Allison Avenue Transit Oriented Development Project

Noise and Vibration Technical Report

July 2021 | 03164.00001.001

Prepared for:

USA Properties Fund, Inc.
3200 Douglas Boulevard, Suite 200
Roseville, CA 95661

Prepared by:

HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, CA 91942

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ACRONYMS AND ABBREVIATIONS

ADT	average daily traffic
ANSI	American National Standards Institute
APN	Assessor’s Parcel Number
CAD	Computer Aided Design
CadnaA	Computer Aided Noise Abatement
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
City	City of La Mesa
CNEL	Community Noise Equivalent Level
CY	cubic yard
dB	decibel
dBA	A-weighted decibels
HVAC	heating, ventilation, and air conditioning
Hz	Hertz
kHz	kilohertz
L_{DN}	Day-Night level
L_{EQ}	equivalent sound level
LLG	Linscott, Law and Greenspan, Engineers
L_{MAX}	maximum noise level
mPa	micro-Pascals
mph	miles per hour
MTS	Metropolitan Transit System
NSLU	noise-sensitive land use
PPV	peak particle velocity
RCNM	Roadway Construction Noise Model
SPL	sound pressure level
STC	Sound Transmission Class
S_{WL}	sound power level
Trolley	San Diego Trolley
TFIC	Transportation Forecast Information Center
TNM	Traffic Noise Model
USDOT	U.S. Department of Transportation

EXECUTIVE SUMMARY

This report presents an assessment of potential noise impacts associated with the proposed Allison Avenue Transit Oriented Development Project (project). The project is located at the southeast corner of the intersection of Allison Avenue and Date Avenue in the City of La Mesa. The project involves the development of a four-story residential structure consisting of 147 apartment homes and an underground parking garage. The project is located adjacent to the San Diego Trolley (Trolley) Orange Line, just north of the La Mesa Boulevard Station.

Future residential units and exterior use areas would be exposed to noise from vehicular and Trolley traffic. Noise levels at common exterior use areas would not exceed the applicable 65 Community Noise Equivalent Level (CNEL) limit set forth in the City of La Mesa (City) General Plan Noise Element. Mitigation measure NOI-1 would be required to reduce interior noise levels. The measure would require specific exterior wall and window construction, to ensure interior noise levels do not exceed the applicable 45 CNEL limit for residential uses.

The project's heating, ventilation, and air conditioning (HVAC) systems are not anticipated to exceed allowable City limits. The project would add traffic to nearby roadways, but transportation noise impacts to off-site land uses would be less than significant.

Anticipated construction activities would generate elevated noise levels in the immediate vicinity; however, no noise-sensitive land uses are located within 500 feet of the project. Temporary construction noise impacts, including from construction traffic and from construction vibration, would be less than significant.

A vibration measurement was conducted at the project site. Vibration levels at the site are not anticipated to exceed Federal Transit Administration (FTA) screening levels. Future residential uses would therefore not be subject to excessive vibration.

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1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

This report analyzes potential noise and vibration impacts associated with the proposed Allison Avenue Transit Oriented Development (TOD) Project (project). The analysis includes a description of existing conditions in the project vicinity and an assessment of potential impacts associated with project implementation. Analysis within this report addresses the relevant issues listed in Appendix G of the California Environmental Quality Act (CEQA) Guidelines.

1.2 PROJECT LOCATION

The project site is located within the city of La Mesa (City) at 8181 Allison Avenue, at the southeast corner of the intersection of Allison Avenue and Date Avenue. The project site consists of one parcel—Assessor's Parcel Number (APN) 470-672-22-00 (see Figure 1, *Regional Location*, and Figure 2, *Aerial Photograph*).

1.3 PROJECT DESCRIPTION

The project would develop a four-story residential structure consisting of 147 apartment homes (103 one-bedroom and 44 two-bedroom units) and on-site amenities on a podium deck with a parking garage underneath. The proposed building would encompass a total floor area of 145,735 square feet (SF). In addition to the residential units, 4,113-SF of lobby space would be provided. A partially subterranean parking garage would encompass 46,700 SF and provide a total of 117 parking spaces for residents. Access to the parking lot would be via one driveway on Date Avenue.

The ground floor would include the residential lobby, mechanical/electric rooms, and the parking garage, which includes 97 standard parking spaces, 15 tandem parking spaces, 5 compact spaces, and bicycle lockers. The podium level (first floor) includes the leasing/management offices, a clubhouse area with game and exercise facilities, and a laundry room. Floors two through four would include residential units and laundry facilities. Three common exterior use areas would be provided, two in ground-level courtyards and a sky deck and lounge at the northwest corner of the project's fourth floor. Other improvements would include landscaping within the building courtyards and along the Allison Avenue and Date Avenue project frontage. Refer to Figures 3a through 3c for site plan drawings of the project's ground floor, first floor, and fourth floor.

Project construction is anticipated to occur over an approximately two-year period starting in August 2022 and completing in September 2024. Construction activities would include site preparation (including removal of asphalt, fencing, concrete masonry unit [CMU] walls, and vegetation), grading and excavation for the parking garage/foundations, podium construction, building construction, and architectural coating (e.g., painting). During site preparation, approximately 600 cubic yards (CY) of debris would be exported. During grading/excavation, approximately 14,200 CY of soil would be exported.

1.4 NOISE AND SOUND LEVEL DESCRIPTORS AND TERMINOLOGY

1.4.1 Descriptors

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting (dBA) to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol L_{EQ}, with a specified duration. The Community Noise Equivalent Level (CNEL) is a 24-hour average, where noise levels during the evening hours of 7:00 p.m. to 10:00 p.m. have an added 5 dBA weighting, and noise levels during the nighttime hours of 10:00 p.m. to 7:00 a.m. have an added 10 dBA weighting. This is similar to the Day Night sound level (L_{DN}), which is a 24-hour average with an added 10 dBA weighting on the same nighttime hours but no added weighting on the evening hours. Sound levels expressed in CNEL are always based on dBA. These metrics are used to express noise levels for both measurement and municipal regulations, as well as for land use guidelines and enforcement of noise ordinances.

1.4.2 Terminology

1.4.2.1 Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound.

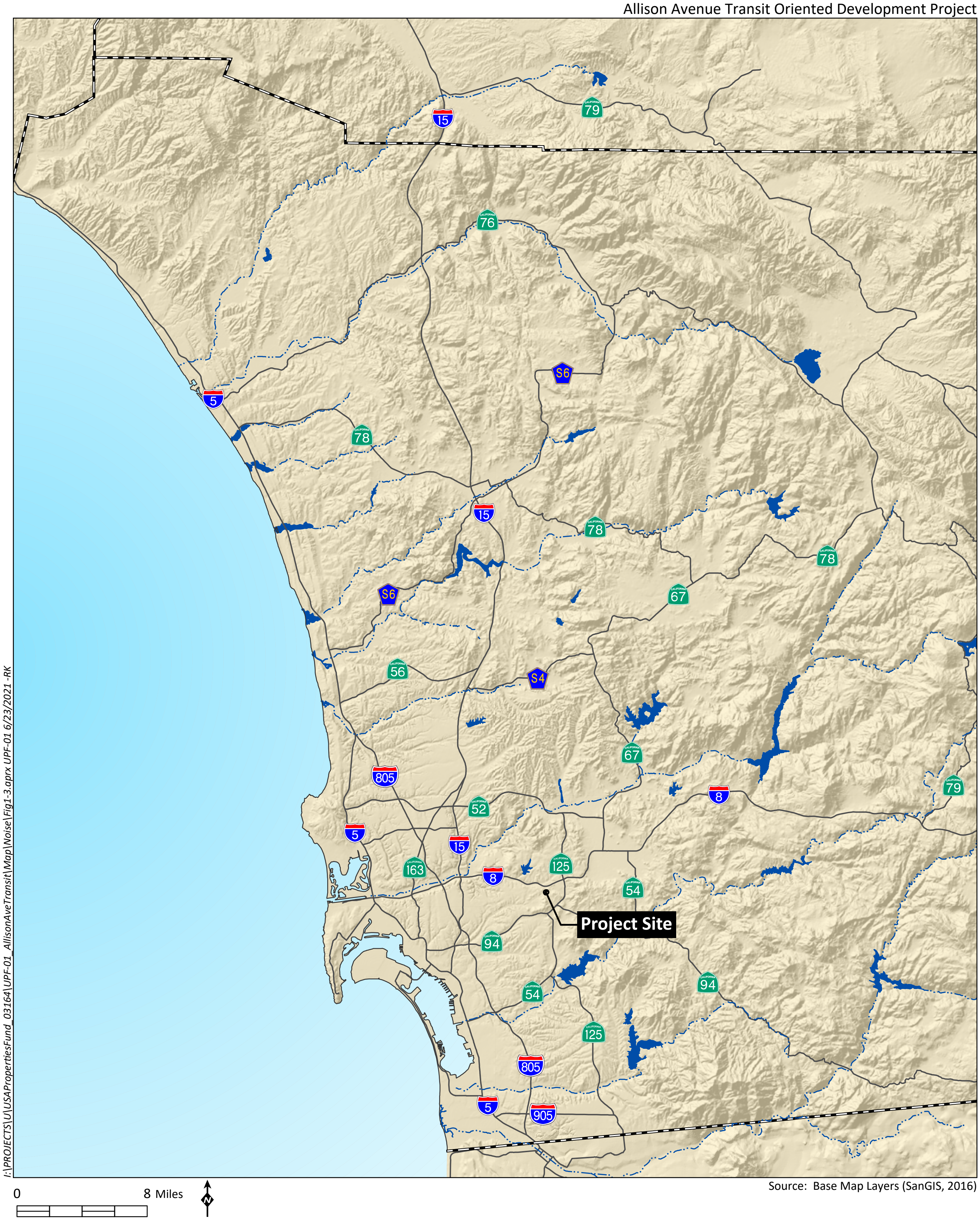
In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determines the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

1.4.2.2 Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

Sound Pressure Levels and Decibels

The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (mPa). One mPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 mPa. Because of this wide range of values, sound is rarely expressed in terms of mPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of dBA. The threshold of hearing for the human ear is about 0 dBA, which corresponds to 20 mPa.



Source: Base Map Layers (SanGIS, 2016)

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Regional Location

Figure 1

Source: Aerial (SanGIS, 2019)

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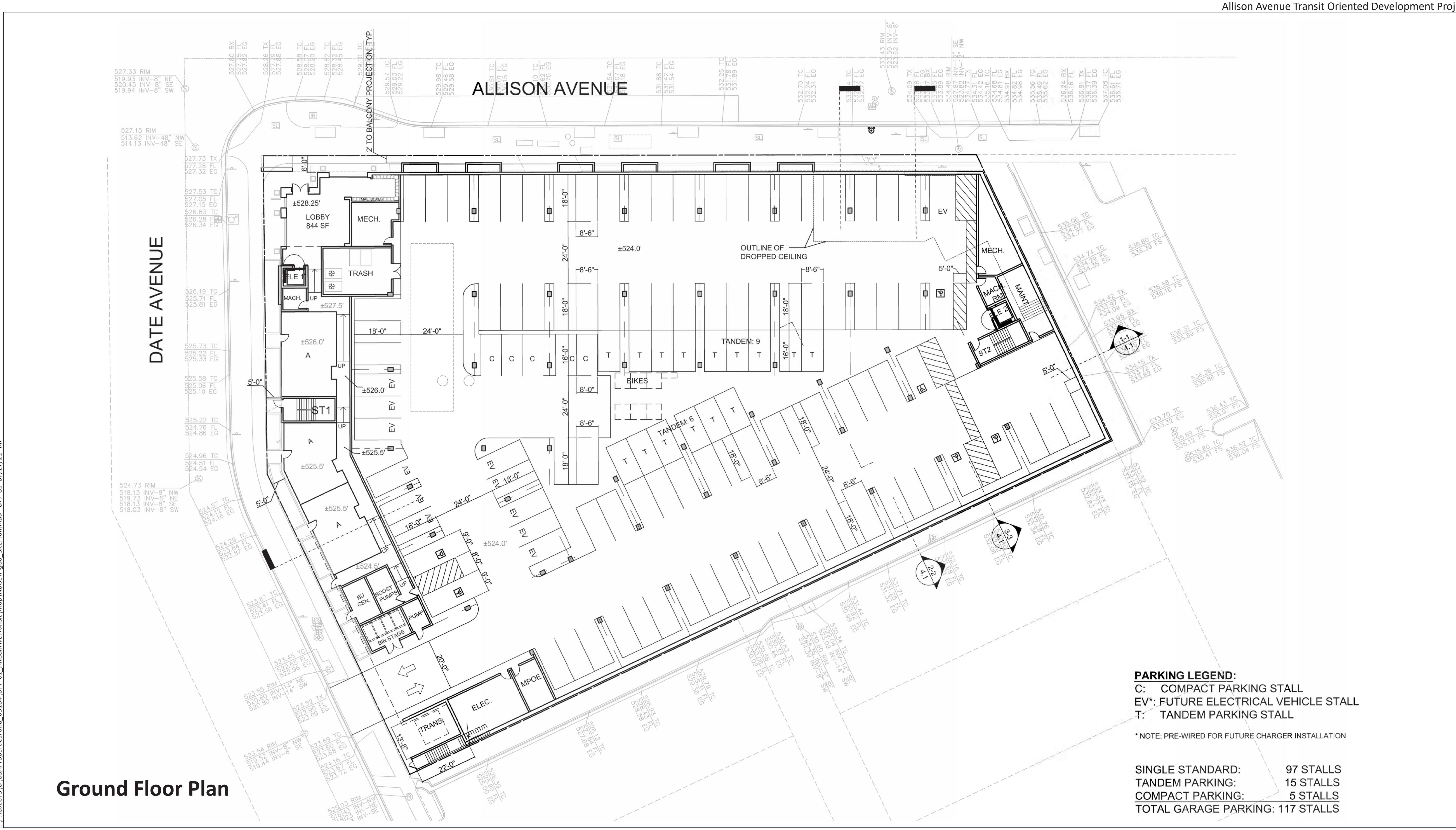
Aerial Photograph

Figure 2



Ground Floor Plan

Source: USA Properties Funds 2021

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Site Plan

Figure 3a

Source: USA Properties Funds 2021

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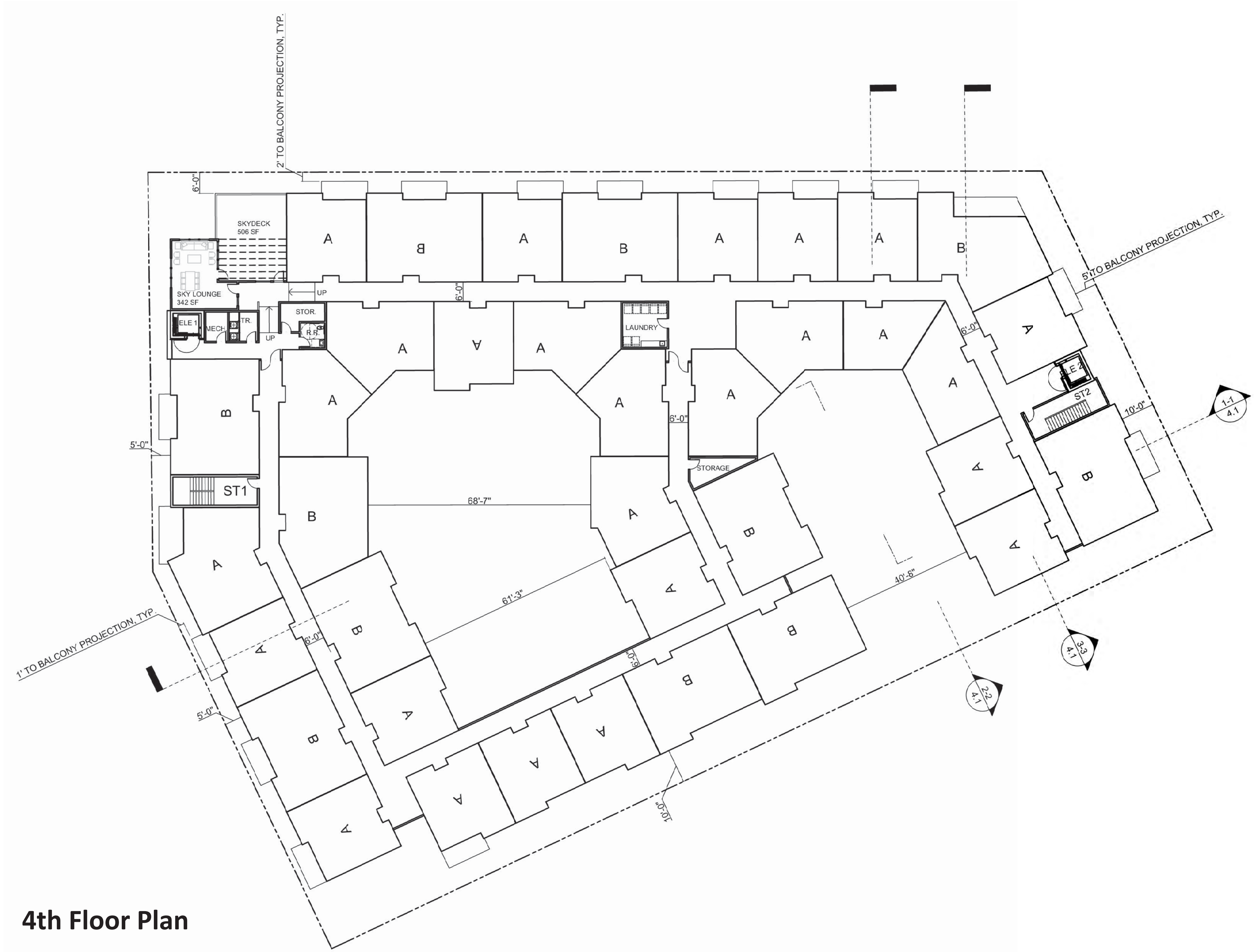

4th Floor Plan

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Source: USA Properties Funds 2021

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Site Plan

Figure 3c

1.4.2.3 Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through standard arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dBA increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dBA higher than from one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dBA—rather, they would combine to produce 73 dBA. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dBA louder than one source.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear is able to discern 1 dBA changes in sound levels, when exposed to steady, single-frequency (“pure-tone”) signals in the mid-frequency (1,000 Hz to 8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dBA are generally not perceptible. It is widely accepted, however, that people begin to detect sound level increases of 3 dB in typical noisy environments. Further, a 5 dBA increase is generally perceived as a distinctly noticeable increase, and a 10 dBA increase is generally perceived as a doubling of loudness.

No known studies have directly correlated the ability of a healthy human ear to discern specific levels of change in traffic noise over a 24-hour period. Many ordinances, however, specify a change of 3 CNEL as the significant impact threshold. This is based on the concept of a doubling in noise energy resulting in a 3 dBA change in noise, which is the amount of change in noise necessary for the increase to be perceptible to the average healthy human ear.

1.4.2.4 Vibration Terminology and Descriptors

Vibration is measured in feet (ft) or inches (in). Acceleration is measured by comparing acceleration to that of the Earth’s gravity, and this unit is “G.” These units of acceleration or velocity are relative to time in seconds and are noted as in/sec^2 for acceleration and in/sec for velocity. Displacement is not relative to time and is only shown as inches.

Vibration effects can be described by its peak and root mean square (RMS) amplitudes. Building damage is often discussed in terms of peak velocity, or peak particle velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV is related to the stresses that are experienced by buildings; it is often used in monitoring of blasting vibration and to discuss construction vibration.

The RMS amplitude is useful for assessing human annoyance. Because the net average of a vibration signal is zero, the RMS amplitude is used to describe the “smoothed” vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal. The RMS amplitude is always less than the PPV and is always positive. The RMS average is typically calculated over a one-second period.

Although it is not universally accepted, decibel notation is in common use for vibration. Decibel notation serves to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as: $L_V = 20 \times LOG10(V/V_{ref})$, where “Lv” is the velocity level in decibels, “V” is the RMS velocity amplitude, and “V_{ref}” is the reference velocity amplitude. The reference must be specified whenever a quantity is expressed in terms of decibels. All railroad vibration levels in this report are referenced to 1×10^{-6} in/sec with the notation VdB.

1.5 NOISE-SENSITIVE LAND USES

Noise-sensitive land uses (NSLUs) are land uses that may be subject to stress and/or interference from excessive noise, including residences, hospitals, schools, hotels, resorts, libraries, sensitive wildlife habitat, or similar facilities where quiet is an important attribute of the environment. Noise receptors are individual locations that may be affected by noise.

1.6 REGULATORY FRAMEWORK

1.6.1 California Noise Control Act

The California Noise Control Act is a section within the California Health and Safety Code that describes excessive noise as a serious hazard to the public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. It also finds that there is a continuous and increasing bombardment of noise in the urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians free from noise that jeopardizes their health or welfare.

1.6.2 City of La Vista General Plan, Noise Element

The goal of the Noise Element of the La Mesa General Plan (City of La Mesa 2013) is to minimize the impact of noise on the community by identifying existing and potential noise sources and providing the policies and standards needed to keep noise from reducing the quality of life in La Mesa. The Noise Element establishes guidelines to evaluate the compatibility of land uses and noise exposure levels. Table 1, *Exterior Land Use/Noise Compatibility Guidelines*, summarizes the City's exterior land use-noise compatibility guidelines. Shading in this table represents the maximum noise exposure level considered compatible for each land use category. The goal for maximum outdoor noise levels in commercial areas is 70 CNEL. This level is intended to guide the design and location of future development and serve as a target for the reduction of noise in existing development.

Table 1
EXTERIOR LAND USE/NOISE COMPATIBILITY GUIDELINES

Land Use Category	Annual CNEL (dBA)				
	55	60	65	70	75
Residential – Low Density Single Family, Duplex, and Mobile homes					
Residential – Multiple Family					
Transient Lodging – Motels, Hotels					
Schools, Libraries, Churches, Hospitals, and Nursing Homes					
Auditoriums, Concert Halls, Amphitheaters					
Sports Arena, Outdoor Spectator Sports					
Playgrounds, Neighborhood Parks					
Golf Courses, Riding Stables, Water Recreation, Cemeteries					
Offices Buildings, Business, Commercial, and Professional					
Industrial, Manufacturing, Utilities, Agriculture					

Source: City 2013

Notes: Shading represents the maximum noise exposure level considered normally acceptable for each land use category.

1.6.3 City of La Mesa Noise Ordinance (Municipal Code, Chapter 10.80 – Noise Regulation)

La Mesa Municipal Code Chapter 10.80, Noise Regulation, prohibits unnecessary, excessive, and annoying noises. Section 10.80.040 establishes standards for exterior noise levels. The exterior noise limits for each zone classification are summarized in Table 2, *Applicable Exterior Property Line Noise Limits.* These standards apply when the ambient noise level does not already exceed the noise limit. In cases where the ambient noise level already exceeds the noise limit, the ambient noise level is the applicable noise limit.

Table 2
APPLICABLE EXTERIOR PROPERTY LINE NOISE LIMITS

Zone	Time	Applicable Limit One-hour Average Sound Level (dBA)
R1 & R2	10:00 p.m. to 7:00 a.m.	50
R1 &R2	7:00 p.m. to 10:00 p.m.	55
R1 & R2	7:00 a.m. to 7:00 p.m.	60
R3 & RB	10:00 p.m. to 7:00 a.m.	55
R3 & RB	7:00 a.m. to 10:00 p.m.	60
C, CN, CD & CM	10:00 p.m. to 7:00 a.m.	60
C, CN, CD & CM	7:00 a.m. to 10:00 p.m.	65
M	Anytime	70

Source: City of La Mesa Municipal Code Section 10.80.040
R1 - Urban Residential; R2 - Medium Low Density Residential; R3 - Multiple Unit Residential;
RB - Residential Business; C - General Commercial; CN - Neighborhood Commercial;
CD - Downtown Commercial; CM - Light Industrial and Commercial Service;
M - Industrial Service and Manufacturing.

Section 10.80.090 states that it is unlawful for any person to install or operate any machinery, equipment, pump, fan, air conditioning apparatus, or similar mechanical device which can be or is operated in any manner so as to create noise which will cause the noise level at the property line of any property to exceed the ambient base noise level by more than 5 dBA. The installer of any such mechanical devices is required to furnish to the Department of Building Inspection and Housing a certificate of compliance indicating that the equipment installed as proposed can, without the addition of any baffling or construction, be operated within these sound limits.

Section 10.80.100 regulates construction noise, and states that it is unlawful for any person within a residential zone or CN (neighborhood commercial) zone, or within 500 feet of these zones, to operate equipment or perform any outside construction or repair work on buildings, structures, or projects or to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist, or any other construction-type device between the hours of 10:00 p.m. of one day and 7:00 a.m. of the next day, or on Sundays unless a special permit authorizing the activity has been duly obtained from the chief building official. The City's exterior noise limits identified in Table 2 do not apply to construction activities.

2.0 ENVIRONMENTAL SETTING

2.1 SURROUNDING LAND USES

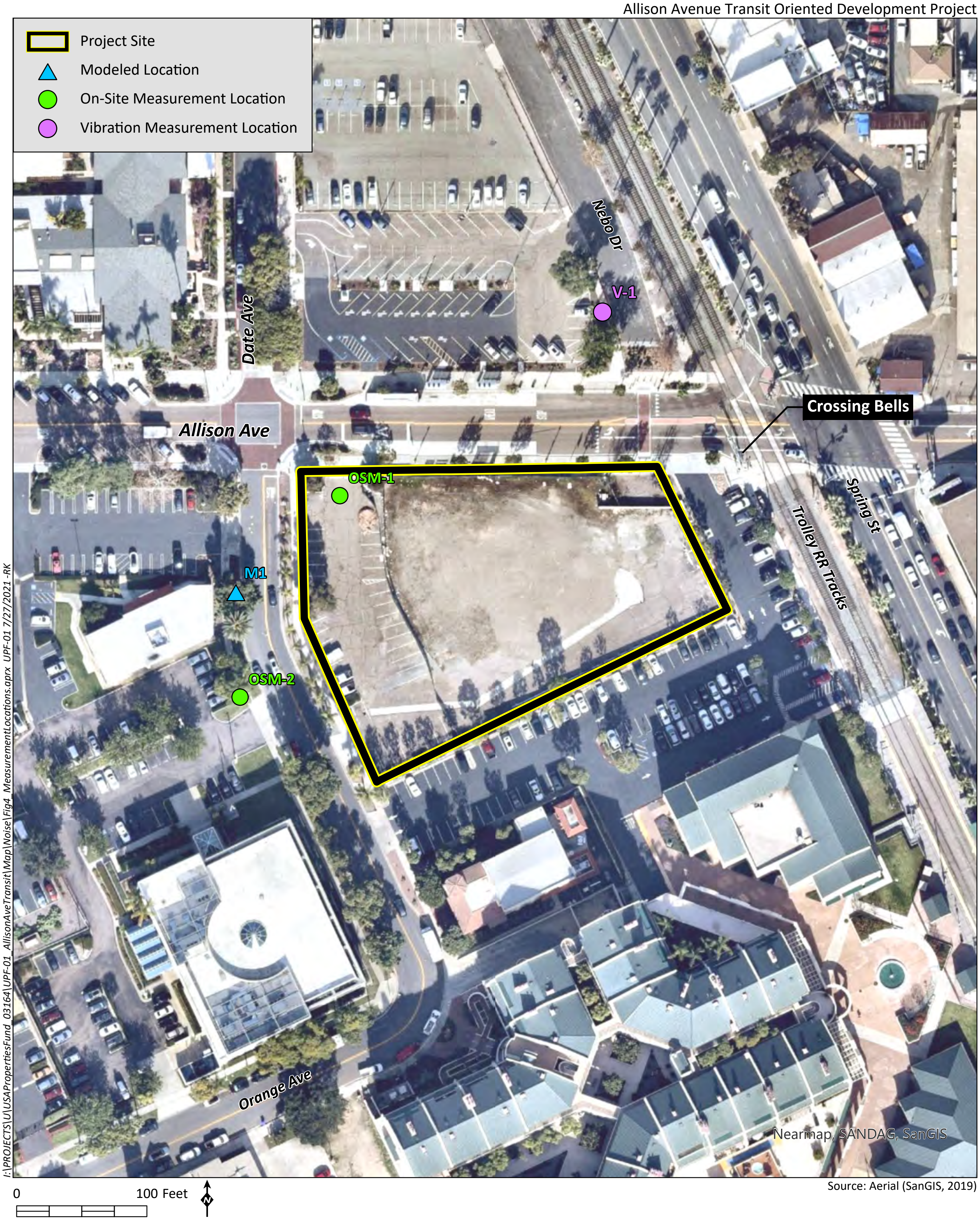
Adjacent lands surrounding the project site include and civic uses to the north, civic and commercial uses to the west, commercial uses to the south, and commercial uses to the east across the railroad tracks and Spring Street. The San Diego Trolley (Trolley) Orange Line is located directly adjacent to the project site to the west, with the Trolley's La Mesa Boulevard Station located south of the project. The existing uses directly across Allison Avenue to the north is a parking lot. Parking lots are located adjacent to the project to the south and west across Date Avenue. Commercial uses at the southeastern corner of Spring Street and Allison Avenue east of the project are currently vacant. The nearest residential uses to the project site are residences along University Avenue and Palm Avenue, approximately 500 feet to the northeast.

2.2 EXISTING NOISE ENVIRONMENT

The existing noise environment is dominated by traffic noise from Spring Street, Allison Avenue, and the Trolley. The project is subject to some distant aircraft noise, though the site is not located near an active airport. The nearest airports are Gillespie Field, located approximately 5 miles to the northeast, and San Diego International Airport, located approximately 9.4 miles to the west.

2.2.1 On-site Survey

Two measurements were taken at the project site for the ambient noise survey, and one measurement was taken for the vibration survey. The first ambient noise measurement was recorded at the intersection of Allison Avenue and Date Avenue across Date Avenue from the project site. The second measurement was taken in the northwestern corner of the site. The measured noise levels are shown in Table 3, *Noise Measurement Results.* The on-site measurement locations are shown as OSM-1 and OSM-2 on Figure 4, *Individual Noise Measurement Locations*. The vibration measurement (V1) was taken at a location north of Allison Avenue, approximately 85 feet from the railway tracks. Vibration levels at a distance of 85 measured approximately 65 VdB.



Source: Aerial (SanGIS, 2019)

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Individual Noise Measurement Locations

Figure 4

Table 3
NOISE MEASUREMENT RESULTS

Measurement 1	
Date:	June 25, 2021
Time:	1:15 p.m. – 1:48 p.m.
Location:	West of the project across Date Avenue
Measured Noise Level:	58.1 dBA L_{EQ}
Notes:	Noise primarily from vehicular traffic on Allison Avenue and Trolley traffic.
Measurement 2	
Date:	June 25, 2021
Time:	1:55 p.m. – 2:10 p.m.
Location:	Southeast corner of Allison Avenue and Date Avenue, approximately 20 feet from each centerline.
Measured Noise Level:	62.0 dBA L_{EQ}
Notes:	Noise primarily from vehicular traffic on Allison Avenue, Trolley trains and horns, and crossing bells.

2.2.2 Ambient Noise Modeling

To provide an additional assessment of ambient noise levels, modeling was conducted using the assumptions and methodology described in Section 3.0, below. Modeling was conducted for location M1, as shown on Figure 4. With pre-project conditions, the ambient noise level was modeled at 64.3 CNEL.

3.0 ANALYSIS, METHODOLOGY, AND ASSUMPTIONS

3.1 METHODOLOGY

3.1.1 Ambient Noise Survey

The following equipment was used to measure existing noise levels at the project site:

- Larson Davis 831 Noise Meter
- Larson Davis Model CA250 Calibrator
- Windscreen and tripod for the sound level meter

The sound level meter was field-calibrated immediately prior to the noise measurements to ensure accuracy. All sound level measurements conducted and presented in this report were made with a sound level meter that conforms to the American National Standards Institute (ANSI) specifications for sound level meters (ANSI SI.4-1983 R2006). All instruments were maintained with National Institute of Standards and Technology traceable calibration per the manufacturers' standards.

3.1.2 Noise Modeling Software

Modeling of the exterior noise environment for this report was accomplished using two computer noise models: Computer Aided Noise Abatement (CadnaA) version 2019 and Traffic Noise Model (TNM) version 2.5. CadnaA is a model-based computer program developed by DataKustik for predicting noise impacts in a wide variety of conditions. CadnaA assists in the calculation, presentation, assessment, and mitigation of noise exposure. It allows for the input of project related information, such as noise source data, barriers, structures, and topography to create a detailed CadnaA model, and uses the most up-to-date calculation standards to predict outdoor noise impacts. CadnaA traffic noise prediction is based on the data and methodology used in the TNM.

TNM was released in February 2004 by the U.S. Department of Transportation (USDOT) and calculates the daytime average hourly L_{EQ} from three dimensional model inputs and traffic data (California Department of Transportation [Caltrans] 2004). TNM was developed from Computer Aided Design (CAD) plans provided by the project applicant. Input variables included road alignment, elevation, lane configuration, area topography, existing and planned noise control features, projected traffic volumes, estimated truck composition percentages, and vehicle speeds.

Peak-hour traffic volumes are estimated based on the assumption that approximately 10 percent of the average daily traffic would occur during a peak hour. The one-hour L_{EQ} noise level is calculated utilizing peak-hour traffic. Peak hour L_{EQ} can be converted to CNEL using the following equation, where $L_{EQ}(h)pk$ is the peak hour L_{EQ}, *P* is the peak hour volume percentage of the average daily trips (ADT), *d* and *e* are divisions of the daytime fraction of ADT to account for daytime and evening hours, and *N* is the nighttime fraction of ADT:

$$CNEL = L_{EQ}(h)pk + 10\log10\ 4.17/P + 10\log10(d + 4.77e + 10N)$$

The model-calculated one-hour L_{EQ} noise output is therefore approximately equal to the CNEL (Caltrans 2013).

Project construction noise was analyzed using the Roadway Construction Noise Model (RCNM; USDOT 2008), which utilizes estimates of sound levels from standard construction equipment.

3.1.3 Vibration Survey

The following equipment was used to measure train vibration levels at the project site:

- Larson Davis 2900 two-channel meter
- PCB J353B33 accelerometer
- PCB 394C06 vibration calibrator

Trolley vibration measurements were taken on June 30, 2020. The measurements was conducted 85 feet west of the existing railroad tracks. This location is the approximate eastern edge of the proposed new building closest to the tracks. Measurements were conducted during passenger train pass-bys of the project site. Multiple measurements were conducted to ensure consistent data results. The highest measured vibration results during a train pass-by event measured 43.98 VdB and 43.95 VdB at a horizontal distance of 75 feet.

3.2 ASSUMPTIONS

3.2.1 Construction

Construction would require the use of equipment throughout the site for the full term of construction. General project construction activities would include site clearing, grading, underground utility installation, physical building construction, paving, and application of architectural coatings. The most prominent noise-generating standard construction equipment anticipated to be used on the site includes excavators, front-end loaders, backhoes, scrapers, dozers, rollers, pavers, and mounted impact hammers.

Debris and soil hauling would be required during initial construction of the project. Debris hauling would be required for approximately 600 CY of material over a 10-day period. Over a 30-day grading period, 14,200 CY of soil would be required for export. 75 one-way trips, or 15 trips per day, would be required for debris removal and 1,775 one-way trips, or 118 trips per day, would be required for grading and excavation.

3.2.2 Operations

The proposed project's operational noise sources are anticipated to include heating, ventilation, and air conditioning (HVAC) systems and vehicular traffic. During operations, the project would also be exposed to vehicular traffic noise from Spring Street, Allison Avenue, and Date Avenue and noise from the Trolley rail line located adjacent to the eastern boundary of the project site.

3.2.2.1 Heating, Ventilation, and Air Conditioning Units

Specific planning data for the future HVAC systems are not available at this stage of project design. The analysis assumes that the design for the future residential buildings would use a typical to larger-sized residential condenser mounted on the project's rooftop. The unit used in this analysis is a Carrier 38HDR060 split system condenser (see Appendix A, *Carrier 38HDR060 Split System Condenser*). The manufacturer's noise data is provided below in Table 4, *Carrier HDR060 Condenser Noise.*

Table 4
CARRIER HDR060 CONDENSER NOISE

Noise Levels in Decibels[1] (dB) Measured at Octave Frequencies							Overall Noise Level in A-weighted Scale (dBA)[1]
125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	
63.0	61.5	64.0	66.5	66.0	64.5	55.5	72.0

[1] Sound Power Level (S_{WL})
KHz = kilohertz

3.2.2.2 Vehicular Traffic

The project's trip generation were provided by Linscott, Law and Greenspan, Engineers (LLG 2021). The project is estimated to generate 882 ADT. Approximately 79 percent of traffic would be directed along Allison Avenue toward University Avenue, with 6 percent traveling east along Avenue and 15 percent traveling south along Date Avenue. Existing traffic volume data for nearby roadways was based on information from SANDAG's Traffic Forecast Information Center (TFIC) Series 14 roadway forecast (SANDAG 2021).

A traffic distribution of 97.5 percent automobiles, 2 percent medium trucks, and 0.5 percent heavy trucks was used in this analysis for Spring Street and Date Avenue. A distribution of 10 percent buses and 0.5 percent heavy trucks was used for Allison Avenue. Table 5, *Existing Plus Project Traffic Volumes*, summarizes the ADT data for the segments of Phillips Street and Santa Fe Avenue relevant to this analysis.

Table 5
EXISTING PLUS PROJECT TRAFFIC VOLUMES

Roadway Segment	ADT Existing	Project ADT	ADT Existing + Project
Allison Avenue			
West of Date Avenue	3,900	697	4,597
East of Date Avenue	4,900	53	4,953
Spring Street			
North of Allison Avenue	24,400	132[1]	24,532
South of Allison Avenue	20,800	132[1]	20,932
Date Avenue			
South of Project Driveway	1,900	132	2,032

Source: LLG, SANDAG 2021

[1] Note: No project traffic percentages were provided for Spring Street. For the purposes of this analysis, it is conservatively assumed 15 percent of project-related ADT would use Spring Street.

3.2.2.3 Trolley Noise

The project is located along railroad tracks for the Trolley's Orange Line. Modeling for train traffic in the project vicinity is based on daily Trolley schedules (MTS 2020). The project site is located north of the La Mesa Boulevard Station. Four Trolley trains going northbound and two trains going southbound pass the site hourly during daytime hours for a total of eight train passes per hour between the hours of 7:00 a.m. and 8:00 p.m. on weekdays, or every 7.5 minutes. Trolley trains typically consist of three approximately 80-foot-long cars travelling at speeds up to 55 miles per hour (mph) (MTS 2015). At this location, because of its proximity to the nearby station, it was assumed that Trolley trains would be travelling approximately 15 mph.

The Trolley's train horns are electronic and have two loudness settings; the low setting is 75 dBA at 100 feet, and the high setting is 85 dBA at 100 feet when measured directly in front of the train (San Diego Association of Governments [SANDAG] 2014a). Off-site noise is reduced by mounting the horns at track level on the trains rather than on the roof and focusing the sound forward of the Trolley car. Noise experienced at greater than a 30 degree angle from the front of the train is reduced by 5 dBA or more as the angle widens.

MTS uses the quieter horn when exiting stations. According to the Mid-Coast Trolley Noise and Vibration Impacts Technical Report, the horns would be used twice when exiting a station (SANDAG 2014b). The California Public Utilities Commission (CPUC) requires use of the high setting when a safety concern is identified by the operator (e.g., a pedestrian on the tracks). The CPUC also requires that MTS use horns to warn patrons before the train departs from a station.

To analyze a conservative scenario from the use of Trolley horns, it was assumed that the loudest setting for the horns would be used three times for three seconds each time upon entering and exiting the station. Given a train entering and leaving the station every 7.5 minutes, this would equal 144 seconds of horn use per daytime hour. Under these assumptions, the horns would create an hourly noise level of 71.0 dBA at 100 feet; noise levels from the horns would be 65 dBA at 200 feet, 60 dBA at 350 feet, and 57 dBA at 500 feet.

3.2.2.4 Level Crossing at Allison Avenue

The train tracks intersect with Allison Avenue at a level crossing just outside the project's northeastern boundary. This crossing contains signals including lights, crossing arms, and warning bells. Warning bells similar to the ones located at the project emit noise levels of 71.3 dBA at approximately 18 feet and are in use for approximately 11 seconds per train crossing.

3.2.2.5 Trolley Vibration

The Federal Transit Administration (FTA) has established guidelines for the evaluation of transit noise and vibration for trains that operate at speeds less than 90 miles per hour. The guidelines are set forth in the document *Transit Noise and Vibration Impact Assessment* (FTA 2018). The guidelines establish impact criteria for rail noise and vibration, define sensitive receivers, and provide methodology for assessing impacts. These guidelines are appropriate to use for the existing rail operations associated with the Trolley railroad tracks adjacent to the project site.

The project falls within the document's Category 2 guidelines, which includes residences and buildings where people sleep (hotels, hospitals, and dormitories). The criteria for acceptable ground-borne vibration are expressed in terms of VdB and the criteria for acceptable ground-borne noise are expressed in terms of dBA. The impact criteria for general assessment are based on the vibration-sensitive land use categories. Table 6, *Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for General Assessment*, describes the FTA's ground-borne vibration and ground-borne noise impact criteria for general assessment.

Table 6
GROUND-BORNE VIBRATION AND GROUND-BORNE NOISE IMPACT CRITERIA FOR GENERAL ASSESSMENT

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 micro-in/sec)			Ground-Borne Noise Impact Levels (dB re 20 mPa)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA

Source: FTA 2018

1 Frequent Events is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2 Occasional Events is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3 Infrequent Events is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4 This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
5 Vibration-sensitive equipment is generally not sensitive to ground-borne noise.

3.3 GUIDELINES FOR THE DETERMINATION OF SIGNIFICANCE

Based on Appendix G of the CEQA Guidelines, implementation of the project would result in a significant adverse impact if it would:

Threshold 1: *Generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the La Mesa General Plan or noise ordinance.*

Per the City Noise Ordinance, impacts would be significant if the project would generate noise levels at the property line of any property exceeding: 60 dBA from 7:00 a.m. to 10:00 p.m., 55 dBA from 10:00 p.m. to 7:00 a.m., or for air conditioning units, to exceed the ambient base noise level by more than 5 dBA.

For traffic-related noise, impacts are considered significant if noise levels at nearby NSLUs would increase by 3 CNEL or more.

As stated in the City noise ordinance, construction activity would be considered significant for residences within 500 feet if construction occurs during the hours of 10:00 p.m. and 7:00 a.m. Construction noise exceeding 10 dBA above ambient noise levels at nearby sensitive receptors would be considered a significant increase.

Threshold 2: *Generate excessive ground-borne vibration or ground-borne noise levels.*

Excessive ground-borne vibration would occur if construction-related ground-borne vibration exceeds the “strongly perceptible” vibration annoyance potential criteria for human receptors of 0.1 inch per second PPV or the damage potential criteria to relatively old residential structures 0.5 inch per second PPV for continuous/frequent intermittent construction sources (such as impact pile drivers, vibratory pile drivers, and vibratory compaction equipment), as specific by Caltrans (2020).

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

Excessive noise exposure is defined as noise levels that exceed the standards in the City General Plan Noise Element for the associated land use.

Threshold 4: *Noise compliance for new uses.*

Future land uses would be compliant with the City General Plan Noise Element if the project's residential exterior use areas are exposed to noise levels below 65 CNEL and interior noise levels are below 45 CNEL.

4.0 IMPACTS

4.1 ISSUE 1: EXCESSIVE NOISE LEVELS

Would the project generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the City General Plan or noise ordinance.

4.1.1 Operational On-site Noise Generation

The project would include HVAC units at the building's rooftop, although specific planning data for the future HVAC units are not available at this stage of project design. As mentioned in Section 3.2.2.1, this analysis assumes that the HVAC unit would be a Carrier 38HDR060 split system condenser. A single unit typically generates a noise level of 56 dBA at a distance of 7 feet.

Section 10.80.090 of the City Noise Ordinance states that HVAC units shall not generate noise that would increase the noise level at the property line to exceed the ambient base noise level by more than 5 dBA. Although multiple HVAC units would be required for the project, the units would be located at heights exceeding 40 feet from ground level and would be screened through the use of architectural parapets. At this height, noise generated by HVAC units would be minimal, and would not exceed existing ambient noise levels.

4.1.2 Operational Off-site Transportation Noise Generation

The project would generate vehicular traffic that would utilize Allison Avenue and Date Avenue. An increase in traffic has the potential to result in increased noise levels along those roadways. The project is expected to generate an additional 882 ADT, with 679 of those trips directed along Allison Avenue west of the project. As a general rule of thumb, the doubling of a noise source, in this case traffic, would lead to a 3 CNEL increase in noise levels. A 3 CNEL increase would be a noticeable increase and would therefore be considered significant for a permanent noise source. As shown on Table 5, Allison Avenue currently carries approximately 3,900 ADT. An additional 679 trips would not double the traffic, and noise levels would therefore not increase significantly. Additionally, no NSLUs are located in the immediate vicinity of the project, with the nearest residences approximately 500 feet to the northwest along University Avenue and Palm Avenue. The traffic generated by the project would therefore not generate an increase in noise levels for nearby NSLUs, and impacts would be less than significant.

4.1.3 On-site Construction Noise Generation

Construction of the project would require site clearing, grading, installation of underground utilities/infrastructure, construction of new buildings, paving, and architectural coating. The magnitude of the noise would depend on the type of construction activity, equipment, duration of each construction phase, distance between the noise source and receiver, and any intervening structures. Construction would generate elevated noise levels at nearby land uses, although no NSLUs are located in the project's immediate vicinity. The nearest residences are those along University Avenue and Palm Avenue, approximately 500 feet to the northeast. At this distance, and with multiple intervening structures, construction noise at the project site would not be expected to rise above ambient noise levels. Additionally, construction equipment would not all operate at the same time or location and would not be in constant use during the 8-hour operating day. For informational purposes, Table 7, *Construction Equipment Noise Levels*, provides the 500-foot distance noise levels for equipment anticipated to be used for general construction activities. At these distances, construction noise is not anticipated to be audible above ambient noise levels. Refer to Appendix B, Construction Modeling Outputs.

Table 7
CONSTRUCTION EQUIPMENT NOISE LEVELS

Unit	Percent Operating Time	L_{MAX} at 500 feet	dBA L_{EQ} at 500 feet
Backhoe	40	57.6	53.6
Compactor	20	63.2	56.2
Compressor	40	57.7	53.7
Concrete Mixer Truck	40	58.8	54.8
Concrete Pump Truck	20	61.4	54.4
Crane	16	60.6	52.6
Dozer	40	61.7	57.7
Dump Truck	50	56.5	52.5
Drum Mixer	40	60	57
Excavator	40	60.7	56.7
Front End Loader	40	59.1	55.1
Generator	50	60.6	57.6
Paver	50	57.2	54.2
Roller	20	60	53

Source: RCNM; Appendix B
L_{MAX} = maximum noise level; dBA = A-weighted decibel; L_{EQ} = equivalent sound level
Note: Modeling results do not include intervening structures that would attenuate noise levels further.

4.1.4 Construction Traffic Noise

As discussed in Section 3.2.1., it is anticipated that 10 haul trips per day would be required for debris hauling, and 118 daily trips would be required during grading and excavation. Over the course of an eight-hour construction day, it is assumed 15 haul truck trips would occur per hour during grading and excavation. This daily traffic level associated with soil export is anticipated to be the highest daily traffic level associated with project construction.

As discussed in Section 4.1.3, existing traffic levels along the nearby streets exceed 3,900 ADT along Allison Avenue. An additional 10 daily trips for debris removal and 118 daily trips for grading and excavation would not be anticipated to increase noise levels above 3 CNEL. Furthermore, no NSLUs are located along the haul routes leading from the project. Noise levels from 118 additional daily trips would therefore not affect nearby residences. Further, this localized increase in noise from haul trucks would be temporary (estimated at 10 days for site preparation and 30 days for grading and excavation) and would cease upon the completion of construction. Therefore, impacts from construction traffic noise would be less than significant.

4.2 ISSUE 2: EXCESSIVE VIBRATION

Would the project expose persons to or generate excessive ground-borne vibration or noise levels?

4.2.1 Construction Vibration

A possible source of vibration during general project construction activities would be a vibratory roller, which may be used for compaction of soil beneath building foundations. As described in Section 4.1.3, construction would not be conducted in the vicinity of off-site residences. The nearest structure is a building across Date Avenue to the west, approximately 75 feet from the project's building footprint. A vibratory roller would create approximately 0.210 inch per second PPV at a distance of 25 feet (Caltrans 2020). A 0.210 inch per second PPV vibration level would equal 0.063 inch per second PPV at a distance of 75 feet.[1] This would be far lower than the structural damage impact to older structures of 0.5 inch per second PPV and the "strongly perceptible" impact for humans of 0.1 inch per second PPV. Additionally, off-site exposure to such ground-borne vibration would be temporary as it would be limited to the short-term construction period. Temporary impacts associated with the roller (and other potential equipment) would be less than significant.

4.2.2 Operational Vibration

As a residential development, the project would not generate excessive ground-borne vibration during operations; therefore, no impacts would occur.

4.2.3 Exposure to Excessive Vibration

The project would be located approximately 85 feet from the Trolley's railroad track centerline. At a distance of 85 feet from the railroad tracks, the highest on-site measurement was measured at approximately 65 VdB. This measurement was measured at the ground surface and is below the impact criteria levels of 72 VdB as shown in Table 6. Vibration impacts on the project would therefore be less than significant and do not require further consideration.

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[1] Equipment PPV = Reference PPV * $(25/D)^n$ (inches per second), where Reference PPV is PPV at 25 feet, D is distance from equipment to the receiver in feet, and n = 1.1 (the value related to the attenuation rate through the ground); formula from Caltrans 2013b.

4.3 ISSUE 3: AIRPORT NOISE EXPOSURE

Would the project expose people residing or working in the project area to excessive noise from a nearby public use airport or private airstrip?

4.3.1 Aircraft Noise

The project is subject to some distant aircraft noise, though the site is not located near an active airport. The nearest airports are Gillespie Field, located approximately 5 miles to the northeast and San Diego International Airport, located approximately 9.4 miles to the west. At these distances, no effects related to airport noise would occur at the project site, and impacts would be less than significant.

4.4 ISSUE 4: LAND USE COMPATIBILITY

Future land uses would be compliant with the City General Plan Noise Element if the project's residential exterior use areas are exposed to noise levels below 65 CNEL and interior noise levels are below 45 CNEL.

4.4.1 Exposure to Excessive Noise

4.4.1.1 Exterior Noise Levels

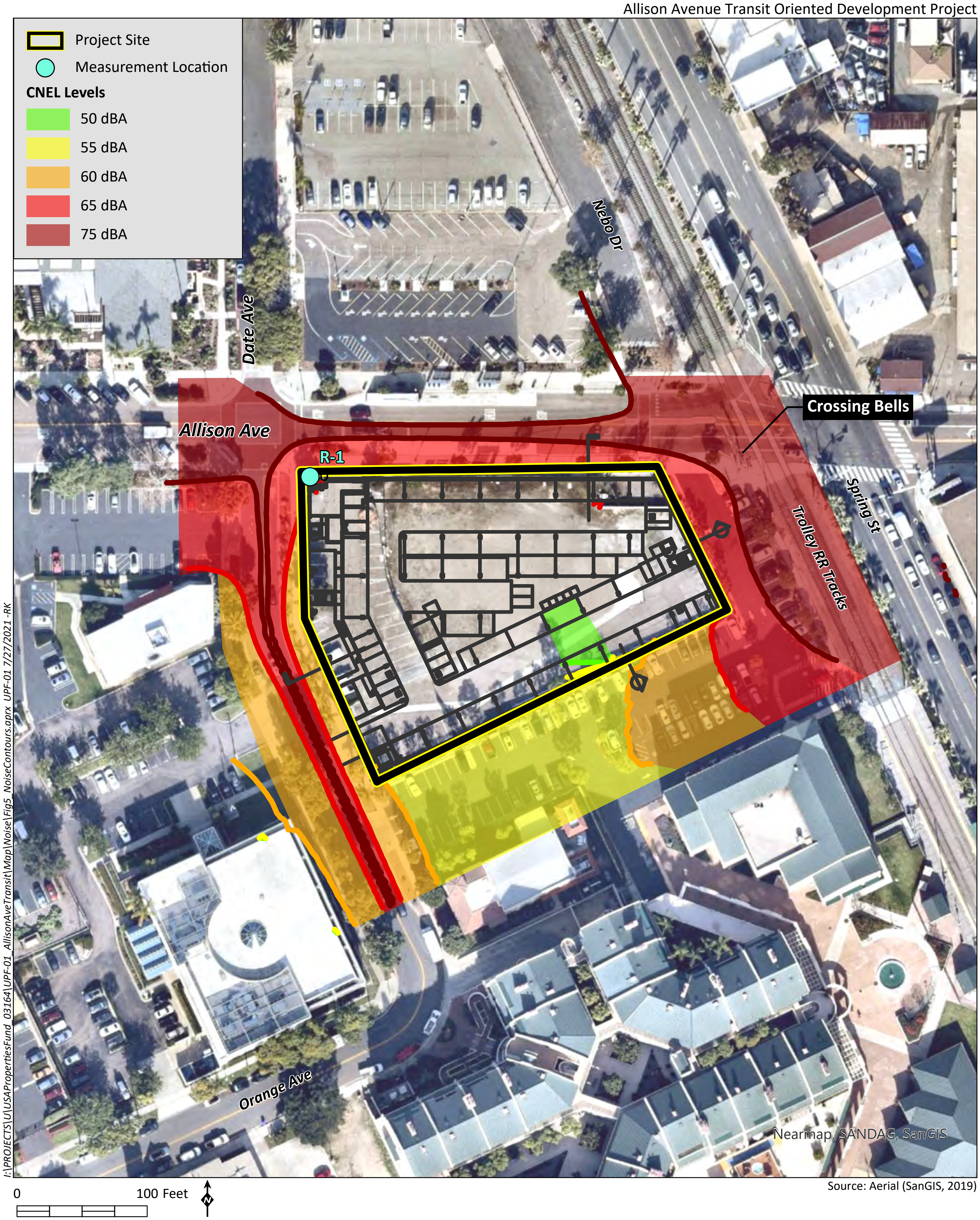
Future on-site residential land uses would be exposed to noise from vehicular traffic and light rail traffic along the Trolley line adjacent to the project site. The noise levels associated with vehicular and rail traffic were modeled at the project site using CadnaA. Impacts related to exterior noise would be significant if common areas intended for frequent outdoor use are exposed to noise levels in excess of the 65 CNEL limit set forth in the City General Plan Noise Element. The project's residential units include outward-facing balconies, however these are not considered areas intended for frequent outdoor use. The project's ground-level common exterior use areas are located in a south-facing east courtyard and within an interior west courtyard. The sky deck and lounge exterior use areas are located at the northwestern corner of the project's fourth floor.

Noise contours from local roads, the Trolley, and crossing bells are shown on Figure 5, *Noise Level Contours*. Common exterior use areas within the project would be shielded from external noise sources and impacts are not considered significant. A receiver, shown on Figure 5 as R1, indicates the location where the project's sky deck and lounge exterior use area was modeled. At this location on the project's fourth floor, noise levels were modeled at approximately 64.4 CNEL, with noise levels being partially shielded by the project itself.

Because noise levels at the common exterior use areas would not exceed 65 CNEL, impacts would be less than significant and no mitigation is required.

4.4.1.2 Interior Noise Levels

Traditional architectural materials are conservatively estimated to attenuate noise levels by 15 CNEL; therefore, if exterior noise levels at building façades exceed 60 CNEL, interior noise levels may exceed the 45 CNEL limit set forth in the City General Plan Noise Element for residential uses. As shown in Figure 5, modeled noise levels exceed 60 CNEL for those units along the northern, eastern, and western



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Source: Aerial (SanGIS, 2019)

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Noise Level Contours

Figure 5

façades. Additionally, noise levels exceed 60 CNEL along the project's southern façade, east of the east courtyard.

Using modeled exterior façade noise levels, an exterior-to-interior noise analysis was conducted to calculate expected interior noise levels to determine if they would comply with the 45 CNEL standard. The information in this interior noise analysis includes wall heights/lengths, room volumes, window/door tables typical for a standard building plan, as well as information on any other openings in the building shell for the habitable residential rooms. The analysis provides information for the rooms with the highest potential interior noise and extends these requirements to other similar rooms.

The highest noise levels were modeled to occur at the project's eastern-facing façade, where noise levels exceed 65 CNEL. This analysis modeled a typical A Unit plan living and bedroom area. The proposed floor plan includes a bedroom with a window and wall exposed to vehicular traffic and rail noise and a living room with a balcony wall and door. The room was analyzed with the conservative noise condition of 67.8 CNEL. The room specifications used in this analysis are based on current floor plans provided by the project applicant. Refer to Figure 6, *Analyzed Rooms*, for the project plans for the room included in this exterior-to-interior analysis.

Table 8, *Exterior-to-Interior Noise Levels*, displays the STC ratings necessary to ensure interior noise levels for the proposed project are consistent with the City's interior 45 CNEL limit. Detailed modeling results can be found in Appendix C, *Exterior-to-Interior Noise Reduction Analysis*.

Table 8
EXTERIOR-TO-INTERIOR NOISE LEVELS

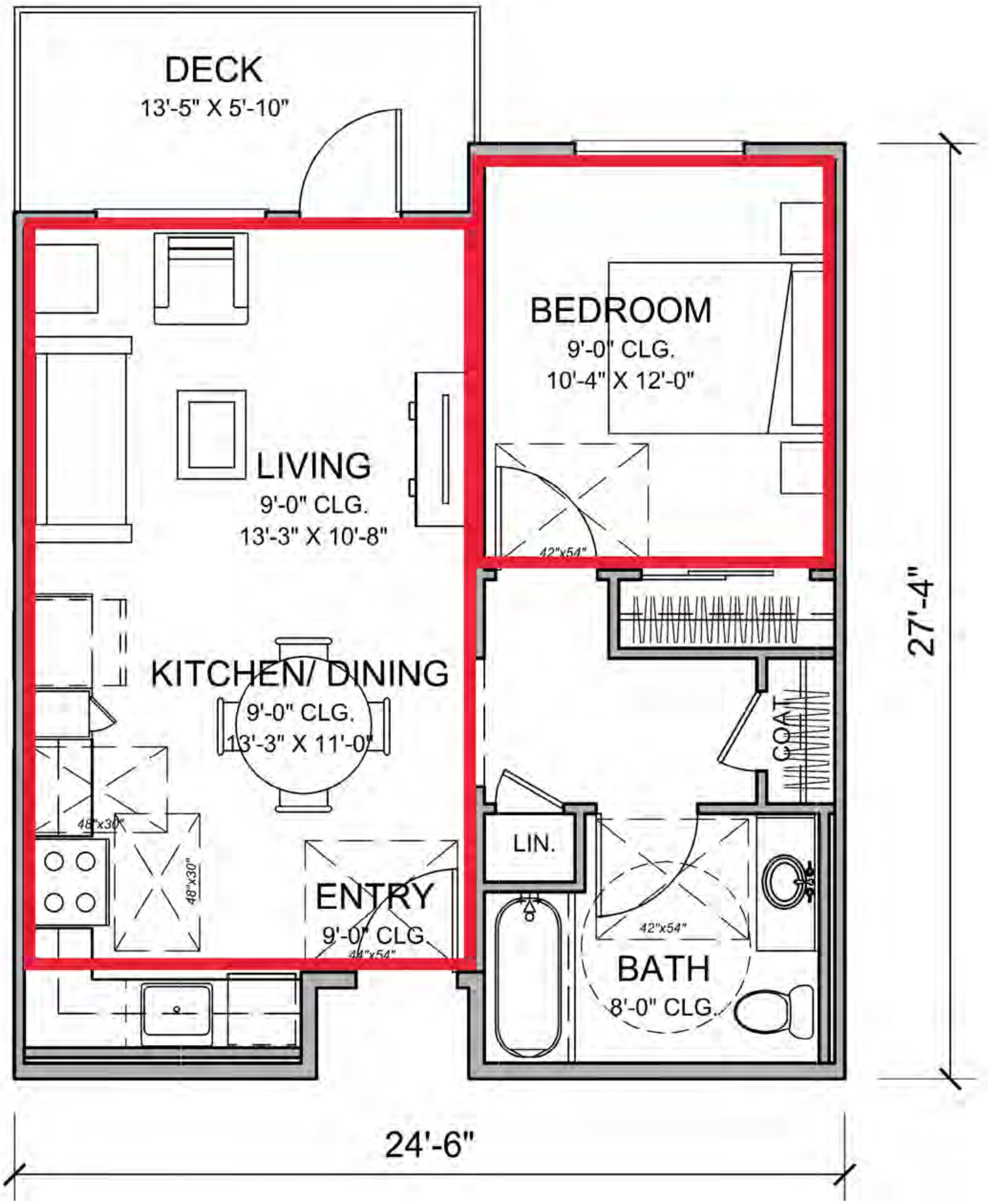
Specification	Bedroom
Minimum exterior wall requirement	STC 46
Wall construction	Standard 0.875-inch Stucco over 0.5-inch Shearwall on 2x6 Studs with 0.625-inch Type "X" Drywall
Minimum window requirement	STC 28
Window construction	Dual Glazing Window Thickness 0.125-inch and 0.5-inch Air Gap
Exterior Noise	67.8 CNEL
Interior Noise	35.0 CNEL (windows closed)
Above 45 CNEL interior noise standard?	**No**
Specification	**Living Room**
Minimum exterior wall requirement	STC 46
Wall construction	Standard 0.875-inch Stucco over 0.5-inch Shearwall on 2x6 Studs with 0.625-inch Type "X" Drywall
Minimum window requirement	STC 28
Window construction	Dual Glazing Window Thickness 0.125-inch and 0.5-inch Air Gap
Exterior Noise	67.8 CNEL
Interior Noise	31.6 CNEL (windows closed)
Above 45 CNEL interior noise standard?	**No**

STC = Sound Transmission Class; CNEL = Community Noise Equivalent Level

Through incorporation of the building materials described above, all rooms would comply with the relevant interior noise standards of 45 CNEL for habitable areas. Appropriate means of air circulation and provision of fresh air would be present to allow windows to remain closed for extended intervals of time so that acceptable levels of noise can be maintained on the interior. The building design would include a mechanical ventilation system that would meet the criteria of the International Building Code (Chapter 12, §1203.3 of the 2016 California Building Code) to ensure that windows would be able to remain permanently closed. With incorporation of mitigation measure NOI-1 below, noise levels would be reduced to acceptable levels per the City's General Plan Noise Element.

NOI-1 **Building Materials.** Interior noise levels shall not exceed the City's General Plan interior noise standard of 45 CNEL for habitable areas of project residences. The following specifications, or like-kind to achieve the required noise control, shall be used in the construction of all habitable rooms along the project's external-facing northern façade, eastern façade, western façade, and southern façade east of the east courtyard:

- Exterior wall requirement of STC 46 including standard 0.875-inch stucco over 0.5-inch shearwall on 2-inch x 6-inch studs with 0.625-inch Type "X" Drywall.
- Minimum window requirement of STC 28 including windows with dual glazing, window thickness 0.125-inch, and 0.5-inch air gap.
- Appropriate means of air circulation and provision of fresh air must be present to allow windows to remain closed for extended intervals of time so that acceptable levels of noise can be maintained on the interior.
- The building design would include a mechanical ventilation system that would meet the criteria of the International Building Code (Chapter 12, §1203.3 of the 2016 California Building Code) to ensure that windows would be able to remain permanently closed.



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Analyzed Rooms

Figure 6

5.0 LIST OF PREPARERS

Jason Runyan, Noise Specialist
Charles Terry, Principal Specialist, Noise, Acoustics & Vibration
Tim Belzman, Project Manager
Joanne Dramko, AICP, Environmental Planning Discipline Leader, QA/QC

HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, CA 91942

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Appendix A

Carrier 38HDR060 Split System Condenser

ELECTRICAL DATA

38HDR UNIT SIZE	V–PH–Hz	VOLTAGE RANGE*		COMPRESSOR		OUTDOOR FAN MOTOR			MIN CKT AMPS	FUSE/ HACR BKR AMPS
		Min	Max	RLA	LRA	FLA	NEC Hp	kW Out		
018	208/230–1–60	187	253	9.0	48.0	0.80	0.125	0.09	12.1	20
024	208/230–1–60	187	253	12.8	58.3	0.80	0.125	0.09	16.8	25
030	208/230–1–60	187	253	14.1	73.0	1.45	0.25	0.19	19.1	30
036	208/230–1–60	187	253	14.1	77.0	1.45	0.25	0.19	19.1	30
	208/230–3–60	187	253	9.0	71.0	1.45	0.25	0.19	12.7	20
	460–3–60	414	506	5.6	38.0	0.80	0.25	0.19	7.8	15
048	208/230–1–60	187	253	21.8	117.0	1.45	0.25	0.19	28.7	50
	208/230–3–60	187	253	13.7	83.1	1.45	0.25	0.19	18.6	30
	460–3–60	414	506	6.2	41.0	0.80	0.25	0.19	8.6	15
060	208/230–1–60	187	253	26.4	134.0	1.45	0.25	0.19	34.5	60
	208/230–3–60	187	253	16.0	110.0	1.45	0.25	0.19	21.5	35
	460–3–60	414	506	7.8	52.0	0.80	0.25	0.19	10.6	15

* Permissible limits of the voltage range at which the unit will operate satisfactorily

FLA – Full Load Amps
HACR – Heating, Air Conditininng, Refrigeration
LRA – Locked Rotor Amps
NEC – National Electrical Code
RLA – Rated Load Amps (compressor)

NOTE: Control circuit is 24–V on all units and requires external power source. Copper wire must be used from service disconnect to unit. All motors/compressors contain internal overload protection.

SOUND LEVEL

Unit Size	Standard Rating (dB)	Typical Octave Band Spectrum (dBA) (without tone adjustment)						
		125	250	500	1000	2000	4000	8000
018	68	52.0	57.5	60.5	63.5	60.5	57.5	46.5
024	69	57.5	61.5	63.0	61.0	60.0	56.0	45.0
030	72	56.5	63.0	65.0	66.0	64.0	62.5	57.0
036	72	65.0	61.5	63.5	65.0	64.5	61.0	54.5
048	72	58.5	61.0	64.0	67.5	66.0	64.0	57.0
060	72	63.0	61.5	64.0	66.5	66.0	64.5	55.5

CHARGING SUBCOOLING (TXV-TYPE EXPANSION DEVICE)

UNIT SIZE–VOLTAGE, SERIES	REQUIRED SUBCOOLING °F (°C)
018	12 (6.7)
024	12 (6.7)
030	12 (6.7)
036	12 (6.7)
048	12 (6.7)
060	12 (6.7)

Appendix B

Construction Modeling Outputs

Roadway Construction Noise Model (RCNM),Version 1.1

Report #####
Case Description:

---- Receptor #1 ----

		Baselines (dBA)		
Descrip	Land U	Daytim	Evenin	Night
1	Resider	40	40	40

			Equipment			
			Spec	Actual	Recept	Estimated
	Impact		Lmax	Lmax	Distanc	Shielding
Description	Device	Usage('	(dBA)	(dBA)	(feet)	(dBA)
Backhoe	No	40		77.6	500	0
Compactor (gr	No	20		83.2	500	0
Compressor (a	No	40		77.7	500	0
Concrete Mixe	No	40		78.8	500	0
Concrete Pum	No	20		81.4	500	0
Dozer	No	40		81.7	500	0
Drum Mixer	No	50		80	500	0
Excavator	No	40		80.7	500	0
Front End Loac	No	40		79.1	500	0
Generator	No	50		80.6	500	0
Paver	No	50		77.2	500	0
Roller	No	20		80	500	0
Crane	No	16		80.6	500	0
Dump Truck	No	40		76.5	500	0

			Results					
	Calculated (dBA)			Noise Limits (dBA)				
			Day		Evening		Night	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Backhoe	57.6	53.6	N/A	N/A	N/A	N/A	N/A	N/A
Compactor (gr	63.2	56.2	N/A	N/A	N/A	N/A	N/A	N/A
Compressor (a	57.7	53.7	N/A	N/A	N/A	N/A	N/A	N/A
Concrete Mixe	58.8	54.8	N/A	N/A	N/A	N/A	N/A	N/A
Concrete Pum	61.4	54.4	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	61.7	57.7	N/A	N/A	N/A	N/A	N/A	N/A
Drum Mixer	60	57	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	60.7	56.7	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loac	59.1	55.1	N/A	N/A	N/A	N/A	N/A	N/A
Generator	60.6	57.6	N/A	N/A	N/A	N/A	N/A	N/A
Paver	57.2	54.2	N/A	N/A	N/A	N/A	N/A	N/A
Roller	60	53	N/A	N/A	N/A	N/A	N/A	N/A
Crane	60.6	52.6	N/A	N/A	N/A	N/A	N/A	N/A
Dump Truck	56.5	52.5	N/A	N/A	N/A	N/A	N/A	N/A
Total	63.2	66.8	N/A	N/A	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.

Appendix C

Exterior-to-Interior Noise Reduction Analysis

EXTERIOR TO INTERIOR NOISE REDUCTION ANALYSIS

Project Name: Allison Avenue TOD
Project # : UPF-01
Room Name: Unit A Living Room

Wall 1 of 1

Room Type : **Soft**

	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Reverberation Time (sec) :	0.8	0.8	0.8	0.8	0.7	0.7	: Highly Absorptive Room
Room Absorption (Sabins) :	155	155	155	155	194	194	

		Noise Level		125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Source 1:	**Traffic**	**67.8**	**CNEL**	51.1	56.6	59.1	63.1	63.1	57.1	: Traffic Spectrum
Source 2:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 3:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 4:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Overall:		**67.8**	**CNEL**	51.1	56.6	59.1	63.1	63.1	57.1	: Effective Noise Spectrum

Assembly Type	Open	Width	Height	Qty	Total Area	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz
STC 46 Typical Exterior Wall	N	13.25	9	1	99.3	29	40	46	46	44	53
STC 28 1/2-inch Dual Insulating Window	Y	5	4	1	20.0	23	23	22	32	43	37
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0

Room Depth: **21.67** ft

Overall Area: **119.25** ft²
Volume: **2584** ft³

Number of Impacted Walls: **1**

Windows Open
Interior Noise Level: **45.5** **CNEL**

Windows Closed
Interior Noise Level: **31.6** **CNEL**

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
51.1	56.6	59.1	63.1	63.1	57.1	: Exterior Wall Noise Exposure
10.7	10.7	10.7	10.8	10.8	10.8	: Transmission Loss
0.0	0.0	0.0	0.0	0.0	0.0	: Noise Reduction
21.9	21.9	21.9	21.9	22.9	22.9	: Absorption
29.2	34.7	37.2	41.2	40.2	34.2	: Noise Level
45.5	**CNEL**	WINDOWS OPEN				

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
51.1	56.6	59.1	63.1	63.1	57.1	: Exterior Wall Noise Exposure
27.2	30.2	29.8	39.2	43.7	44.5	: Transmission Loss
6.4	9.5	9.0	18.5	23.0	23.8	: Noise Reduction
21.9	21.9	21.9	21.9	22.9	22.9	: Absorption
22.8	25.2	28.2	22.7	17.3	10.5	: Noise Level
31.6	**CNEL**	WINDOWS CLOSED				

EXTERIOR TO INTERIOR NOISE REDUCTION ANALYSIS

Project Name: Allison Avenue TOD
Project # : UPF-01
Room Name: Unit A Bedroom

Wall 1 of 1

Room Type : **Soft**

	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Reverberation Time (sec) :	0.8	0.8	0.8	0.8	0.7	0.7	: Highly Absorptive Room
Room Absorption (Sabins) :	67	67	67	67	84	84	

		Noise Level		125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Source 1:	**Traffic**	**67.8**	**CNEL**	51.1	56.6	59.1	63.1	63.1	57.1	: Traffic Spectrum
Source 2:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 3:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 4:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Overall:		**67.8**	**CNEL**	51.1	56.6	59.1	63.1	63.1	57.1	: Effective Noise Spectrum

Assembly Type	Open	Width	Height	Qty	Total Area	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz
STC 46 Typical Exterior Wall	N	10.333	9	1	73.0	29	40	46	46	44	53
STC 28 1/2-inch Dual Insulating Window	Y	5	4	1	20.0	23	23	22	32	43	37
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0

Room Depth: **12** ft

Overall Area: **92.997** ft²
Volume: **1116** ft³

Number of Impacted Walls: **1**

Windows Open Interior Noise Level:	**49.1**	**CNEL**
Windows Closed Interior Noise Level:	**35.0**	**CNEL**

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
51.1	56.6	59.1	63.1	63.1	57.1	: Exterior Wall Noise Exposure
9.6	9.7	9.7	9.7	9.7	9.7	: Transmission Loss
0.0	0.0	0.0	0.0	0.0	0.0	: Noise Reduction
18.3	18.3	18.3	18.3	19.2	19.2	: Absorption
32.8	38.3	40.8	44.8	43.9	37.9	: Noise Level

49.1 **CNEL** WINDOWS OPEN

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
51.1	56.6	59.1	63.1	63.1	57.1	: Exterior Wall Noise Exposure
26.8	29.3	28.7	38.4	43.7	43.6	: Transmission Loss
7.1	9.6	9.0	18.7	24.0	23.9	: Noise Reduction
18.3	18.3	18.3	18.3	19.2	19.2	: Absorption
25.7	28.8	31.8	26.2	19.9	14.0	: Noise Level

35.0 **CNEL** WINDOWS CLOSED