ENVIRONMENTAL NOISE ASSESSMENT

MOORPARK SUPPORTIVE HOUSING
1710 Moorpark Avenue
San Jose, California

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Prepared for:

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INTRODUCTION

The proposed development involves the development of a Supportive Housing project on an approximately 1.1-acre site at 1710 Moorpark Avenue in San Jose, California which is bordered by Moorpark Avenue and Interstate 280 (I-280) beyond to the north, Leigh Avenue and San Jose City College beyond to the west, Richmond Avenue the east, and Immanuel Lutheran Church to the south. The project is a five-story building which includes four levels of residential and community uses over one level of lobby, utility, ecumenical, and parking uses. The site and its surroundings are shown in Figure 1.

Figure 1: Project Site and Surroundings

This report assesses the compatibility of the proposed project in relation to the noise environment at the site. The fundamentals of environmental noise are provided first to assist those unfamiliar with acoustical terminology and concepts. A discussion of policies and standards applicable to the project and the results of noise measurements made at the project site are then presented to establish the setting. Impacts resulting from the project are then assessed and mitigation measures are presented.

FUNDAMENTALS OF ENVIRONMENTAL NOISE

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is intensity of sound waves combined with the reception characteristics of the ear.

In addition to the concepts of pitch and loudness, there are several noise measurement scales, which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement, which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10-decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

TABLE 1: Definitions of Acoustical Terms Used in this Report

Term	Definitions
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which 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.

There are several methods of characterizing sound. The most common in California is the A-weighted sound level or dBA. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

TABLE 2: Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), Caltrans, November 2009.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The Community Noise Equivalent Level, CNEL, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The Day/Night Average Sound Level, L_{dn} or DNL, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA DNL. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA DNL with open windows and 65-70 dBA DNL if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA DNL. At a DNL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the DNL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a DNL of 60-70 dBA. Between a DNL of 70-80 dBA the percentage of the population highly annoyed noise increases by about 3 percent per each decibel increase. People appear to respond more adversely to aircraft noise. When the DNL is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

REGULATORY CRITERIA

The State of California, City of San José, and the U.S. Department of Housing and Urban Development (HUD) have established plans and policies designed to limit noise exposure at noise sensitive land uses. These plans and policies are contained in the following documents: (1) the California Building Code, (2) the City of San José Noise Element of the General Plan, (3) and the HUD Noise Compatibility Criteria.

2016 California Building Code, Title 24, Part 2. Section 1207.4 of the current (2016) California Building Code (CBC) states that interior noise levels attributable to exterior sources shall not exceed 45 dB(A) L_{dn}, DNL, or CNEL (consistent with the noise element of the local general plan) in any habitable room. Though this section does not explicitly apply this interior limit to multifamily residential buildings, in keeping with the requirements of prior editions of the CBC this limit is applied to any habitable room for new dwellings other than detached single-family dwellings.

City of San José General Plan. The Environmental Leadership Chapter in The Envision San José 2040 General Plan sets forth policies related to noise control in the City of San José. Policy EC-1.1, reported below, is applicable to assessment of the compatibility of the proposed project in relation to the noise environment at the site:

Policy EC-1.1:

> Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San José include:
>
> Interior Noise Levels
>
> The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.
>
> Exterior Noise Levels
>
> The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses (Table EC-1). For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

Table EC-1 on the San José 2040 General Plan establishes that residential uses are considered "normally acceptable" where exterior noise exposures are 60 dBA DNL or less. Where the exterior noise exposure is between 60 dBA and 75 dBA DNL residential uses are considered "conditionally acceptable" such that the "specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design." Residential uses are considered "unacceptable" in noise environments exceeding 75 dBA DNL because mitigation is usually not feasible to comply with noise element policies.

HUD Noise Compatibility Criteria. The U.S. Department of Housing and Urban Development (HUD) environmental noise regulations are set forth in 24CFR Part 51B (Code of Federal Regulations). The following exterior noise standards for new housing construction would be applicable to this project.

- 65 dBA DNL or less – acceptable.
- exceeding 65 dBA DNL but not exceeding 75 dBA DNL – normally unacceptable (appropriate sound attenuation measures must provide an additional 5 decibels of attenuation over that typically provided by standard construction in the 65 dBA Ldn to 70 dBA DNL zone; 10 decibels additional attenuation in the 70 dBA DNL to 75 dBA DNL zone)
- exceeding 75 dBA DNL – unacceptable

These noise standards also apply, "… at a location 2 meters from the building housing noise sensitive activities in the direction of the predominant noise source…" and "…at other locations where it is determined that quiet outdoor space is required in an area ancillary to the principal use on the site."

A goal of 45 dBA DNL is set forth for interior noise levels and attenuation requirements are geared toward achieving that goal. It is assumed that with standard construction any building will provide sufficient attenuation to achieve an interior level of 45 dBA DNL or less if the exterior level is 65 dBA DNL or less.

EXISTING NOISE ENVIRONMENT

A noise monitoring survey was conducted between 2:00 p.m. on Wednesday, September 11th and 8 a.m. on Tuesday September 17th 2019 to quantify the existing noise environment on the Project site. The monitoring survey included one long-term continuous noise measurement (LT-1), and one short-term 10-minute duration noise measurement (ST-1) as shown in Figure 2.

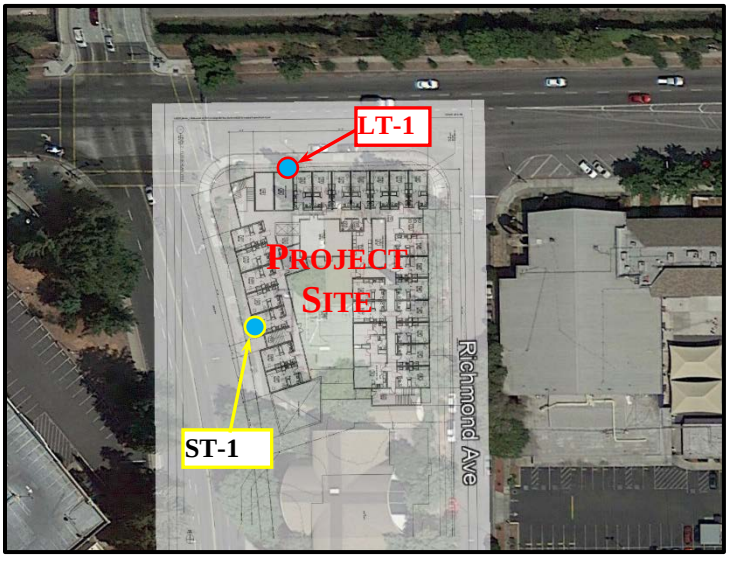


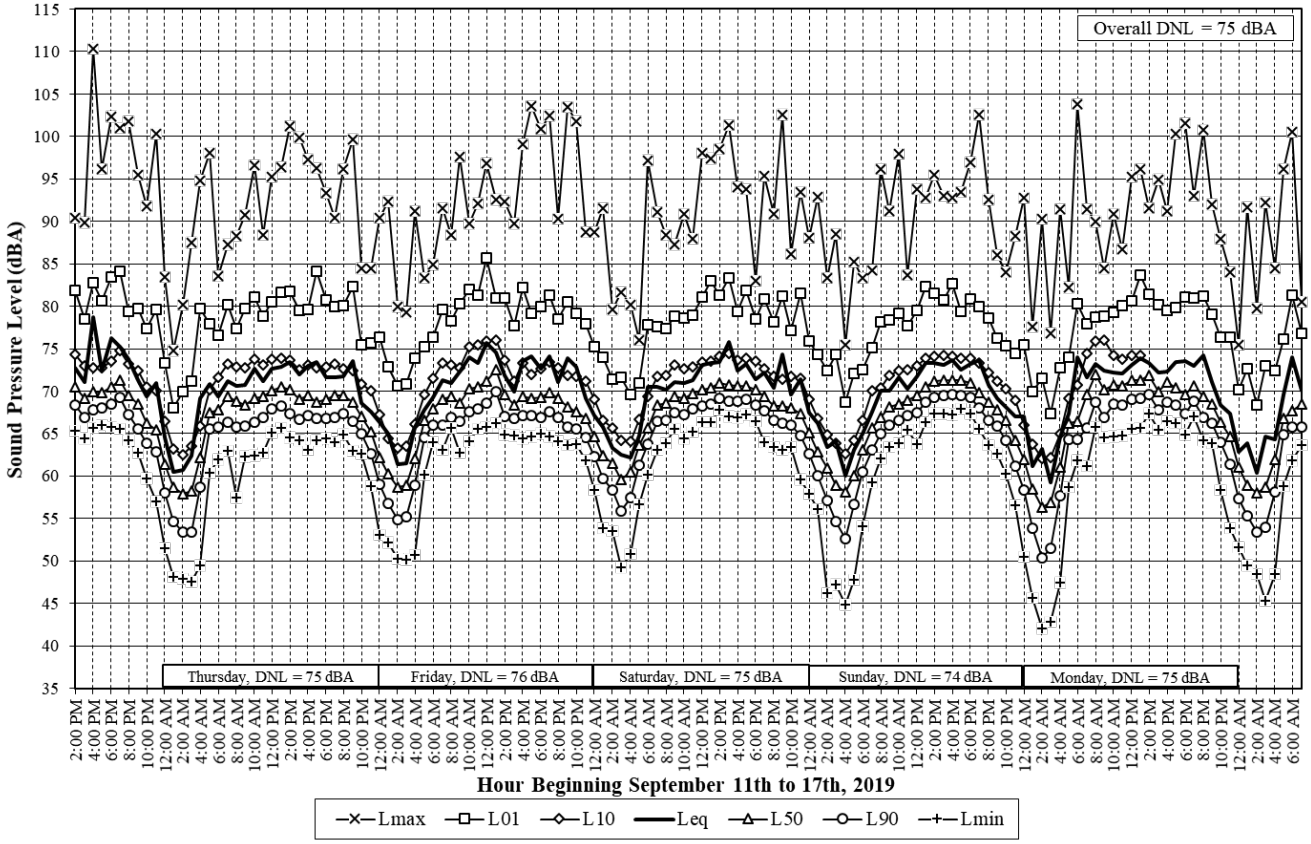
Figure 2: Project & Noise Measurement Locations

Traffic on Moorpark Avenue and I-280 was the predominant noise source affecting the site while traffic on Leigh Avenue and activities associated with San Jose City College also contributed to the measured environmental noise levels on the western side of the site.

Noise measurements where conducted with Larson Davis Laboratories (LDL) Type I Model 820 Sound Level Meter fitted with a ½-inch pre-polarized condenser microphone and windscreen. The meters were calibrated with a Larson Davis Model CA250 precision acoustic calibrator prior to and following the measurement survey.

The noise monitor at location LT-1 was positioned at a height of 12 feet above road grade on the trunk of a tree light along Moorpark Avenue at approximately 50 feet from the centerline of the roadway. The measured noise levels at this location, including the energy equivalent noise level (L_{eq}), maximum (L_{max}), minimum (L_{min}), and the noise levels exceeded 10, 50 and 90 percent of the time (indicated as L_{10}, L_{50} and L_{90}) are shown on Chart 1. The L_{eq} noise level is typically considered the average noise level, while the L_1 is considered the intrusive level, the L_{50} is considered the median noise level and the L_{90} is considered the background or ambient noise level.

Chart 1: Measured Noise Levels at LT-1



A review of Chart 1 indicates that the noise levels at site LT-1 followed a diurnal pattern characteristic of traffic noise, with the average daytime noise levels ranging from 68 to 79 dBA L_{eq} and the average nighttime noise levels ranging from 59 to 74 dBA L_{eq}. The Day/Night Average Noise Level (DNL) over the 138-hour measurement period was calculated to be 75 dBA, with daily DNL levels ranging from 74 to 76 dBA.

An attended short-term noise measurement was made at approximately 170 feet from the centerline of Moorpark Avenue and 50 feet from the centerline of Leigh Avenue between 2:10 and 2:20 pm on September 11th to document the sound levels at the proposed building facades along Leigh Avenue and the reduction in sound levels further removed from Moorpark Avenue. Table 3 summarizes the results of these measurements.

Table 3: Summary of Short-term and Simultaneous Long-term Noise Measurement Data

Noise Measurement Location	**L_{max}**	**$L_{(1)}$**	**$L_{(10)}$**	**$L_{(50)}$**	**$L_{(90)}$**	**L_{eq}**	**DNL**
ST-1: ~170 feet from the centerline of Moorpark Avenue. (9/11/19, 2:10 p.m.-2:20 p.m.)	78	74	68	64	62	66	**68**
LT-1: ~50 feet from the centerline of Moorpark Avenue. (9/11/19, 2:10 p.m.-2:20 p.m.)	86	82	75	71	69	73	**75**
Difference:	*-8*	*-8*	*-7*	*-7*	*-7*	*-7*	*-7*

Note: The DNL at the short-term site is approximated by correlating data to that at the long-term site.

Based on the results of the short and long term measurements and the measured reduction in environmental noise levels with distance from Moorpark Avenue and I-280, we have calculated the existing 70 dBA and 65 dBA DNL noise contours in areas with a clear line of sight to traffic on Moorpark Avenue to, respectively, be 120 feet and 285 feet from the roadway centerline.

FUTURE NOISE ENVIRONMENT

The predominant noise source affecting the project site is and is expected to continue to be, traffic on Moorpark Avenue and I-280. An increase in traffic volumes on these roadways would correlate to an increase in noise levels at the project site. Assuming an annual growth rate of between 1% and 2% per year, traffic noise levels in the area would be expected to increase by about 1 dBA over the next 20 years. Thus, the future noise exposure at the project's northern facades are calculated to reach a DNL of 76 dBA of 50 feet from the centerline of Moorpark Avenue. Considering this the future 70 dBA and 65 dBA DNL noise contours in areas with a clear line of sight to traffic on Moorpark Avenue will, respectively, be 145 feet and 345 feet from the roadway centerline.

A review of the project site plan indicates that the project's outdoor common use area will be on a podium (2^{nd}) level terrace, which will be shielded from environmental noise by the project's 4-story structures to the north, east and west. Based on the barrier effect of the project structures, exterior noise levels in the common use terrace area are expected to less than 60 dBA DNL.
Figure 3, following, shows the relative noise exposures at the exterior facades of the proposed residential units at the project.

NOISE AND LAND USE COMPATIBILITY ASSESSMENT

Based on the results of the noise measurement survey and analysis discussed above, residential units on the project's northern façade immediately adjacent to Moorpark Avenue would be exposed to future exterior noise levels of 76 dBA DNL, while units further south along the western Leigh Avenue and eastern Richmond Avenue project frontages would be exposed to future exterior noise levels of 74 dBA to 67 dBA DNL. The DNL levels at residential facades with views of roadway traffic are shown in Figure 3 These predicted exterior noise level at the northern project facades would be considered "Unacceptable" for residential use, and the exterior noise levels at the western and eastern project facades would be considered "Conditionally Acceptable" for residential use by the City of San Jose Noise and Land Use compatibility standards. The DNL at all residences which do not have any windows with roadway view s and face the interior common use terrace will be exposed to a future DNL of 60 dBA or less.

Additionally, exterior noise levels at the proposed common outdoor use area of the project, which will be exposed to environmental noise levels of less than 60 dBA DNL will meet both the City of San Jose General Plan and State exterior noise level objective of 60 dBA DNL and the HUD noise compatibility criteria of 65 dBA DNL or less.

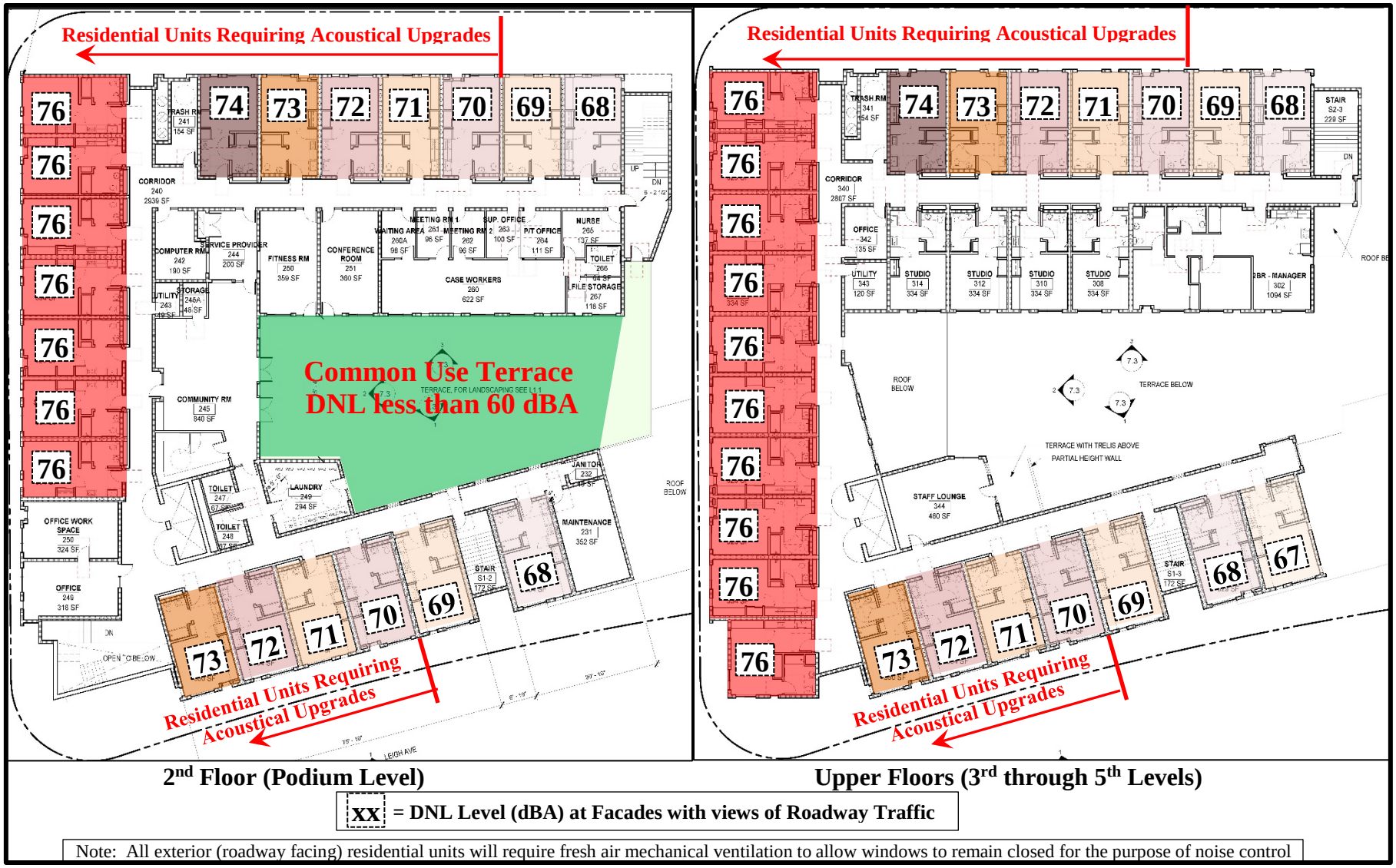


Figure 3: DNL Noise Exposures of Residential Units and Outdoor Use Area

RESIDENTIAL NOISE MITIGATION

Exterior Noise Mitigation

None Needed

Interior Noise Mitigation

Based on the results of the noise measurement survey and the analysis discussed above, the northern residential facades fronting Moorpark Avenue would be considered "Unacceptable" for residential use, and the exterior noise levels at the western and eastern project facades would be considered "Conditionally Acceptable" for residential use by the City of San Jose Noise and Land Use compatibility standards. Though City and HUD noise standards seek to disallow residential use within areas exposed to environmental noise level of 75 dBA DNL or greater a detailed analysis of the noise-reduction requirements at these facades and the other project facades was conducted to determine whether feasible noise mitigation can be developed to meet the City, State, and HUD interior noise level standard of 45 dBA DNL within project residences.

A review of the building elevations indicates that the exterior roadway facing walls of residences on the project site will be mostly finished with cement plaster with only the corner of the building at the Moorpark/ Leigh Avenue intersection finished with fiber cement siding. Though not shown in the current drawings, based on typical California construction, we expect the exterior wall to be an internally insulated single wood stud assembly with one layer of gypsum board at the interior face. Based on this and that the cement plaster finishes would be full three-coat (7/8" thick) stucco and that the fiber cement siding would be similar to Hardie-board siding or equal, the sound isolation rating of these exterior wall assemblies would be STC 46 for walls with cement plaster (stucco)[1] finishes and STC 40 for walls with fiber cement siding[2]

Based on a review of the residential unit plans and considering the proposed exterior wall siding materials along with the window areas as a percentage of the total exterior wall area of residences, we have determined that with typical internally insulated single stud exterior walls, and closed standard thermal insulating windows, the exterior noise levels will be reduced within the residential interiors by 25 dBA with fiber-cement siding and by 25 to 26 dBA with stucco finished exterior walls. This level of noise reduction is sufficient to meet the City, State and HUD interior noise standards in interior (terrace) facing residential units and exterior (roadway) facing residential units exposed to DNL levels of 69 dBA or less.

However, to allow for residents of all units which will be exposed to a DNL of more than 60 dBA to close their windows for the purpose of noise control, all roadway facing residences will require mechanical ventilation to allow the windows to remain closed at the residents' option as the interior noise standards would not be met with open windows. In our experience a standard central air conditioning system or a central heating system equipped with a 'summer switch' which allows the fan to circulate air without furnace operation in each residence requiring mechanical ventilation will provide a habitable interior environment

Exterior (roadway) facing residences exposed to future DNL levels in excess of 69 dBA, as shown in Figure 3, will also require exterior wall and/or window acoustical improvements to meet the City, State and HUD required DNL of 45 dBA within interior living spaces. The sound isolation improvements needed to meet the interior noise standard within these residences are discussed below by the relative noise exposure of the units:

[1] Based on laboratory test number W-50-71 published by the U.S. National Bureau of Standards.

[2] Based on laboratory test TL365A; James Hardie Building Products Sound Isolation Technical Bulletin 07272007

76 dBA DNL (Northernmost residences adjacent to Moorpark Avenue)

Based on a review of project drawings the residences facing Moorpark Avenue and exposed to a DNL level of 76 dBA will have either plaster cement (stucco) or fiber cement exterior finishes. To meet the City, State, and HUD required DNL of 45 dBA within the interiors of these residences some combination of acoustically upgraded exterior walls and/or windows will need to be incorporated in their design. The use of one of the following combinations of stucco or fiber cement finished exterior wall assemblies and closed windows with the listed STC ratings will reduce exterior noise levels within the interior noise levels due to exterior sources to meet the 45 dBA DNL interior standard:

Stucco Exterior Walls

Standard (non-upgraded) exterior wall;

As discussed above the standard three-coat (7/8" thick) stucco finished exterior wall is assumed to be an internally insulated single wood stud assembly with one layer of rigidly mounted gypsum board at the interior face which achieves a laboratory STC rating of 46. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-36 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 76 dBA DNL.

Exterior wall upgrade 1; (sheathing under stucco and 2 layers of gypsum board at interior):

The first Stucco exterior wall upgrade analyzed is described as follows:

EXTERIOR: Three-coat (7/8" thick) stucco over one layer of wood or gypsum sheathing.
CAVITY: 2x4 wood studs with 3 ½" thick sound attenuation blankets in the cavity.
INTERIOR: 2 layers of 5/8" gypsum board.

This upgraded exterior wall has an estimated laboratory STC rating of 51. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-34 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 76 dBA DNL.

Exterior wall upgrade 2; (sheathing under stucco & 2 layers of gyp. bd. on resilient channels):

The second Stucco exterior wall upgrade analyzed is described as follows:

EXTERIOR: Three-coat (7/8" thick) stucco over one layer of wood or gypsum sheathing.
CAVITY: 2x4 wood studs with 3 ½" thick sound attenuation blankets in the cavity.
INTERIOR: 2 layers of 5/8" gypsum board on ½" resilient channels spaced at 24" o. c.

This upgraded exterior wall has an estimated laboratory STC rating of 61. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-33 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 76 dBA DNL.

Fiber Cement Sided Exterior Walls

Standard (non-upgraded) exterior wall;

As discussed above the standard fiber cement sided exterior wall is assumed to be an internally insulated single wood stud assembly with one layer of rigidly mounted gypsum board at the interior face which achieves a laboratory STC rating of 40. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-45 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 76 dBA DNL. STC-45 rated windows are typically double window assemblies, the width of which require a minimum 2x6 stud wall assembly accommodate the increased width of the window.

Exterior wall upgrade 1; (sheathing under fiber cement & 2 layers of gyp. board at interior):

The first fiber cement exterior wall upgrade analyzed is described as follows:

EXTERIOR: Fiber cement siding over one layer of wood or gypsum sheathing.
CAVITY: 2x4 wood studs with 3 ½" thick sound attenuation blankets in the cavity.
INTERIOR: 2 layers of 5/8" gypsum board.

This upgraded exterior wall has an estimated laboratory STC rating of 45. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-36 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 76 dBA DNL.

Exterior wall upgrade 2; (sheathing under fiber cement and 2 layers of gyp. bd. on resilient channels):

The second Stucco exterior wall upgrade analyzed is described as follows:

EXTERIOR: fiber cement siding over one layer of wood or gypsum sheathing.
CAVITY: 2x4 wood studs with 3 ½" thick sound attenuation blankets in the cavity.
INTERIOR: 2 layers of 5/8" gypsum board on ½" resilient channels spaced at 24" o. c.

This upgraded exterior wall has an estimated laboratory STC rating of 49. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-35 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 76 dBA DNL

73 to 74 dBA DNL (Residences facing Leigh and Richmond Avenue)

Based on a review of project drawings the residences facing Leigh and Richmond Avenues and exposed to DNL levels of between 73 and 74 will have plaster cement (stucco) exterior finishes. To meet the City, State, and HUD required DNL of 45 dBA within residential interiors of units exposed to an exterior DNL of 73 to 74 dBA some combination of acoustically upgraded exterior walls and/or windows will need to be incorporated in the project design. A combination of the following Stucco finished exterior wall assemblies and closed windows with the listed STC ratings will reduce exterior noise levels within the interior noise levels due to exterior sources to meet the DNL of 45 dBA interior standard:

Standard (non-upgraded) exterior stucco wall;

As discussed above the standard three-coat (7/8" thick) stucco finished exterior wall is expected to achieve a laboratory STC rating of 46. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-34 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 73 to 74 dBA DNL.

Exterior wall upgrade 1; (sheathing under stucco and 2 layers of gypsum board at interior):

With the use of exterior wall upgrade 1, which has an estimated laboratory STC rating of 51 as previously discussed (see page 11), closed windows with a minimum sound isolation rating of STC-32 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 73 to 74 dBA DNL.

Exterior wall upgrade 2; (sheathing under stucco & 2 layers of gyp. bd. on resilient channels):

With the use of exterior wall upgrade 2, which has an estimated laboratory STC rating of 61 as previously discussed (see page 11), closed windows with a minimum sound isolation rating of STC-31 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 73 to 74 dBA DNL.

70 to 72 dBA DNL (Residences facing Leigh and Richmond Avenue)

Based on a review of project drawings the residences facing Leigh and Richmond Avenues and exposed to DNL levels of between 70 and 72 will have plaster cement (stucco) exterior finishes. To meet the City, State, and HUD required DNL of 45 dBA within residential interiors of units exposed to an exterior DNL of 70 to 72 dBA some combination of acoustically upgraded exterior walls and/or windows will be needed to be incorporated in the project design. A combination of the following Stucco finished exterior wall assemblies and closed windows with the listed STC ratings will reduce exterior noise levels within the interior noise levels due to exterior sources to meet the DNL of 45 dBA interior standard:

Standard (non-upgraded) exterior stucco wall;

As discussed above the standard three-coat (7/8" thick) stucco finished exterior wall is expected to achieve a laboratory STC rating of 46. With the use of this exterior wall, closed windows with a minimum sound isolation rating of STC-32 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 70 to 72 dBA DNL.

Exterior wall upgrade 1; (sheathing under stucco and 2 layers of gypsum board at interior):

With the use of exterior wall upgrade 1, which has an estimated laboratory STC rating of 51 as previously discussed (see page 11), closed windows with a minimum sound isolation rating of STC-30 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 70 to 72 dBA DNL.

Exterior wall upgrade 2; (sheathing under stucco & 2 layers of gyp. bd. on resilient channels):

With the use of exterior wall upgrade 2, which has an estimated laboratory STC rating of 61 as previously discussed (see page 11), closed windows with a minimum sound isolation rating of STC-29 will allow the 45 dBA DNL interior standard to be met within residential units exposed to an exterior noise level of 70 to 72 dBA DNL.