81.0	45.9
15	1:00 AM	7/21/21	63.5	85.3	48.4
16	2:00 AM	7/21/21	64.5	90.3	47.4
17	3:00 AM	7/21/21	62.8	81.1	49.1
18	4:00 AM	7/21/21	67.3	86.9	55.1
19	5:00 AM	7/21/21	68.0	88.2	59.2
20	6:00 AM	7/21/21	69.2	84.6	59.8
21	7:00 AM	7/21/21	68.6	86.5	61.0
22	8:00 AM	7/21/21	68.0	84.0	59.5
23	9:00 AM	7/21/21	68.5	85.4	59.1
24	10:00 AM	7/21/21	68.8	87.9	58.8

Source: Compiled by LSA Associates, Inc. (2021).

dBA = A-weighted decibel

L_{eq} = equivalent continuous sound level

L_{max} = maximum measured sound level

L_{min} = minimum measured sound level

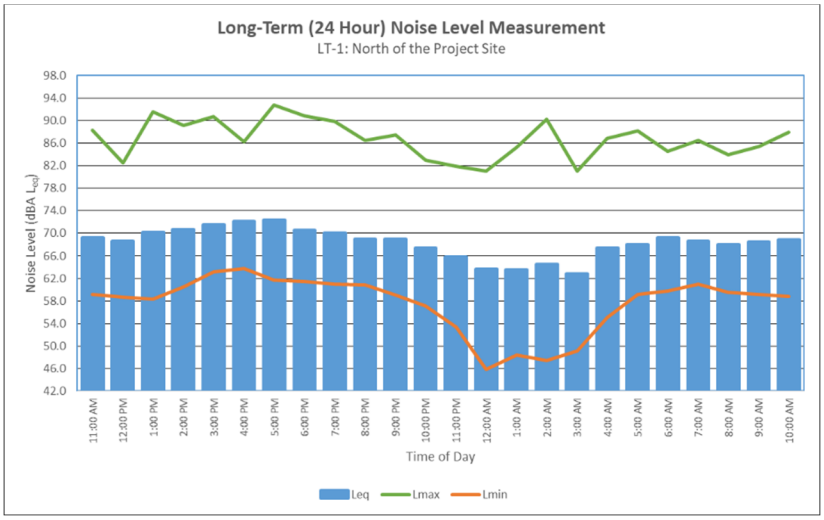


Table H: Long-Term (24-Hour) Noise Level Measurement Results at LT-2

Start Time		Date	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
1	10:00 AM	7/20/21	66.9	85.8	51.9
2	11:00 AM	7/20/21	68.9	91.6	53.6
3	12:00 PM	7/20/21	67.3	86.3	54.2
4	1:00 PM	7/20/21	67.6	85.7	53.3
5	2:00 PM	7/20/21	69.0	85.0	54.7
6	3:00 PM	7/20/21	71.9	95.7	55.6
7	4:00 PM	7/20/21	71.3	96.3	55.1
8	5:00 PM	7/20/21	69.4	87.8	56.4
9	6:00 PM	7/20/21	70.2	91.9	55.5
10	7:00 PM	7/20/21	71.2	93.5	54.7
11	8:00 PM	7/20/21	67.5	85.5	54.0
12	9:00 PM	7/20/21	67.2	88.0	51.0
13	10:00 PM	7/20/21	69.3	91.4	50.6
14	11:00 PM	7/20/21	66.0	90.4	50.2
15	12:00 AM	7/21/21	65.1	88.5	46.9
16	1:00 AM	7/21/21	61.8	89.0	44.8
17	2:00 AM	7/21/21	59.0	78.3	43.8
18	3:00 AM	7/21/21	61.6	89.1	46.0
19	4:00 AM	7/21/21	63.4	80.5	45.8
20	5:00 AM	7/21/21	65.7	87.3	52.0
21	6:00 AM	7/21/21	65.8	85.0	53.0
22	7:00 AM	7/21/21	66.4	87.8	52.8
23	8:00 AM	7/21/21	66.2	87.4	51.9
24	9:00 AM	7/21/21	66.7	87.1	53.2

Source: Compiled by LSA Associates, Inc. (2021).

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

L_{max} = maximum measured sound level

L_{min} = minimum measured sound level

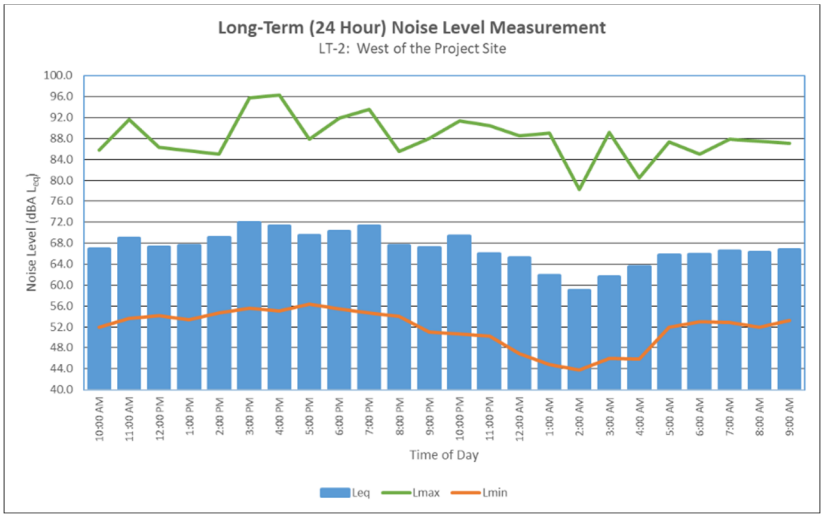


Table I: Long-Term (24-Hour) Noise Level Measurement Results at LT-3

Start Time		Date	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
1	10:00 AM	7/20/21	68.8	92.4	49.4
2	11:00 AM	7/20/21	68.6	86.2	50.5
3	12:00 PM	7/20/21	68.6	86.3	51.9
4	1:00 PM	7/20/21	68.9	83.8	52.4
5	2:00 PM	7/20/21	69.7	92.8	54.5
6	3:00 PM	7/20/21	70.0	85.2	56.8
7	4:00 PM	7/20/21	70.3	89.5	54.6
8	5:00 PM	7/20/21	70.9	84.8	56.5
9	6:00 PM	7/20/21	69.9	83.2	56.7
10	7:00 PM	7/20/21	69.3	81.8	54.6
11	8:00 PM	7/20/21	68.7	90.1	55.0
12	9:00 PM	7/20/21	67.6	89.1	52.7
13	10:00 PM	7/20/21	66.7	83.5	49.9
14	11:00 PM	7/20/21	65.0	85.9	48.8
15	12:00 AM	7/21/21	62.3	80.1	45.8
16	1:00 AM	7/21/21	60.2	83.6	43.0
17	2:00 AM	7/21/21	59.0	77.8	41.7
18	3:00 AM	7/21/21	61.0	78.7	46.5
19	4:00 AM	7/21/21	64.6	79.9	47.5
20	5:00 AM	7/21/21	65.5	88.9	52.4
21	6:00 AM	7/21/21	67.2	81.7	50.3
22	7:00 AM	7/21/21	68.1	81.1	51.9
23	8:00 AM	7/21/21	67.2	81.5	49.7
24	9:00 AM	7/21/21	67.9	80.7	50.3

Source: Compiled by LSA Associates, Inc. (2021).

dBA = A-weighted decibels

L_{eq} = equivalent continuous sound level

L_{max} = maximum measured sound level

L_{min} = minimum measured sound level

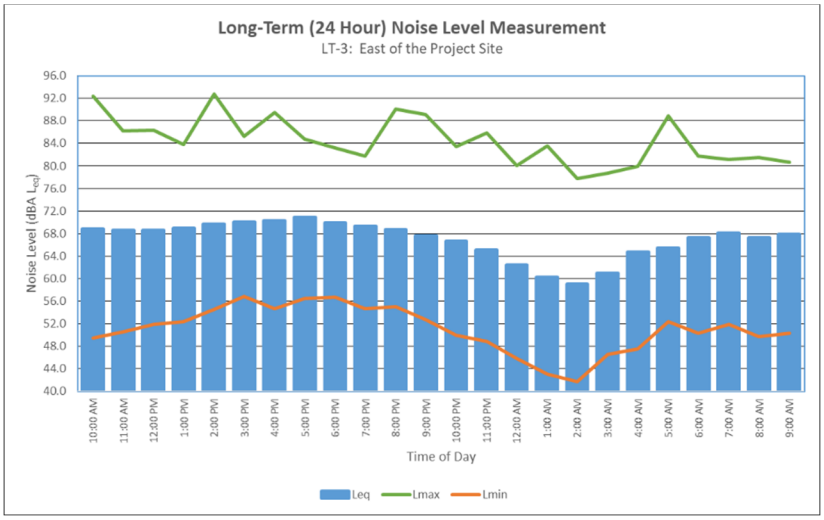


Table J: Long-Term Ambient Noise Monitoring Results

Monitoring No.	Location	Start Date	Start Time	Duration (hours)	Noise Level (dBA)				Noise Source(s)
					CNEL[1]	L_{eq}	L_{max}	L_{min}	
LT-1	North of the project site	7/20/21	11:00 AM	24	73.9	62.8–72.3	81.0–92.8	45.9–63.7	Traffic on SR-210 and South Highland Avenue; occasional traffic on Mango Avenue
LT-2	West of the project site	7/20/21	10:00 AM	24	72.8	59.0–71.9	78.3–96.3	43.8–56.4	Traffic on SR-210 and South Highland Avenue
LT-3	East of the project site	7/20/21	10:00 AM	24	72.3	59.0–70.9	77.8–92.8	41.7–56.8	Traffic on SR-210. Some traffic noise from South Highland Avenue and Mango Avenue.

Source: Compiled by LSA Associates, Inc. (2021).

[1] The CNEL level was calculated from the long-term noise level measurement.

CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
L_{eq} = equivalent continuous sound level
L_{max} = maximum measured sound level
L_{min} = minimum measured sound level
SR = State Route

Existing Traffic Noise

The guidelines included in the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (1977; FHWA RD-77-108) were used to evaluate 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. The existing (2021) average daily traffic (ADT) volumes were obtained from the project's Traffic Study (Urban Crossroads 2021). The standard vehicle mix for Southern California roadways was used for traffic on these roadway segments. Table K provides the existing traffic noise levels in the project vicinity. It should be noted that although SR-210 is within the project vicinity, traffic noise levels on SR-210 are not included in Table K. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Attachment C provides the specific assumptions used in developing these noise levels and model printouts.

Table K shows that traffic noise levels along South Highland Avenue are moderate to moderately high, with the 70, 65, and 60 dBA CNEL noise contours extending up to 61, 124, and 263 feet (ft), respectively, from the roadway centerline. Also, traffic noise levels along Mango Avenue are low, with the 70 and 65 dBA CNEL noise contour confined to the roadway right-of-way and the 60 dBA CNEL noise contour extending up to 94 ft from the roadway centerline.

Table K: Existing (2021) Traffic Noise Levels

Roadway Segment	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane
South Highland Avenue west of Highland Village Center/Driveway 1	16,100	61	124	263	68.6
South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue	11,150	< 50	98	206	67.2
South Highland Avenue east of Mango Avenue	8,400	< 50	81	171	66.2
Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2	6,500	< 50	< 50	99	63.7
Mango Avenue south of Walnut Grove/Driveway 2	6,050	< 50	< 50	94	63.4

Source: Compiled by LSA Associates, Inc. (2021).
Note: Traffic noise within 50 feet of the roadway centerline should be evaluated with site-specific information. In addition, it should be noted that although SR-210 is within the project vicinity, traffic noise levels on SR-210 are not included in this table.

ADT = average daily traffic dBA = A-weighted decibels
CNEL = Community Noise Equivalent Level

IMPACTS

Short-Term Construction Noise Impacts

Two types of short-term noise impacts would occur during project construction. The first type would be from construction crew commutes and the transport of construction equipment and materials to the project site and would incrementally raise noise levels on access roads leading to the site. The pieces of construction equipment for construction activities would move on site, would remain for the duration of each construction phase, and would not add to the daily traffic volume in the project vicinity. Although there would be a relatively high single-event noise exposure potential causing intermittent noise nuisance (passing trucks at 50 feet would generate up to a maximum of 84 dBA), the effect on longer-term ambient noise levels would be small because the number of daily construction-related vehicle trips would be small compared to existing daily traffic volume on Mango Avenue and South Highland Avenue. The building construction phase would generate the most trips out of all of the construction phases, at 222 trips per day based on the California Emissions Estimator Model (Version 2020.4.0). Roadways that would be used to access the project site are Mango Avenue and South Highland Avenue. Based on Table K, Mango Avenue and South Highland Avenue have estimated existing daily traffic volumes of 6,050 and 8,400, respectively, near the project site. Based on the information above, construction-related traffic would increase noise by up to 0.2 dBA. This increase in noise would be lower than 0.2 dBA when factoring traffic noise on SR-210. A noise level increase of less than 3 dBA would not be perceptible to the human ear in an outdoor environment. Therefore, no short-term, construction-related impacts associated with worker commutes and transport of construction equipment and material to the project site would occur and no noise reduction measures would be required.

The second type of short-term noise impact is related noise generated from construction activities. The proposed project anticipates site preparation, grading, building construction, paving, and architectural coating phases of construction. Construction is performed in discrete steps, each of which has its own mix of equipment and, consequently, its own noise characteristics. These various sequential phases change the character of the noise generated on a project site. Therefore, the noise levels vary 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 L lists the L_{max} recommended for noise impact assessments for typical construction equipment included in the FHWA *Highway Construction Noise Handbook* (FHWA 2006), based on a distance of 50 feet between the equipment and a noise receptor.

Table L: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor[1] (%)	Maximum Noise Level (L_{max}) at 50 feet[2]
Backhoe	40	80
Compactor (ground)	20	80
Compressor	40	80
Crane	16	85
Dozer	40	85
Dump Truck	40	84
Excavator	40	85
Flatbed Truck	40	84
Forklift	20	85
Front-End Loader	40	80
Grader	40	85
Impact Pile Driver	20	95
Jackhammer	20	85
Pavement Scarifier	20	85
Paver	50	85
Pickup Truck	40	55
Pneumatic Tools	50	85
Pump	50	77
Rock Drill	20	85
Roller	20	85
Scraper	40	85
Tractor	40	84
Welder	40	73

Source: Table 9.1, *FHWA Highway Construction Noise Handbook* (FHWA 2006).

Note: The 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 CA/T program to be consistent with the City of Boston, Massachusetts, Noise Code for the "Big Dig" project.

CA/T = Central Artery/Tunnel
FHWA = Federal Highway Administration
L_{max} = maximum instantaneous noise level

Typical noise levels range up to 88 dBA L_{max} at 50 feet during the noisiest construction phases. The site preparation and grading phase tends to generate the highest noise levels because the noisiest construction equipment is earth-moving equipment. Earth-moving equipment includes excavating machinery such as backfillers, bulldozers, draglines, and front-end loaders. Earth-moving and compacting equipment includes compactors, scrapers, and graders.

Project construction is expected to require the use of graders, bulldozers, and water trucks/pickup trucks. Noise associated with the use of each type of construction equipment for the site preparation phase is estimated to be between 55 dBA L_{max} and 85 dBA L_{max} at a distance of 50 feet from the active construction area. As shown in Table L, the maximum noise level generated by each grader is assumed to be approximately 85 dBA L_{max} at 50 feet. Each bulldozer would generate approximately 85 dBA L_{max} at 50 feet. The maximum noise level generated by water trucks/pickup trucks is approximately 55 dBA L_{max} at 50 feet from these vehicles. Each doubling of the sound sources with equal strength increases the noise level by 3 dBA. Assuming that each piece of construction equipment operates at some distance from the other equipment, the worst-case combined noise level during this phase of construction would be 88 dBA L_{max} at a distance of 50 feet from the active construction area. Based on a usage factor of 40 percent, the worst-case combined noise level during this phase of construction would be 84 dBA L_{eq} at a distance of 50 feet from the active construction area.

The closest residential property line is within 50 feet of the project construction boundary and may be subject to short-term construction noise reaching 88 dBA L_{max} (84 dBA L_{eq}) or higher generated by construction activities on the project site. Ambient noise levels in the project vicinity range between 50.3 and 72.3 dBA L_{eq} and 60.4 and 96.3 dBA L_{max} based on short-term and long-term noise level measurement shown in Tables F and J. Although the noise generated by project construction activities would be higher than the ambient noise levels and may result in a temporary increase in the ambient noise levels, construction noise would stop once project construction is completed. The proposed project would be required to comply with the construction hours specified in Section 18-63(b) of the City's Municipal Code and the best construction practices for construction listed below would minimize construction noise. Therefore, no noise impacts from construction activities would occur. No noise reduction measures are required.

- The construction contractor shall limit construction activities to between the hours of 7:00 a.m. and 6:00 p.m. on weekdays and between the hours of 8:00 a.m. and 5:00 p.m. on Saturdays pursuant to Section 18-63(b) of the City's Municipal Code. Construction is prohibited on Sunday and outside of these hours.

- During all project site excavation and grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.

- The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and most noise-sensitive receptors nearest the project site during all project construction.

- The construction contractor shall place all stationary construction equipment so that the emitted noise is directed away from the sensitive receptors nearest the project site.

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 damage using vibration levels in PPV (in/sec). Vibration levels calculated in RMS are best for characterizing human response to building vibration, whereas vibration levels in PPV are best for characterizing damage potential. As shown in Table D, the FTA guidelines indicate that a vibration level up to 102 VdB (equivalent to 0.5 PPV [in/sec]) is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage (FTA 2018). For a non-engineered timber and masonry building, the construction vibration damage criterion is 94 VdB (0.2 PPV [in/sec]). For a fragile building, the construction vibration damage criterion is 90 VdB (0.12 PPV [in/sec]).

Table M shows the reference vibration levels at a distance of 25 feet for each type of standard construction equipment from the FTA's *Transit Noise and Vibration Impact Assessment Manual* (2018). Outdoor site preparation and grading for the proposed project would require the use of a large bulldozer and loaded trucks, which would generate ground-borne vibration of up to 87 VdB (0.089 PPV [in/sec]) and 86 VdB (0.076 PPV [in/sec]), respectively, when measured at 25 feet.

Table M: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L_V at 25 feet	
	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

Sources: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018), Table 7-4.

[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
FTA = Federal Transit Administration
in/sec = inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity decibels

The formulas for vibration transmission are provided below.

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

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

The greatest vibration levels are anticipated to occur during the site preparation and grading phases. All other phases are expected to result in lower vibration levels. The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the

project boundary (assuming the construction equipment would be used at or near the project boundary), because vibration impacts normally occur within the buildings.

Table N lists the projected vibration levels from various construction equipment expected to be used on the project site to the closest buildings in the project vicinity. As shown in Table N, the residential building south of the project site and the commercial building north of the project site are the closest structures from the project construction boundary. These building structures are approximately 30 feet and 125 feet from the project construction boundary and would experience vibration levels of up to 85 VdB (0.0.068 PPV [in/sec]) and 66 VdB (0.008 PPV [in/sec]), respectively.

Table N: Summary of Construction Vibration Levels

Land Use	Direction	Equipment/Activity	Reference Vibration Level at 25 feet		Distance to Structure (feet)	Maximum Vibration Level	
			VdB	PPV (in/sec)		VdB	PPV (in/sec)
Commercial	North	Large Bulldozer	87	0.089	125	66	0.008
		Loaded Truck	86	0.076	125	65	0.007
Residential	East	Large Bulldozer	87	0.089	85	71	0.014
		Loaded Truck	86	0.076	85	70	0.012
Residential	South	Large Bulldozer	87	0.089	30	85	0.068
		Loaded Truck	86	0.076	30	84	0.058
Commercial	West	Large Bulldozer	87	0.089	130	66	0.008
		Loaded Truck	86	0.076	130	65	0.006

Source: Compiled by LSA Associates, Inc. (2021).
Note: The FTA-recommended building damage threshold is 94 VdB (0.2 PPV [in/sec]) at the receiving residential and commercial building structure.
FTA = Federal Transit Administration
in/sec = inches per second
PPV = peak particle velocity
VdB = vibration velocity decibels

For the closest residential structure, although vibration levels would have the potential to result in community annoyance because vibration levels would exceed the FTA's community annoyance threshold of 78 VdB, vibration levels would not have to potential to cause building damage because the structure would be equivalent to a structure constructed of non-engineered timber and masonry and vibration levels would not exceed the FTA vibration damage threshold of 94 VdB (0.2 PPV [in/sec]).

For the closest commercial structure, vibration levels would not have the potential to result in community annoyance because vibration levels would not exceed the FTA's community annoyance threshold of 84 VdB for structures that are not as sensitive to vibration. In addition, vibration levels would not have to potential to cause building damage because the structure would be equivalent to a structure constructed of non-engineered timber and masonry and vibration levels would not exceed the FTA vibration damage threshold of 94 VdB (0.2 PPV [in/sec]).

Other nearby structures surrounding the project site, including residential and commercial structures, are farther away and vibration levels would not result in community annoyance and building damage. Therefore, no construction vibration impacts would occur. No vibration reduction measures are required.

Long-Term Aircraft Noise Impacts

As discussed above, the Ontario International Airport and Flabob Airport are 9.9 mi southwest and 10.0 mi south of the project site, respectively. The Compatibility Policy Map: Noise Impact Zones from the LA/Ontario International Airport Land Use Compatibility Plan (City of Ontario 2011) shows that the project site is outside the 60 to 65 dBA CNEL noise contour. Also, the noise compatibility contours for Flabob Airport in the Riverside County Airport Land Use Compatibility Plan (Riverside County Airport Land Use Commission 2004) show that the project site is outside the 55 dBA CNEL noise contour. Also, there are no private airstrips or helipads within 2 mi of the project site. Therefore, the project would not expose people residing or working in the project area to excessive noise levels from aircraft.

Long-Term Traffic Noise Impacts

The guidelines included in the *FHWA Highway Traffic Noise Prediction Model* (1977; FHWA RD-77-108) were used to evaluate 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. The existing (2021), opening year (2023), and the horizon year (2040) with and without project ADT volumes were obtained from the project's Traffic Study (Urban Crossroads 2021). The standard vehicle mix for Southern California roadways was used for traffic on these roadway segments under the without project scenario. Tables O, P, and Q show the existing (2021), opening year (2023), and future horizon year (2040) traffic noise levels without and with the project, respectively, along roadways in the project vicinity. These noise levels represent the worst-case scenario, which assumes that no shielding is provided between the traffic and the location where the noise contours are drawn. Attachment C provides the specific assumptions used in developing these noise levels and model printouts.

Tables O, P, and Q show that project-related traffic would increase noise by up to 0.2 dBA. This noise level increase would be lower when factoring traffic noise from SR-210. Noise level increases less than 3 dBA would not be perceptible to the human ear in an outdoor environment. Therefore, no traffic noise impacts from project-related traffic on off-site sensitive receptors would occur. No noise reduction measures are required.

Long-Term Stationary Noise Impacts

Heating, Ventilation, and Air Conditioning Equipment

The proposed project would include ground-floor heating, ventilation, and air conditioning (HVAC) units for each residential dwelling unit. The HVAC equipment could operate 24 hours per day. Each ground floor HVAC unit would generate a noise level of 44.4 dBA L_{eq} at a distance of 50 ft. The closest residential use areas to the proposed ground-floor HVAC equipment are approximately 90 ft east and 20 ft south of the project site. The ground-floor HVAC equipment would be screened from public view and shielded by the proposed 6 ft high perimeter block wall, which would provide a minimum noise reduction of 5 dBA.

Table O: Existing Traffic Noise Levels Without and With Project

Roadway Segment	Without Project Traffic Conditions					With Project Traffic Conditions					
	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	Increase from Without Project Conditions (dBA)
South Highland Avenue west of Highland Village Center/Driveway 1	16,100	61	124	263	68.6	16,700	63	127	269	68.8	0.2[1]
South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue	11,150	< 50	98	206	67.2	11,300	< 50	98	208	67.3	0.1[1]
South Highland Avenue east of Mango Avenue	8,400	< 50	81	171	66.2	8,550	< 50	82	173	66.3	0.1[1]
Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2	6,500	< 50	< 50	99	63.7	6,750	< 50	< 50	102	63.9	0.2[1]
Mango Avenue south of Walnut Grove/Driveway 2	6,050	< 50	< 50	94	63.4	6,350	< 50	< 50	98	63.6	0.2[1]

Source: Compiled by LSA Associates, Inc. (2021).

Note: Traffic noise within 50 feet of the roadway centerline should be evaluated with site-specific information.

[1] The project-related traffic noise increase would be lower when factoring traffic noise from SR-210.

ADT = average daily traffic
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
SR = State Route

Table P: Opening Year (2023) Traffic Noise Levels Without and With Project

Roadway Segment	Without Project Traffic Conditions					With Project Traffic Conditions					
	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	Increase from Without Project Conditions (dBA)
South Highland Avenue west of Highland Village Center/Driveway 1	18,100	66	134	284	69.1	18,700	67	136	290	69.2	0.1[1]
South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue	13,050	< 50	108	229	67.9	13,200	< 50	109	230	67.9	0.0
South Highland Avenue east of Mango Avenue	10,450	< 50	93	197	67.2	10,600	< 50	94	199	67.2	0.0
Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2	7,200	< 50	< 50	106	64.2	7,450	< 50	51	108	64.3	0.1[1]
Mango Avenue south of Walnut Grove/Driveway 2	6,750	< 50	< 50	102	63.9	6,800	< 50	< 50	102	63.9	0.0

Source: Compiled by LSA Associates, Inc. (2021).

Note: Traffic noise within 50 feet of the roadway centerline should be evaluated with site-specific information.

[1] The project-related traffic noise increase would be lower when factoring traffic noise from SR-210.

ADT = average daily traffic
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
SR = State Route

Table Q: Horizon Year (2040) Traffic Noise Levels Without and With Project

Roadway Segment	Without Project Traffic Conditions					With Project Traffic Conditions					
	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	ADT	Centerline to 70 dBA CNEL (feet)	Centerline to 65 dBA CNEL (feet)	Centerline to 60 dBA CNEL (feet)	CNEL (dBA) 50 feet from Centerline of Outermost Lane	Increase from Without Project Conditions (dBA)
South Highland Avenue west of Highland Village Center/Driveway 1	22,000	74	152	323	70.0	22,600	75	154	329	70.1	0.1[1]
South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue	15,850	60	122	260	68.7	16,000	60	123	262	68.8	0.1[1]
South Highland Avenue east of Mango Avenue	13,100	< 50	108	229	68.1	13,300	< 50	109	231	68.2	0.1[1]
Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2	8,750	< 50	56	121	65.0	9,000	< 50	57	123	65.2	0.2[1]
Mango Avenue south of Walnut Grove/Driveway 2	8,200	< 50	54	116	64.8	8,250	< 50	54	116	64.8	0.0

Source: Compiled by LSA Associates, Inc. (2021).

Note: Traffic noise within 50 feet of the roadway centerline should be evaluated with site-specific information.

[1] The project-related traffic noise increase would be lower when factoring traffic noise from SR-210.

ADT = average daily traffic
CNEL = Community Noise Equivalent Level
dBA = A-weighted decibels
SR = State Route

Table R summarizes the noise levels generated by the ground-floor residential HVAC units at the adjacent land uses. As shown in Table R, noise level generated from ground floor residential HVAC units at the property line of adjacent land uses range from 31.8 to 47.4 dBA L_{eq}. These noise levels would not exceed the City's exterior daytime and nighttime noise standards of 70 dBA and 65 dBA, respectively, for residential uses. Also, noise levels from on-site ground-floor HVAC units would not substantially increase ambient noise levels at adjacent land uses because ambient noise levels in the project area are moderate to high, ranging from 50.2 and 72.3 dBA L_{eq} based on the short-term and long-term ambient noise level measurements. Therefore, no noise impacts from on-site HVAC equipment would occur. No noise reduction measures are required.

Table R: HVAC Noise Levels

Land Use	Direction	Reference Noise Level at 50 ft (dBA L_{eq})	Distance to Receptor Property Line (ft)	Distance Attenuation (dBA)	Shielding[1] (dBA)	Noise Level (dBA L_{eq})
Commercial	North	44.4	120	7.6	5	31.8
Residential	East	44.4	90	5.1	5	34.3
Residential	South	44.4	20	-8.0[2]	5	47.4
Commercial	West	44.4	120	7.6	5	31.8

Source: Compiled by LSA Associates, Inc. (2021).

[1] The screen and 6 ft high perimeter block wall would provide a minimum noise reduction of 5 dBA.

[2] A negative number denotes a noise level increase.

dBA = A-weighted decibels
ft = feet
HVAC = heating, ventilation, and air conditioning
L_{eq} = equivalent continuous sound level

Long-Term Vibration Impacts

The proposed project would not generate vibration. In addition, vibration levels generated from project-related traffic on the adjacent roadways (South Highland Avenue and Mango Avenue) are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Therefore, no vibration impacts from project-related operations would occur, and no vibration reduction measures are required.

Land Use Compatibility Assessment

The land use compatibility of the project site was assessed based on the City's exterior noise standard contained in the Noise and Safety Element of the City of Fontana General Plan and an interior noise standard of 45 dBA CNEL, which is consistent with State's noise insulation standards.

Exterior Noise Levels

The proposed project would include 107 townhomes, four passive open-space areas at various locations on the site, and an amenity and tot lot near the center of the site. Figure 2 shows the locations of the proposed townhomes, passive open-space areas, and amenity and tot lot. The amenity and tot lot would be shielded by one row of residential buildings from South Highland Avenue and multiple rows of residential buildings from Mango Avenue. The four passive open-space areas on the project site were not evaluated because there are no use areas where people would remain for a prolonged period of time.

Exterior noise levels at the proposed residential buildings along South Highland Avenue, Mango Avenue, the amenity, and the tot lot were calculated using the long-term noise level measurement and the change in traffic noise levels from the existing to horizon year (2040) with project condition. Table S shows the reference noise level and distance from the long-term noise level measurement at LT-1 and LT-3, the nearest roadway, the distance from roadway centerline to receptor, noise level reduction provided by shielding factors, and the noise increase from existing to horizon year (2040) with project condition based on Tables K and Q. As shown in Table S, the horizon year (2040) with project exterior noise level of 55.1 dBA CNEL at the tot lot would not exceed the City's exterior noise standard of 65 dBA CNEL. No exterior noise impacts would occur at the residences along South Highland Avenue and Mango Avenue because there are no outdoor active-use areas such as ground-floor patios or upper floor balconies associated with the proposed residential dwelling units. Therefore, no on-site noise impacts would occur. No noise reduction measures are required.

Interior Noise Levels

Table T shows the interior noise levels with windows and doors open for the proposed residences along South Highland Avenue and Mango Avenue. Interior noise levels with windows and doors open were calculated using an exterior-to-interior noise reduction of 12 dBA based on the United States Environmental Protection Agency's (EPA) Protective Noise Levels (EPA 1978) and standard construction in California (warm climate) with a combination of exterior walls, doors, and windows. As shown in Table T, interior noise levels with windows and doors open would reach up to 59.8 dBA CNEL, which would exceed the interior noise standard of 45 dBA CNEL. Therefore, mechanical ventilation systems, such as air conditioning, would be required for all residential units on the project site so that windows and doors could remain closed for a prolonged period of time.

Also, Table T shows that an exterior-to-interior noise reduction of 26.8 and 23.5 dBA required for residential units along South Highland Avenue and Mango Avenue, respectively, is required to meet the interior noise standard of 45 dBA CNEL. To calculate and estimate the noise reduction provided by an exterior wall assembly, the transmission loss at the octave band frequencies for wall material by type is combined to provide an overall noise reduction. The rating of the wall and window or windows within the assembly will have a rating often referred to as a sound transmission class (STC) rating. The program INSUL was used to estimate the window ratings to ensure that compliance is achieved. Based on standard building construction in Southern California, the following elements make up the assumed exterior wall assembly:

- 7/8-inch-thick, three-coat stucco
- One layer of 0.5-inch-thick plywood or oriented strand board
- 2-inch x 4-inch wooden stud wall channels spaced at 24 inches and a minimum R-19 fiberglass insulation
- One layer of 1/2-inch-thick gypsum board

Table S: Exterior Noise Levels

Receptor	Roadway	Long-Term Noise Level Measurement	Reference Noise Level (dBA CNEL)	Reference Distance[3] (ft)	Distance[4] (ft)	Shielding (dBA)	Existing Noise Level (dBA CNEL)	Increase[6] (dBA)	Horizon Year (2040) with Project Noise Level (dBA CNEL)
Amenity/Tot Lot	South Highland Avenue	LT-1	73.9[1]	36.0	178.0	10.0[5]	53.5	1.6	55.1
Residences	South Highland Avenue	LT-1	73.9[1]	36.0	64.0	0.0	70.2	1.6	71.8
Residences	Mango Avenue	LT-3	72.3[2]	23.0	52.0	0.0	67.0	1.5	68.5

Source: LSA Associates, Inc. (2021)

[1] Reference noise level from LT-1.

[2] Reference noise level from LT-3.

[3] Reference distance is the distance from the roadway centerline to the long-term noise level measurement.

[4] The distance is from the roadway centerline to receptor.

[5] The proposed 28.5 ft high residential building would provide a minimum noise reduction of 10 dBA.

[6] The noise increase from existing to horizon year (2040) with project condition.

CNEL = Community Noise Equivalent Level

dBA = A-weighted decibels

ft = foot/feet

Table T: Interior Noise Levels and Required Noise Reduction

Receptor	Roadway	Long-Term Noise Level Measurement	Horizon Year (2040) with project		Noise Reduction to Meet 45 dBA CNEL Interior Noise Standard (dBA)
			Exterior Noise Level (dBA CNEL)	Interior Noise Level with Windows and Doors Open[1] (dBA CNEL)	
Residences	South Highland Avenue	LT-1	71.8	59.8	26.8
Residences	Mango Avenue	LT-3	68.5	56.5	23.5

Source: LSA Associates, Inc. (2021)

[1] Interior noise levels were calculated using an exterior-to interior noise reduction of 12 dBA based on the EPA's Protective Noise Levels (EPA 1978) and standard construction in California (warm climate) with a combination of exterior walls, doors, and windows.

CNEL = Community Noise Equivalent Level

dBA = A-weighted decibels

EPA = United States Environmental Protection Agency

In addition to the wall construction details, information from the VPI Quality Windows Endurance Series, which is energy and sound rated, was used to determine window STC ratings. The required window STC ratings and the composite noise level reduction are provided for the sensitive rooms based on the project floor plans. Attachment D provides the INSUL model results. Should architectural details in the final design plans be less than those assumed above, a supplemental memorandum may be required to confirm that interior noise levels are reduced to 45 dBA CNEL or below.

For all the sensitive rooms along South Highland Avenue and Mango Avenue, windows and glass doors with a minimum rating of STC-31 shall be installed. For all other residential units that are second row or further from South Highland Avenue and Mango Avenue, windows and glass doors with a minimum rating of STC-28, which is assumed to be a standard double-paned glazing, would achieve an interior noise levels of 45 dBA CNEL or below.

BEST CONSTRUCTION PRACTICES

The following best construction practices would minimize construction noise:

- The construction contractor shall limit construction activities to between the hours of 7:00 a.m. and 6:00 p.m. on weekdays and between the hours of 8:00 a.m. and 5:00 p.m. on Saturdays pursuant to Section 18-63(b) of the City's Municipal Code. Construction is prohibited on Sunday and outside of these hours.

- During all project site excavation and grading, the project contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers consistent with manufacturers' standards.

- The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and most noise-sensitive receptors nearest the project site during all project construction.

- The construction contractor shall place all stationary construction equipment so that the emitted noise is directed away from the sensitive receptors nearest the project site.

REDUCTION MEASURES

Short-Term Construction Noise Impacts

No noise reduction measures are required.

Short-Term Construction Vibration Impacts

No vibration reduction measures are required.

Aircraft Noise Impacts

No noise reduction measures are required.

Traffic Noise Impacts

No noise reduction measures are required.

Long-Term Stationary Noise Impacts

No noise reduction measures are required.

Long-Term Vibration Impacts

No vibration reduction measures are required.

Land Use Compatibility Assessment

The following noise reduction measures are required:

- A mechanical ventilation system, such as air conditioning, is required for all residential units.
- The exterior wall assembly shall meet or exceed the assumptions above.
- Windows and glass doors in habitable rooms (i.e., bedrooms, living rooms, and dining rooms) at the first row along South Highland Avenue and Mango Avenue shall have a minimum STC rating of 31.
- All other windows and glass doors in habitable rooms (i.e., bedrooms, living rooms, and dining rooms) at second row or farther from South Highland Avenue and Mango Avenue shall have a minimum STC rating of 28.

ATTACHMENTS

A: References
B: Figures
C: FHWA Traffic Noise Model Printouts
D: INSUL Model Printouts

ATTACHMENT A

REFERENCES

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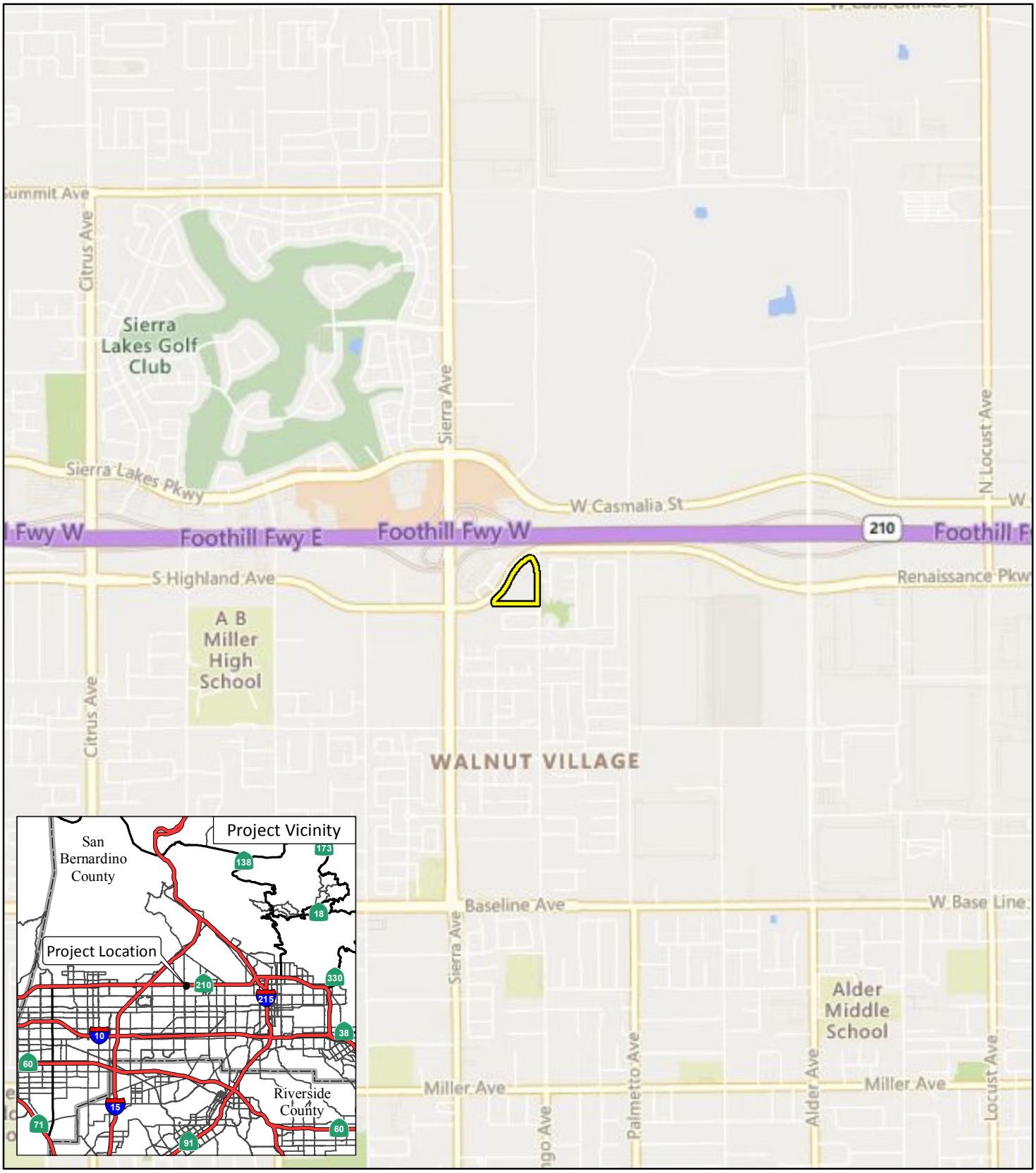
ATTACHMENT B

FIGURES



LSA

LEGEND

Project Location

FIGURE 1

N

0 1000 2000

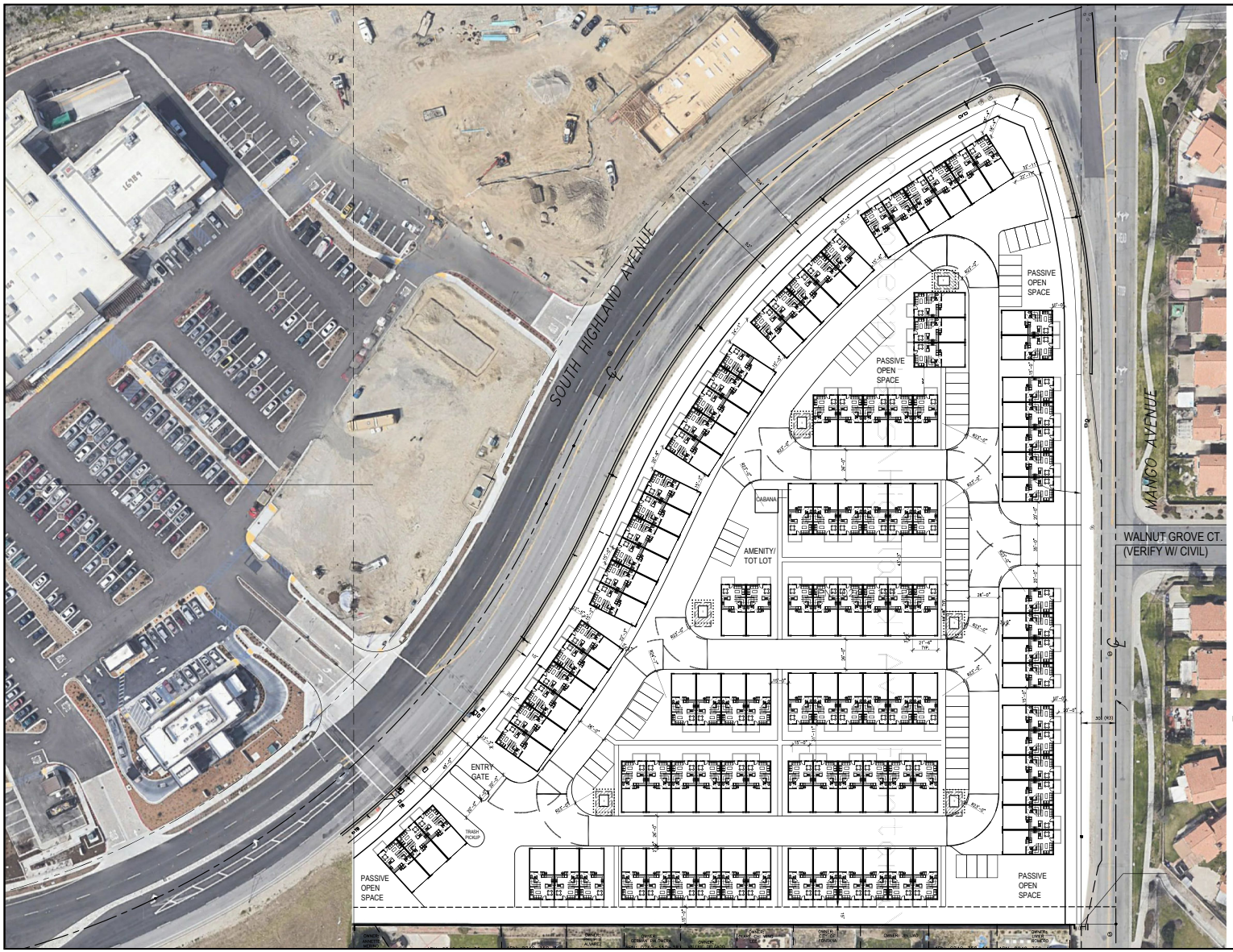
FEET

SOURCE: Bing (2020)

I:\FTR2102\GIS\MXD\Noise\ProjectLocation_Noise.mxd (7/28/2021)

Mango and South Highland Townhomes

Project Location and Vicinity



PROJECT SUMMARY:

TOTAL NET ACRES: 6.45 (280,962 SF)
DENSITY: 16.59 DU/AC; FAR: xx% (XX GSF)
PROPOSED ZONE: SPECIFIC PLAN AMENDMENT
TOTAL UNITS PROVIDED:
TOTAL 2 BEDROOMS/ 2 BATH: 26 (25%)
TOTAL 3 BEDROOMS/ 2 BATH: 78 (75%)
TOTAL: 107 UNITS

TOTAL PARKING PROVIDED:
SURFACE = 56 GUEST STALLS
GARAGES = 214
TOTAL = 270 STALLS (2.52 STALLS/UNIT)

TOTAL OPEN SPACE:
REQUIRED: (150 SF/DU) x 107 = 16,050 SF
PROVIDED: ___ SF
WQMP REQUIRED: 24,000 CF STORAGE

LEGEND

TYP. FIRE TRUCK TURN RADIUS (PER CITY OF FONTANA FIRE)

*NOTE: ALL INSIDE TURNING RADII IS 23'-0" PER BURRTEC TRASH TRUCK REQUIREMENT

TRANSFORMER LOCATION (DASHED LINE IS CLEAR DIMS)

LSA

FIGURE 2

N

0 70 140

FEET

SOURCE: AO Architecture Design Relationships

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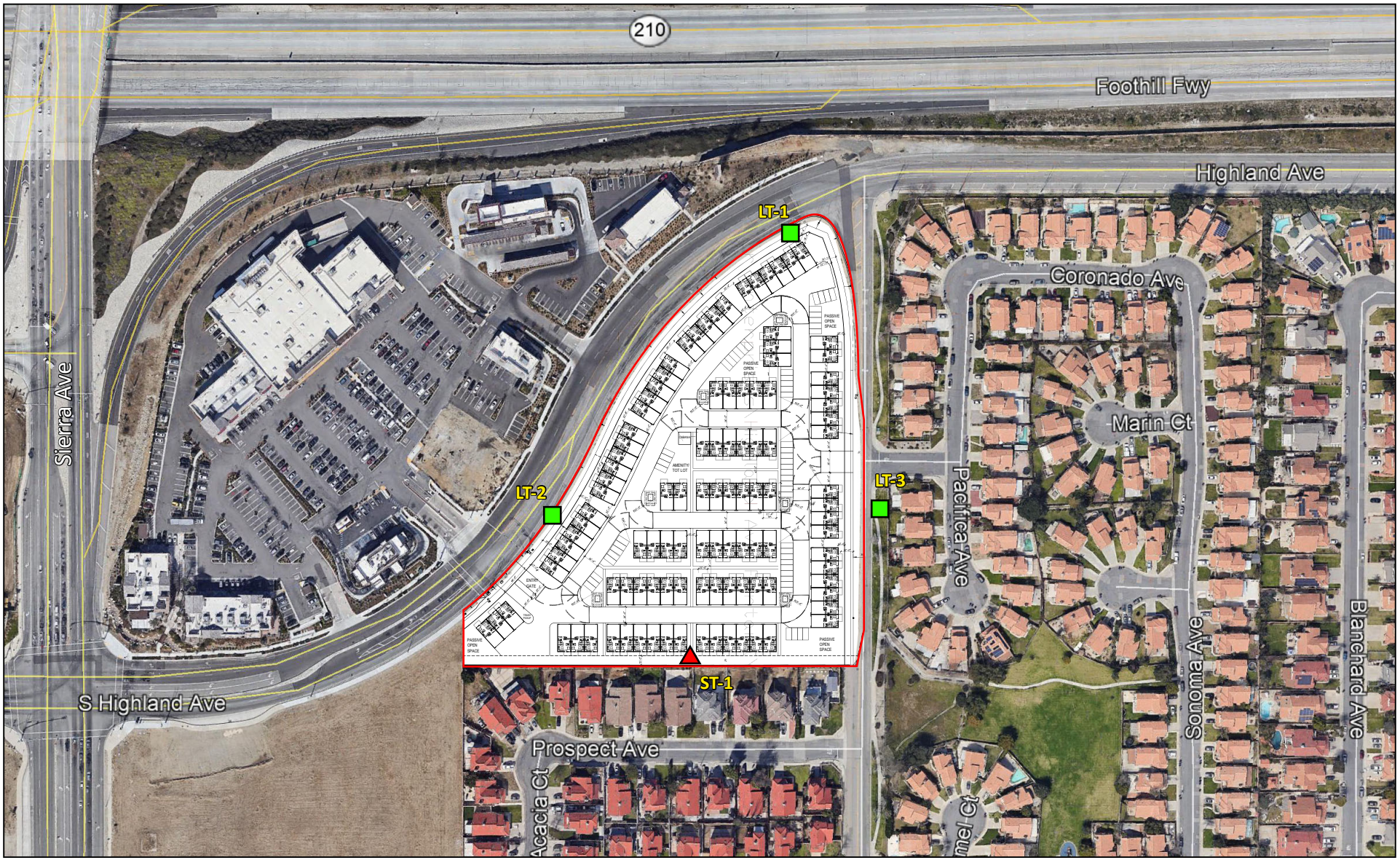
Mango and South Highland Townhomes

Site Plan



LSA

LEGEND

- Project Site Boundary
- ST-1 - Short-Term Noise Monitoring Location
- LT-1 - Long-Term Noise Monitoring Location

0 125 250

FEET

SOURCE: AO Architecture, Google Earth, 2021

I:\FTR2102\G\Noise_Monitor_Locs.ai (8/5/2021)

FIGURE 3

Mango and South Highland Townhomes

Noise Monitoring Locations

ATTACHMENT C

FHWA HIGHWAY TRAFFIC NOISE MODEL PRINTOUTS

TABLE Existing (2021) No Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue west of Highland Village Center/Driveway 1
NOTES: Mango and South Highland Townhome - Existing (2021) No Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 16100 SPEED (MPH): 50 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): 24 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.60

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
61.3	123.9	263.0	564.6

TABLE Existing (2021) No Project-02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue
NOTES: Mango and South Highland Townhome - Existing (2021) No Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 11150 SPEED (MPH): 50 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): 21 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.21

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	97.5	206.2	442.3

TABLE Existing (2021) No Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue east of Mango Avenue
NOTES: Mango and South Highland Townhome - Existing (2021) No Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 8400 SPEED (MPH): 50 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): 18 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 66.20

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	80.9	170.8	366.3

TABLE Existing (2021) No Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Existing (2021) No Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6500 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.74

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	99.1	213.0

TABLE Existing (2021) No Project-05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue south of Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Existing (2021) No Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6050 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.43

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	94.4	203.1

TABLE Existing (2021) Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue west of Highland Village Center/Driveway 1
NOTES: Mango and South Highland Townhome - Existing (2021) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 16700 SPEED (MPH): 50 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): 24 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.76

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
62.6	126.9	269.4	578.5

TABLE Existing (2021) Project-02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue
NOTES: Mango and South Highland Townhome - Existing (2021) Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 11300 SPEED (MPH): 50 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): 21 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.27

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	98.3	208.0	446.2

TABLE Existing (2021) Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue east of Mango Avenue
NOTES: Mango and South Highland Townhome - Existing (2021) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 8550 SPEED (MPH): 50 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): 18 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 66.28

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	81.8	172.8	370.6

TABLE Existing (2021) Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Existing (2021) Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6750 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.91

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	101.6	218.5

TABLE Existing (2021) Project-05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue south of Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Existing (2021) Project

---

* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6350 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.64

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	97.5	209.8

TABLE Opening Year (2023) No Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue west of Highland Village Center/Driveway 1
NOTES: Mango and South Highland Townhome - Opening Year (2023) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 18100 SPEED (MPH): 50 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): 24 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.11

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
65.6	133.6	284.2	610.3

TABLE Opening Year (2023) No Project-02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue
NOTES: Mango and South Highland Townhome - Opening Year (2023) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 13050 SPEED (MPH): 50 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): 21 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.89

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL	70 CNEL	65 CNEL	60 CNEL	55 CNEL
	0.0	107.8	228.7	491.1

TABLE Opening Year (2023) No Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue east of Mango Avenue
NOTES: Mango and South Highland Townhome - Opening Year (2023) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 10450 SPEED (MPH): 50 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): 18 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.15

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	93.0	197.3	423.6

TABLE Opening Year (2023) No Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Opening Year (2023) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 7200 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): 6 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 64.19

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	106.0	228.1

TABLE Opening Year (2023) No Project-05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue south of Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Opening Year (2023) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6750 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.91

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	101.6	218.5

TABLE Opening Year (2023) Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue west of Highland Village Center/Driveway 1
NOTES: Mango and South Highland Townhome - Opening Year (2023) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 18700 SPEED (MPH): 50 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): 24 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.25

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
66.8	136.5	290.4	623.7

TABLE Opening Year (2023) Project-02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue
NOTES: Mango and South Highland Townhome - Opening Year (2023) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 13200 SPEED (MPH): 50 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): 21 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.94

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	108.6	230.5	494.8

TABLE Opening Year (2023) Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue east of Mango Avenue
NOTES: Mango and South Highland Townhome - Opening Year (2023) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 10600 SPEED (MPH): 50 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): 18 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 67.21

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	93.8	199.2	427.6

TABLE Opening Year (2023) Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Opening Year (2023) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 7450 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 64.33

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	50.6	108.4	233.3

TABLE Opening Year (2023) Project-05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue south of Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Opening Year (2023) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 6800 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 63.94

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	0.0	102.1	219.5

TABLE Horizon Year (240) No Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue west of Highland Village Center/Driveway 1
NOTES: Mango and South Highland Townhome - Horizon Year (240) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 22000 SPEED (MPH): 50 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): 24 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 69.96

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
73.5	151.6	323.4	695.0

TABLE Horizon Year (240) No Project-02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue
NOTES: Mango and South Highland Townhome - Horizon Year (240) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 15850 SPEED (MPH): 50 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): 21 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.74

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
59.7	122.2	260.1	558.8

TABLE Horizon Year (240) No Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue east of Mango Avenue
NOTES: Mango and South Highland Townhome - Horizon Year (240) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 13100 SPEED (MPH): 50 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): 18 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.13

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	107.6	229.1	492.3

TABLE Horizon Year (240) No Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Horizon Year (240) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 8750 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 65.03

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	56.3	120.7	259.7

TABLE Horizon Year (240) No Project-05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue south of Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Horizon Year (240) No Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 8200 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): 6 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 64.75

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	53.9	115.6	248.7

TABLE Horizon Year (2040) Project-01
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue west of Highland Village Center/Driveway 1
NOTES: Mango and South Highland Townhome - Horizon Year (2040) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 22600 SPEED (MPH): 50 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): 24 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 70.07

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
74.7	154.3	329.2	707.6

TABLE Horizon Year (2040) Project-02
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue between Highland Village Center/Driveway 1 and Mango Avenue
NOTES: Mango and South Highland Townhome - Horizon Year (2040) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 16000 SPEED (MPH): 50 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): 21 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.78

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
60.0	122.9	261.7	562.3

TABLE Horizon Year (2040) Project-03
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: South Highland Avenue east of Mango Avenue
NOTES: Mango and South Highland Townhome - Horizon Year (2040) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 13300 SPEED (MPH): 50 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): 18 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 68.20

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL			
70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	108.6	231.4	497.3

TABLE Horizon Year (2040) Project-04
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue between South Highland Avenue and Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Horizon Year (2040) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 9000 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): 6 SITE CHARACTERISTICS: SOFT

---

* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 65.16

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	57.3	122.9	264.6

TABLE Horizon Year (2040) Project-05
FHWA ROADWAY NOISE LEVEL ANALYSIS

RUN DATE: 08/05/2021
ROADWAY SEGMENT: Mango Avenue south of Walnut Grove/Driveway 2
NOTES: Mango and South Highland Townhome - Horizon Year (2040) Project

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* * ASSUMPTIONS * *

AVERAGE DAILY TRAFFIC: 8250 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): 6 SITE CHARACTERISTICS: SOFT

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* * CALCULATED NOISE LEVELS * *

CNEL AT 50 FT FROM NEAR TRAVEL LANE CENTERLINE (dB) = 64.78

DISTANCE (FEET) FROM ROADWAY CENTERLINE TO CNEL

70 CNEL	65 CNEL	60 CNEL	55 CNEL
0.0	54.1	116.0	249.7

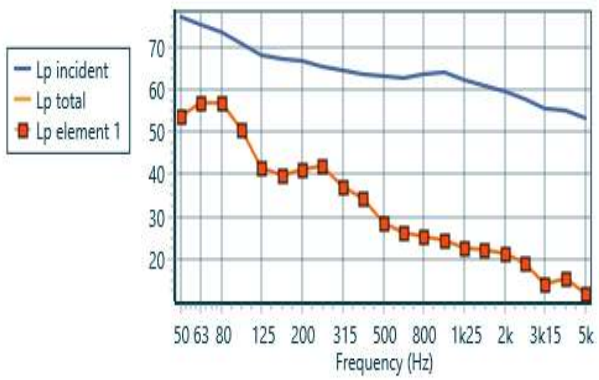
ATTACHMENT D

INSUL MODEL PRINTOUTS

Outdoor To Indoor Sound Transmission (v9.0.22)

Margin of error is generally within STC ±3 dB
- Key No. 4862
Job Name:
Job No.: Initials:JStephens
Date:9/3/2021
File Name:

Comment: Great Room -31

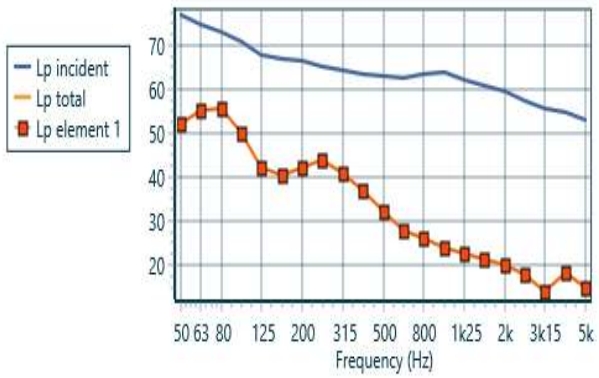


Source	Octave Band Centre Frequency (Hz) 63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	77.0 75.0 73.3 70.9 67.9 67.2 66.7 65.4 64.4 63.6 63.0 62.7 63.6 63.8 62.2 60.8 59.6 57.5 55.6 54.8 53.3							72
Path								
Element 1 , STL	-25 -20 -18 -22 -28 -29 -27 -25 -29 -31 -36 -38 -40 -41 -41 -40 -40 -40 -43 -41 -43							
Facade Shape factor Level diff.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Insertion Loss	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Area(+10LogA) [210 ft2]	23 23 23 23 23 23 23 23 23 23 23 23 23 23 23 23 23 23 23 23 23							
Element sound level contribution	54 57 57 50 41 40 41 42 37 34 29 26 25 24 23 22 21 19 14 15 12							41
Receiver								
Room volume(-10LogV) [2380 ft3]	-34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34 -34							
Reverberation time (s)	0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4							
RT (+10LogT)	-4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0							
Equation Constant	16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16							
Room sound level	54 57 57 50 41 40 41 42 37 34 29 26 25 24 23 22 21 19 14 15 12							43

Outdoor To Indoor Sound Transmission (v9.0.22)

Margin of error is generally within STC ±3 dB
- Key No. 4862
Job Name:
Job No.: Initials:JStephens
Date:9/3/2021
File Name:

Comment: A Bed 2 - 31

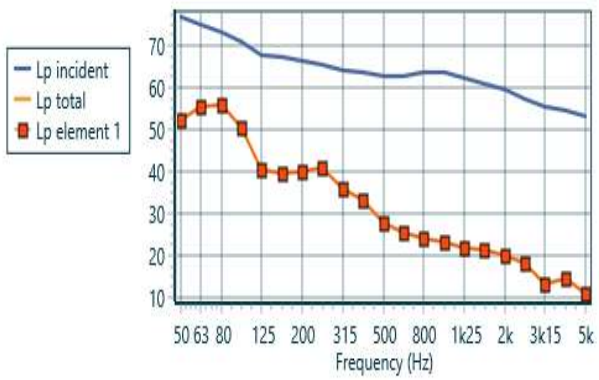


Source	Octave Band Centre Frequency (Hz) 63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	77.0 75.0 73.3 70.9 67.9 67.2 66.7 65.4 64.4 63.6 63.0 62.7 63.6 63.8 62.2 60.8 59.6 57.5 55.6 54.8 53.3							72
Path								
Element 1 , STL	-25 -20 -18 -21 -26 -27 -25 -22 -24 -27 -31 -35 -38 -40 -40 -40 -40 -40 -42 -37 -39							
Facade Shape factor Level diff.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Insertion Loss	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Area(+10LogA) [140 ft2]	21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21							
Element sound level contribution	52 55 56 50 42 41 42 44 41 37 32 28 26 24 23 21 20 18 14 18 15							42
Receiver								
Room volume(-10LogV) [2100 ft3]	-33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33							
Reverberation time (s)	0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4							
RT (+10LogT)	-4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0							
Equation Constant	16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16							
Room sound level	52 55 56 50 42 41 42 44 41 37 32 28 26 24 23 21 20 18 14 18 15							43

Outdoor To Indoor Sound Transmission (v9.0.22)

Margin of error is generally within STC ±3 dB
- Key No. 4862
Job Name:
Job No.: Initials:JStephens
Date:9/3/2021
File Name:

Comment: A Master - 31

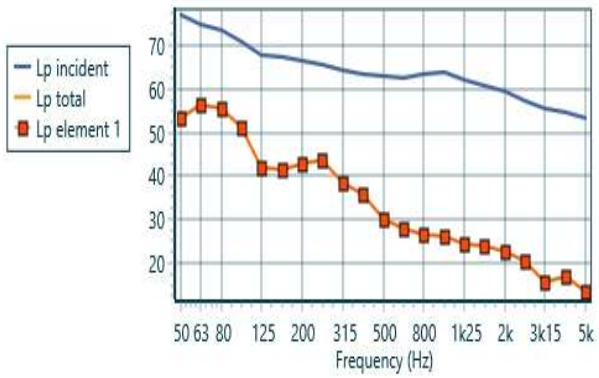


Source	Octave Band Centre Frequency (Hz) 63	125	250	500	1k	2k	4k	Overall dBA
Incident sound level (freefield)	77.0 75.0 73.3 70.9 67.9 67.2 66.7 65.4 64.4 63.6 63.0 62.7 63.6 63.8 62.2 60.8 59.6 57.5 55.6 54.8 53.3							72
Path								
Element 1 , STL	-25 -20 -18 -21 -28 -28 -27 -25 -29 -31 -36 -38 -40 -41 -41 -40 -40 -40 -43 -41 -43							
Facade Shape factor Level diff.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Insertion Loss	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
Area(+10LogA) [130 ft2]	21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21							
Element sound level contribution	52 55 56 50 40 40 40 41 36 33 27 25 24 23 22 21 20 18 13 14 11							40
Receiver								
Room volume(-10LogV) [1890 ft3]	-33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33 -33							
Reverberation time (s)	0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4							
RT (+10LogT)	-4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0 -4.0							
Equation Constant	16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16							
Room sound level	52 55 56 50 40 40 40 41 36 33 27 25 24 23 22 21 20 18 13 14 11							42

Outdoor To Indoor Sound Transmission (v9.0.22)

Margin of error is generally within STC ±3 dB
- Key No. 4862
Job Name:
Job No.: Initials:JStephens
Date:9/3/2021
File Name:

Comment: B Bed 2 - 31

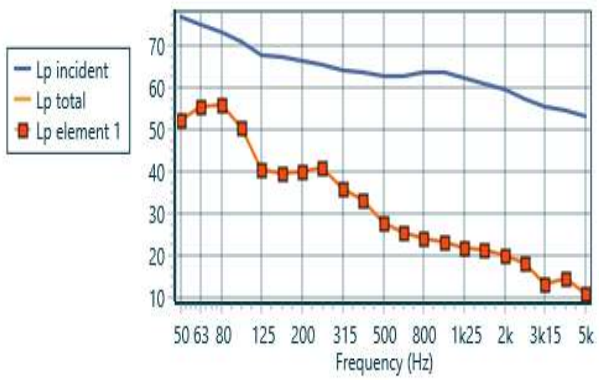


Source	63	125	250	500	1k	2k	4k	Overall dBA
Octave Band Centre Frequency (Hz)								
Incident sound level (freefield)	77.0 75.0 73.3	70.9 67.9 67.2	66.7 65.4 64.4	63.6 63.0 62.7	63.6 63.8 62.2	60.8 59.6 57.5	55.6 54.8 53.3	72
Path								
Element 1 , STL	-25 -20 -19	-21 -27 -27	-25 -23 -27	-29 -34 -36	-38 -39 -39	-38 -38 -38	-41 -39 -41	
Facade Shape factor Level diff.	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	
Insertion Loss	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	
Area(+10LogA) [105 ft2]	20 20 20	20 20 20	20 20 20	20 20 20	20 20 20	20 20 20	20 20 20	
Element sound level contribution	53 56 56	51 42 41	43 44 39	36 30 28	27 26 24	24 23 21	16 17 14	42
Receiver								
Room volume(-10LogV) [1295 ft3]	-31 -31 -31	-31 -31 -31	-31 -31 -31	-31 -31 -31	-31 -31 -31	-31 -31 -31	-31 -31 -31	
Reverberation time (s)	0.4 0.4 0.4	0.4 0.4 0.4	0.4 0.4 0.4	0.4 0.4 0.4	0.4 0.4 0.4	0.4 0.4 0.4	0.4 0.4 0.4	
RT (+10LogT)	-4.0 -4.0 -4.0	-4.0 -4.0 -4.0	-4.0 -4.0 -4.0	-4.0 -4.0 -4.0	-4.0 -4.0 -4.0	-4.0 -4.0 -4.0	-4.0 -4.0 -4.0	
Equation Constant	16 16 16	16 16 16	16 16 16	16 16 16	16 16 16	16 16 16	16 16 16	
Room sound level	53 56 56	51 42 41	43 44 39	36 30 28	27 26 24	24 23 21	16 17 14	43

Outdoor To Indoor Sound Transmission (v9.0.22)

Margin of error is generally within STC ±3 dB
- Key No. 4862
Job Name:
Job No.: Initials:JStephens
Date:9/3/2021
File Name:

Comment: B Master - 31



Source		Octave Band Centre Frequency (Hz)																				Overall dBA
		63			125			250			500			1k			2k			4k		
Incident sound level (freefield)		77.0	75.0	73.3	70.9	67.9	67.2	66.7	65.4	64.4	63.6	63.0	62.7	63.6	63.8	62.2	60.8	59.6	57.5	55.6	54.8	53.3	72
Path																						
Element 1 , STL		-25	-20	-18	-21	-28	-28	-27	-25	-29	-31	-36	-38	-40	-41	-41	-40	-40	-40	-43	-41	-43	
Facade Shape factor Level diff.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Insertion Loss		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Area(+10LogA)	[130 ft2]	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	
Element sound level contribution		52	55	56	50	40	40	40	41	36	33	27	25	24	23	22	21	20	18	13	14	11	40
Receiver																						
Room volume(-10LogV)	[1890 ft3]	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	-33	
Reverberation time (s)		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
RT (+10LogT)		-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	
Equation Constant		16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	
Room sound level		52	55	56	50	40	40	40	41	36	33	27	25	24	23	22	21	20	18	13	14	11	42