APPENDIX D

NOISE AND VIBRATION ASSESSMENT AND PEER REVIEW

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24 March 2014

Elaine Breeze
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Subject: **Carolan/Rollins Site**
Environmental Noise Study
CSA Project: 13-0340

Dear Elaine:

As requested, we have conducted an environmental noise study for the project. The project consists of a 268-unit low-rise apartment building and 22 townhomes. The purpose of the study is to determine the noise environment at the site, compare the measured data with applicable standards, and propose mitigation measures as necessary. This report summarizes the results of our study.

PROJECT CRITERIA

The project site is subject to noise criteria from the California Building Code and also the City of Burlingame General Plan. The specific criteria for each of these are discussed below.

State Noise Standards

The 2013 California Building Code (CBC) does not currently include an exterior noise intrusion criterion. However, the CBC has historically required that indoor noise level in residential units of new multi-family dwellings not exceed DNL[1] 45 dB where the exterior noise level is greater than DNL 60 dB. This criterion is our recommended goal.

City Noise Guidelines

The interior noise standard from the Noise Element of the Burlingame General Plan (dated 15 September 1975) is consistent with the historical State requirement for multi-family housing (see Page N-28).

The Noise Element also includes a recommended goal for outdoor noise levels. The City considers outdoor noise levels in residential locations to be acceptable if they are no greater than DNL 60 dB (see Table 4-2). The Noise Element has no other land-use compatibility descriptors (e.g., "conditionally acceptable"). Most other city noise elements also include "conditionally acceptable" and "unacceptable"

[1] Day-Night Average Sound Level (DNL) – A descriptor established by the U.S. Environmental Protection Agency to represent a 24-hour average noise level with a 10 dB penalty applied to noise occurring during the nighttime hours (10 pm to 7 am) to account for the increased sensitivity of people during sleeping hours.

descriptors. The City's goal for outdoor noise levels will apply at the project's pool and courtyards. Typically, standards for outdoor noise levels do not apply to small private decks, front entry patios, or balconies.

NOISE ENVIRONMENT

The project site is in Burlingame, between Rollins Road and Carolan Avenue, east of Toyon Drive. There is an existing multi-family residential development to the west of the site and a combination of single and multi-family homes to the east of the site. US-101 is immediately north of Rollins Road, approximately 120 feet to the north of the site. The Caltrain tracks are approximately 145 feet to the south of the site. The major noise sources at the site are traffic on US-101, local street traffic, and rail activity.

To quantify the existing noise environment, we conducted three long-term noise measurements at the project site between 25 and 28 June 2013. Figure 1 shows the measurement locations and the measured noise levels. The noise monitors were attached to utility poles at a height of 12 feet above grade.

Based on the above data, we calculated the expected DNL at the various facades and elevations. We did not receive projected future traffic volumes for the roadways, so we have added 1 dB to the expected DNL to account for future traffic increases[2].

We understand that the project is proposing an extension of the existing 16-foot high Caltrans wall for the length of the site. This would provide shielding at the townhomes and the first two levels of the apartments. We have conducted two sets of analyses – one with the site in its current condition and a second that includes the proposed sound wall extension.

RECOMMENDATIONS – WITHOUT EXTENDED CALTRANS SOUND WALL

Outdoor Noise

We calculated noise levels of DNL 59 dB to 78 dB across the site. The pool area, eastern courtyard, central courtyard, and western courtyard will be subject to the City's land-use compatibility guidelines. At the pool area, eastern courtyard, and western courtyard, noise levels will be less than DNL 60 dB.

At the central courtyard, the noise levels will be approximately DNL 63 dB without mitigation. A six-foot fence would be needed along the northern edge of the central courtyard to reduce the noise levels to DNL 60 dB.

The fence must be continuous from grade to top, have no cracks or gaps, and have a minimum surface density of three pounds per square foot (e.g., one-inch thick marine-grade plywood, 1/2-inch laminated glass, CMU).

[2] Caltrans assumes a traffic volume increase of three-percent per year, which corresponds to a 1 dB increase over ten years. In the absence of City data, we have used this same formula for the local roads.

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Indoor Noise

To meet the indoor criterion of DNL 45 dB, it will be necessary for all of the facades to be sound-rated. We used the floor plans and elevations dated 7 March 2014 for our calculations. We have assumed that all bedrooms are carpeted and that all other rooms will have hard-surfaced flooring. In the units facing US-101 (e.g., Units x01 to x07), we understand that the living rooms will be carpeted.

We calculated the window and exterior door STC[3] ratings needed to meet the project criteria. These are shown on Figure 2. Where the figures denote upgraded exterior walls, the exterior wall will need to be at minimum an insulated staggered-stud assembly.

Typical construction-grade dual-pane thermal windows achieve an STC rating of 28. One-inch assemblies (two 1/4-inch thick panes with a 1/2-inch airspace) typically achieve an STC rating of 32. Where STC ratings above 33 are required, one pane will need to be laminated. STC ratings up to about 42 can be achieved with dual-pane systems (perhaps with wider airspaces and enhanced lamination layers). Above STC 42 might require a "jockey-sash" system, where there is an additional inboard glazing component.

It is important to note that the STC ratings recommended are for full window assemblies (glass and frame) rather than just the glass itself. Tested sound-rated assemblies should be used.

Where windows need to be closed to achieve an indoor DNL of 45 dB, an alternative method of supplying fresh air (e.g., mechanical ventilation) should be considered. This applies to all of the residences at the project site. This issue should be discussed with the project mechanical engineer.

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[3] Sound Transmission Class (STC) – A single-figure rating standardized by ASTM and used to rate the sound insulation properties of building partitions. The STC rating is derived from laboratory measurements of a particular building element and as such is representative of the maximum sound insulation. Increasing STC ratings correspond to improved noise isolation.

RECOMMENDATIONS – WITH EXTENDED CALTRANS SOUND WALL

Outdoor Noise

If the Caltrans sound wall is extended, noise levels at the pool area, eastern courtyard, western courtyard, and central courtyard will be the same or lower than the sound levels without the sound wall extension. No changes in mitigation measures are recommended.

Indoor Noise

To meet the indoor criterion of DNL 45 dB with the extended sound wall, it will still be necessary for all of the facades to be sound-rated. We have used the previously stated assumptions for our calculations. The necessary window and exterior door STC ratings are shown on Figures 3 and 4. As before, where the figures denote upgraded exterior walls, the exterior wall will need to be at minimum an insulated staggered-stud assembly.

* * *

This concludes our environmental noise study for the Carolan/Rollins Site in Burlingame. Should you have any questions, please give us a call.

Sincerely,

CHARLES M. SALTER ASSOCIATES, INC.

Valerie Smith
Senior Consultant

Eric Broadhurst, PE
Senior Vice President

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CAROLAN/ROLLINS SITE – BURLINGAME, CA
NOISE MEASUREMENT LOCATIONS AND MEASURED DNL

FIGURE 1

CSA # 13–0340

VS/ELB 03.14.14

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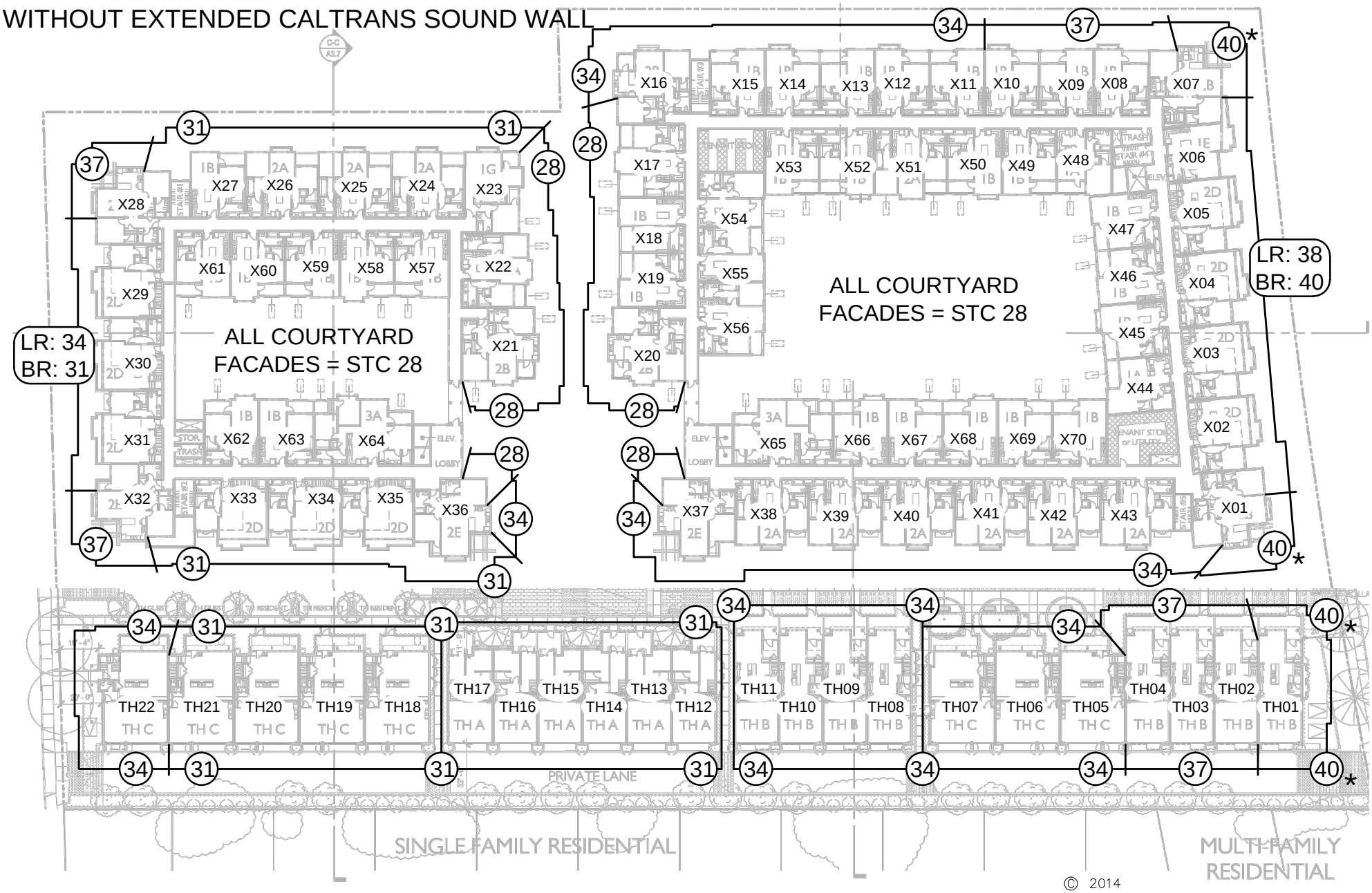
WITHOUT EXTENDED CALTRANS SOUND WALL



* WITH UPGRADED EXTERIOR WALL

CAROLAN/ROLLINS SITE – BURLINGAME, CA
MINIMUM RECOMMENDED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS (ALL FLOORS)

FIGURE 2

CSA # 13–0340

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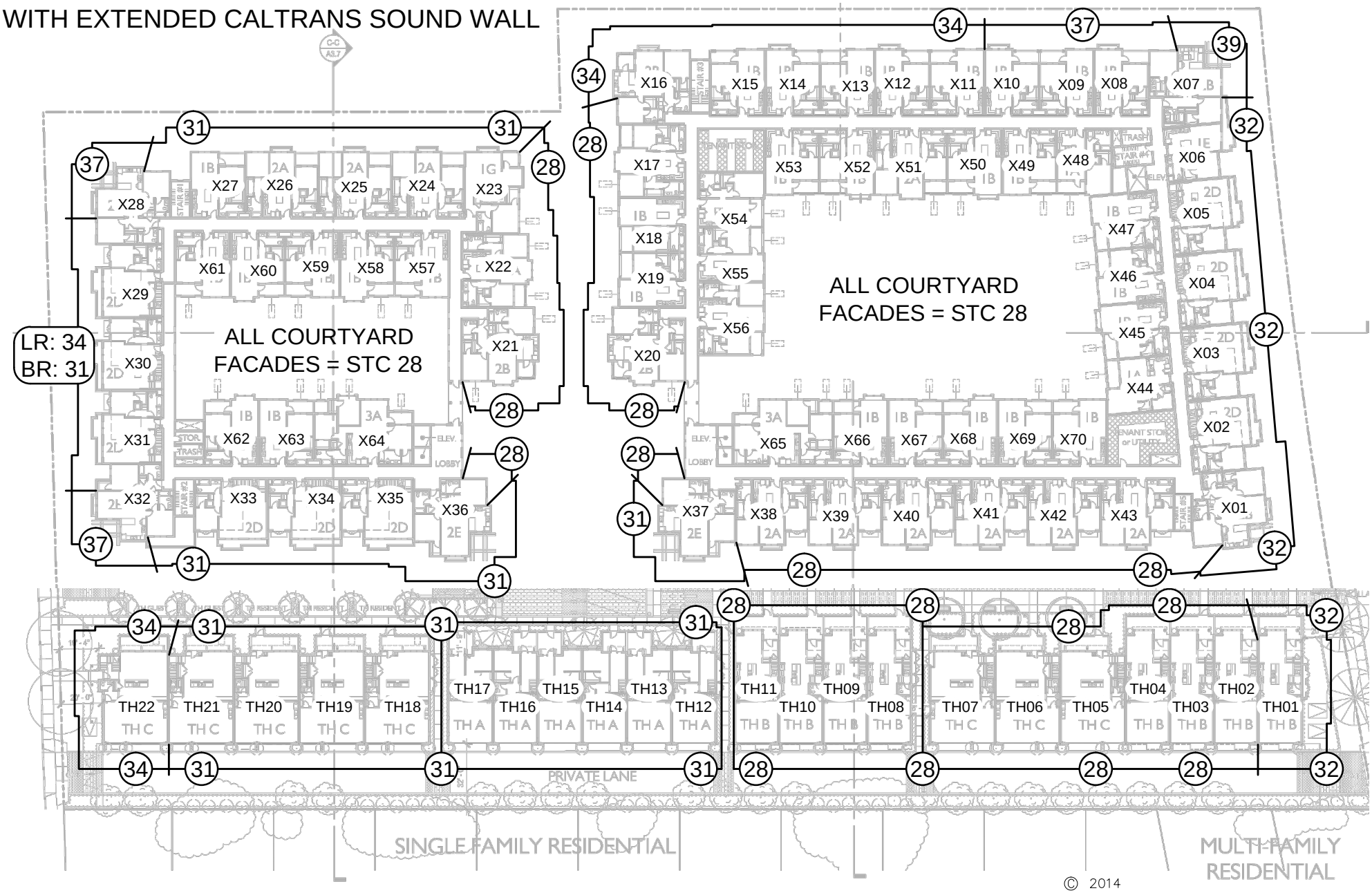
WITH EXTENDED CALTRANS SOUND WALL



*WITH UPGRADED EXTERIOR WALL

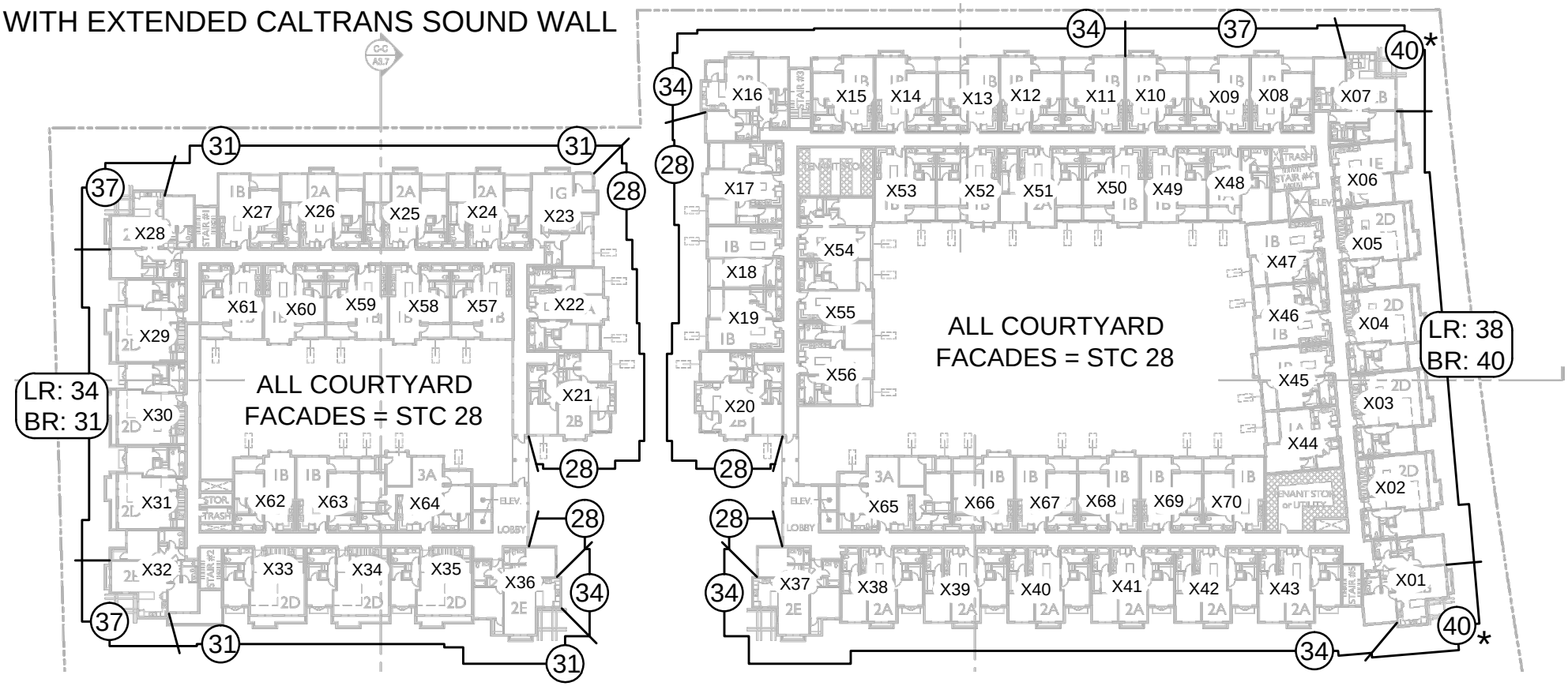
CAROLAN/ROLLINS SITE – BURLINGAME, CA
MINIMUM RECOMMENDED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS (FLOORS 1 & 2)

FIGURE 3

CSA # 13-0340

VCS/ELB 03.24.14

WITH EXTENDED CALTRANS SOUND WALL



*WITH UPGRADED EXTERIOR WALL

CAROLAN/ROLLINS SITE – BURLINGAME, CA
MINIMUM RECOMMENDED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS (FLOORS 3 TO 5)

FIGURE 4

CSA # 13–0340

VCS/ELB 03.24.14

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PEER REVIEW

Prepared By: Illingworth & Rodkin

CAROLAN/ROLLINS RESIDENTIAL PROJECT ENVIRONMENTAL NOISE ASSESSMENT BURLINGAME, CALIFORNIA

September 18, 2014

♦ ♦ ♦

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INTRODUCTION

The Carolan/Rollins Residential project proposes the construction of 22 two-story townhome condominiums in four buildings and 268 apartments in two five-story buildings on a 5.4-acre site located between Carolan Avenue and Rollins Road in Burlingame, California. The site currently consists of an automotive repair shop, automotive rental shop, and automotive sales dealerships located along Carolan Avenue and an automotive sales dealership located along Rollins Road. To the east, opposite Rollins Road and U.S. Highway 101, undeveloped land, a hotel, and outdoor sports facilities currently exist. Single- and multi-family residences are located to the south. Adjacent to the project site to the north is the Northpark Apartment complex. Opposite Carolan Avenue to the west of the project site and running parallel to the roadway are Caltrain railroad tracks. Opposite the tracks is California Drive, which is currently adjacent to retail property and a daycare.

This report evaluates the project's potential to result in significant impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed by *Charles M. Salter Associates, Inc.* and *Illingworth & Rodkin, Inc.* to document existing noise conditions; and 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

SETTING

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. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

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.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (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.

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 p.m. - 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. - 7:00 a.m.) noise levels. The *Day/Night Average Sound Level* (L_{dn}) 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.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can

give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
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 micro Pascals.
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 p.m. and 7:00 a.m.
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 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
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.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

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 (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reactions of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The State of California and the City of Burlingame 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 CEQA Guidelines, Appendix G, (2) the City of Burlingame General Plan, and (3) the City of Burlingame Municipal Code. Regulations, plans, and policies presented within these documents form the basis of the significance criteria used to assess project impacts.

State CEQA Guidelines. The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels; or

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels?

Of these guidelines, items (a), (b), (c), (d) and (e) are applicable to the proposed project. Guideline (f) is not applicable because the project is not located in the vicinity of a private airstrip.

Noise Element of the City of Burlingame General Plan. The Noise Element of the General Plan sets forth noise and land use compatibility standards to guide development, and noise goals and policies to protect citizens from the harmful and annoying effects of excessive noise. Suggested outdoor noise levels suitable for single- and multi-family residential land uses would range up to 60 dBA CNEL, according to the General Plan. The suggested maximum outdoor noise levels for various land uses were provided in Table 4-2 of the General Plan and are shown in Table 4 in this report. The General Plan also establishes the indoor noise level planning criterion to be 45 dBA CNEL.

The City of Burlingame General Plan establishes recommended noise emission standards for construction equipment operating within the City in Table 4-6 of the General Plan. This table is summarized in Table 5. The General Plan also states that no construction noise shall be emitted passed the property line so as to create a noise level increase of more than 5 dBA L_{max} above ambient L_{max} noise levels.

TABLE 4 Maximum Outdoor Noise Levels (dBA)

Land Use Categories	CNEL
Public, Quasi-Public and Residential: Schools, hospitals, libraries, auditoriums, intensively-used parks and playgrounds, public buildings, single-family home, multiple family apartments and condominiums, mobile home parks	60
Passively-Used Open Space: Wilderness-type parks, nature or contemplation areas of public parks	45
Commercial: Shopping centers, self-generative business, commercial districts, offices, banks, clinics, hotels and motels	65
Industrial: Non-manufacturing industry, transportation, communications, utilities, manufacturing	75

Source: City of Burlingame General Plan: Noise Element, City of Burlingame, September 1975.

TABLE 5 Maximum Allowable Noise Levels from Construction Equipment

Equipment	Peak Noise Level in dBA at 50 feet
Earthmoving:	
Front loader	75
Backhoes	75
Dozers	75
Tractors	75
Scrapers	80
Graders	75
Trucks	75
Paver	80
Materials Handling:	
Concrete mixer	75
Concrete pump	75
Crane	75
Derrick	75
Stationary:	
Pumps	75
Generators	75
Compressors	75
Impact:	
Pile drivers	95
Jackhammers	75
Rock drills	80
Pneumatic tools	80
Other:	
Saws	75
Vibrator	75

Source: City of Burlingame General Plan: Noise Element, City of Burlingame, September 1975.

City of Burlingame Municipal Code. The Building Construction Section of the Municipal Code establishes daily hours for construction in the City of Burlingame. Chapter 18.07.110 states that no person shall erect, demolish, alter, or repair any building or structure other than between the hours of 7:00 a.m. and 7:00 p.m. on weekdays, 9:00 a.m. and 6:00 p.m. on Saturdays, and 10:00 a.m. and 6:00 p.m. on Sundays and holidays, except under circumstances of urgent necessity in the interest of public health and safety. An exception must be approved in writing by the building official and shall be granted for a period of no more than three days for projects including structures with a gross floor area of less than 40,000 ft^2; when reasonable to accomplish the erection, demolition, alteration, or repair, the exception shall not exceed 20 days for projects including structures with a gross floor area of 40,000 ft^2 or greater.

Existing Noise Environment

The project site is located east of Carolan Avenue and west of Rollins Road, near the Toyon Drive cross street. The surrounding land uses include single- and multi-family residential developments to the north and to the south. A hotel, outdoor sports facilities, and undeveloped land are located to the east, opposite Rollins Road and U.S. Highway 101, and to the west, opposite Carolan Avenue, Caltrain railroad tracks, and California Drive is a daycare and commercial retail. The single- and multi-family residences to the south of the project site are shielded from traffic noise generated along U.S. Highway 101 by a sound wall, located between Rollins Road and the highway. This wall currently stops near the southern boundary of the project site. A noise monitoring survey was performed at the site by *Charles M. Salter Associates, Inc.* starting on June 25, 2013 and concluding on June 28, 2013.[1] The monitoring survey included three long-term noise measurements, which are shown in Figure 1. Additionally, *Illingworth & Rodkin, Inc.* conducted a noise survey, during which five short-term noise measurements were taken at the site. The short-term measurements were made on Tuesday, June 17, 2014 and are also shown in Figure 1. The noise environment at the site and in the surrounding areas results primarily from vehicular traffic along U.S. Highway 101 and the surrounding local roadways, as well as occasional train traffic along the Caltrain tracks located to the west of the project site and airplane flyovers from San Francisco International Airport (SFO), which is approximately 1.5 miles to the north of the project site.

From the noise study conducted in June 2013 by *Charles M. Salter Associates, Inc.*[1], measured levels ranged from 63 to 78 dBA L_{dn} across the site. Long-term noise measurement, M1, was made along the eastern boundary of the project site to document the noise levels resulting from traffic along Rollins Road, as well as U.S. Highway 101. M1 was positioned at the property line, approximately 23 feet from the centerline of Rollins Road. The day-night average noise level from Tuesday June 25, 2013 through Friday June 28, 2013 was 78 dBA L_{dn}. M2 was a long-term measurement taken in the northwest corner of the project site to document the traffic noise along Carolan Avenue and along the Caltrain railroad tracks. M2 was approximately 47 feet from the centerline of Carolan Avenue and approximately 132 feet from the near edge of the railroad tracks. No specific short-term measurements were made during a train pass-by, but at least three trains were expected to have been monitored in a 24-hour period during the June 2013 measurements. The day-night average noise level measured at M2 was 73 dBA L_{dn}. The final long-term measurement, M3, was taken in the front yard of a residence along Toyon Drive and was positioned approximately 25 feet from the centerline of the roadway. While a backyard measurement would have more accurately represented the southern boundary of the project site, M3 did characterize the traffic noise along Toyon Drive. The measured day-night average noise level at M3 was 63 dBA L_{dn}.

Short-term noise measurements, ST-1, ST-2, ST-3, ST-4, and ST-5, were made in ten-minute intervals starting at 1:30 p.m. The ST-1 measurement was made in the parking lot of the Hyundai dealership, located in the northeast corner of the project site approximately 57 feet west of the

[1] Charles M. Salter Associates, Inc., "Carolan/Rollins Site Environmental Noise Study (CSA Project: 13-0340)," March 2014.

centerline of Rollins Road. The average noise level measured at ST-1 was 65 dBA $L_{eq(10)}$. ST-2 was made in the southwest corner of the project site, approximately 69 feet east of the centerline of Carolan Avenue. The average noise level measured at ST-2 was 61 dBA $L_{eq(10)}$. ST-3 was located along the northern boundary of the project site, approximately 234 feet east of the centerline of Carolan Avenue. The average noise level measured at ST-3 was also 61 dBA $L_{eq(10)}$. The short-term measurement identified in Figure 1 as ST-4 was located in the northwest corner of the project site, approximately 75 feet east of the centerline of Carolan Avenue. The average noise level measured at ST-4 was 56 dBA $L_{eq(10)}$. The final measurement, ST-5, was taken along the southern boundary of the project site, halfway between Rollins Road and Carolan Avenue. The average noise level measured at ST-5 was 57 dBA L_{dn}. Table 6 summarizes the results for all of the short-term measurements.

FIGURE 1 Noise Measurement Locations

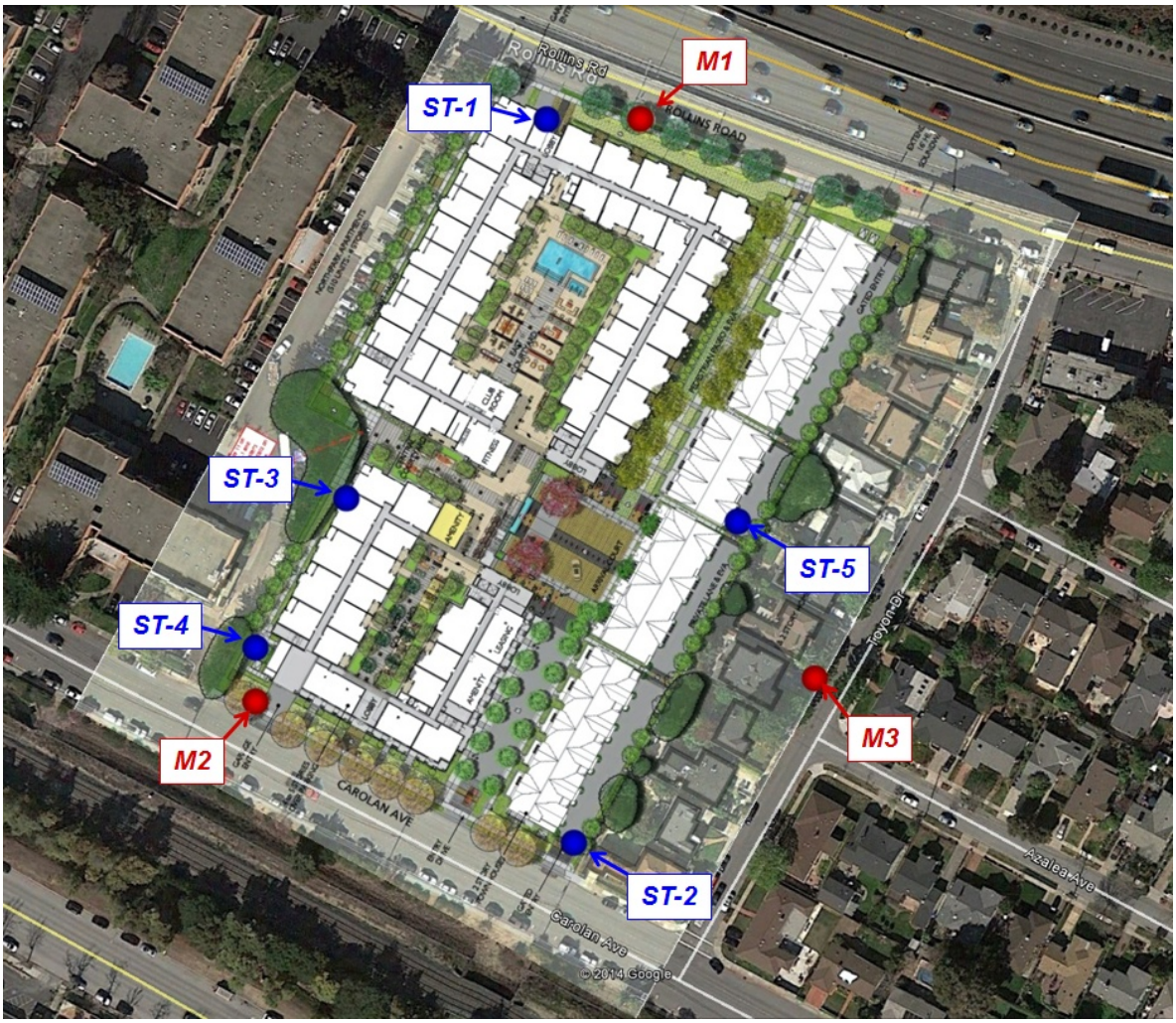


TABLE 6 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{min}	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$
ST-1: Northeast corner of site in Hyundai lot, ~57 feet west of centerline of Rollins Rd. (6/17/2014, 13:30-13:40)	61	70	69	67	65	62	65
ST-2: Southwest corner of site, ~69 feet east of centerline of Carolan Ave. (6/17/2014, 13:50-14:00)	51	79	70	62	56	53	61
ST-3: Along the northern boundary of the site, centrally-located, ~234 feet east of centerline of Carolan Ave. (6/17/2014, 14:10-14:20)	58	72	66	62	61	60	61
ST-4: Northwest corner of site, ~75 feet east of centerline of Carolan Ave. (6/17/2014, 14:20-14:30)	51	62	62	59	56	52	56
ST-5: Along the southern boundary of the site, centrally-located, ~338 feet west of centerline of Rollins Rd. (6/17/2014, 14:50-15:00)	55	65	59	58	57	56	57

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise or vibration impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA CNEL or greater, with a

future noise level of less than 60 dBA CNEL, or b) the noise level increase is 3 dBA CNEL or greater, with a future noise level of 60 dBA CNEL or greater.

- A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels exceeding 60 dBA $L_{eq,}$ and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses.

Impact 1: **Noise and Land Use Compatibility.** Future residential uses developed at the project site would be exposed to exterior noise levels greater than 60 dBA CNEL, which exceeds the exterior noise and land use compatibility standard for residential land uses as presented in the City of Burlingame General Plan. Interior noise levels would be expected to exceed 45 dBA CNEL assuming standard residential construction methods. **This is a significant impact.**

Future Exterior Noise Environment

The future noise environment at the project site would continue to result from vehicular traffic along Carolan Avenue, Rollins Road, and U.S. Highway 101, in addition to Caltrain traffic along the railroad tracks. The project site is currently unshielded from traffic along each of these roadways and the railroad tracks. However, a sound wall extension has been proposed between U.S. Highway 101 and Rollins Road that would potentially shield the future noise-sensitive receptors located on the project site from traffic along U.S. Highway 101. Currently, there is a 16-foot sound wall that shields the existing single- and multi-family residences to the south of the project site from traffic noise generated along U.S. Highway 101. The sound wall stops at the southern boundary of the project site, but the proposed extension would shield the project site from the traffic noise produced along the highway. When conducting their noise study, *Charles M. Salter Associates, Inc.* predicted the future traffic noise levels at the outdoor use areas with and without the proposed sound wall extension. Future traffic volumes were not available at the time of their noise study, but based on the assumed traffic volume increase of Caltrans over a 10-year period, they used a traffic noise level increase of 1 dBA L_{dn}. Since their study, however, *Hexagon Transportation Consultants, Inc.* has provided a traffic report, and based on the findings, future traffic volumes would result in a 1 dBA L_{dn} increase at the project site.

Noise levels in outdoor use areas that are affected by transportation noise are required to be maintained at or below 60 dBA CNEL, according to the City's General Plan. The noise measurements made by *Charles M. Salter Associates, Inc.* were in L_{dn} units rather than CNEL, but the discrepancy between the two units is generally 1 dBA or less, which is assumed to be negligible for purposes of this report. The outdoor use areas for the proposed project consist of the west courtyard, the central courtyard, and the east courtyard, which includes the pool area. The west and east courtyards would be completely surrounded by buildings from the proposed project, and the calculated noise levels would be less than 60 dBA L_{dn} at these locations, which would be less-than-significant. The central courtyard would have a direct line-of-sight along the

northern boundary of the project site to the traffic noise along Carolan Avenue. *Charles M. Salter Associates, Inc.* predicted the future noise levels at this courtyard to be approximately 63 dBA L_{dn}, which assumes a 4.5 dB reduction in noise level per doubling of the distance between the noise source and receptor. However, when calculating the worst-case future noise levels, the conservative approach would be to assume a 3 dB reduction per doubling of the distance. Under that assumption, the worst-case future noise levels would be 66 dBA L_{dn}. These future exterior noise levels would be the same with and without the proposed U.S. Highway 101 sound wall extension. This would be a significant impact.

The apartment units that would experience the highest future exterior noise levels, with and without the proposed sound wall extension, would be those facing Carolan Avenue and Rollins Road. Along Carolan Avenue, the future exterior noise levels at the street-facing units would be approximately 72 dBA L_{dn}, assuming a building setback from the centerline of the roadway of approximately 73 feet. Without the proposed sound wall extension, the future exterior noise levels measured at the Rollins Road-facing apartment units would be approximately 76 dBA L_{dn}, assuming a building setback from the centerline of the roadway of approximately 45 feet. Some of the apartment units facing the northern boundary of the project site would not have direct line-of-sight to the roadways due to shielding provided by the Northpark Apartment complex. The worst-case future exterior noise levels at the units with direct line-of-sight would range from approximately 66 to 76 dBA L_{dn}. The units located along the southern boundary of the site would receive shielding from the row of single- and multi-family residences adjacent to the project site, as well as partial shielding from the existing 16-foot sound wall. The future exterior noise levels at these units would range from below 60 dBA L_{dn} at the interior units to either 72 dBA L_{dn} at the Carolan Avenue corner unit or 76 dBA L_{dn} at the Rollins Road corner unit.

The height of the proposed sound wall extension would be 16 feet, similar to the existing sound wall located south of the project site. While the proposed sound wall extension would shield the project site from the traffic along U.S. Highway 101, the project site would still be exposed to traffic along Rollins Road. However, the contribution of traffic noise from Rollins Road is relatively insignificant compared to the traffic noise from U.S. Highway 101. Future exterior noise levels measured at the Rollins Road-facing units, setback approximately 45 feet from the roadway, would be approximately 70 to 71 dBA L_{dn} at the first and second floors. Since the building height along Rollins Road is approximately 61.5 feet, the 16-foot proposed sound wall would only reduce noise levels at the first and second floors. The units facing Rollins Road in floors three through five would be exposed to traffic along Rollins Road and U.S. Highway 101; therefore, with the proposed sound wall extension, future exterior sound levels at these units would be approximately 76 dBA L_{dn}. Future exterior noise levels at the corner units, as well as the units with direct line-of-site to Rollins Road and U.S. Highway 101 along the northern and southern boundaries, would also be reduced with the construction of the proposed sound wall; however, these units would also be exposed to traffic noise levels from Carolan Avenue. Along the northern and southern boundaries, future exterior noise levels would range from below 60 to 72 dBA L_{dn}.

Future Interior Noise Environment

The City of Burlingame requires that interior noise levels within new residential units do not exceed 45 dBA CNEL. Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA L_{dn}, the inclusion of adequate forced air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA L_{dn}, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

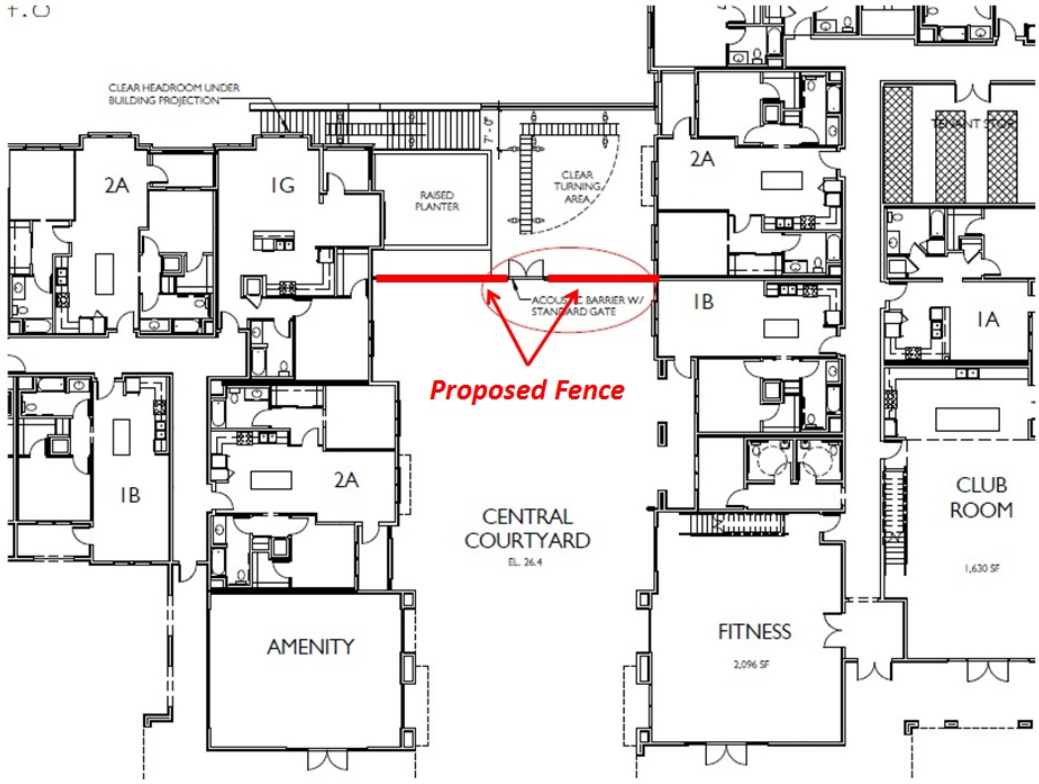
In the noise study conducted by *Charles M. Salter Associates, Inc.*, it was determined that all of the facades would need to be sound-rated, with and without the proposed sound wall extension. Future interior noise levels at the outward facing units on the project site would exceed the 45 dBA L_{dn} limit, assuming standard residential construction methods only; therefore, this would be a significant impact.

Mitigation Measure 1:

The following mitigation measures were recommended by *Charles M. Salter Associates, Inc.* and shall be incorporated into the project to reduce exterior noise levels at the central courtyard:

- Mitigation methods available to reduce exterior noise levels in outdoor use areas include site planning alternatives (e.g., increased setbacks and using the proposed buildings as noise barriers), the construction of traditional noise barriers or earth berms, or a combination of the above. *Charles M. Salter Associates, Inc.* recommended the construction of a fence located at the opening of the central courtyard along the northern boundary of the project site to shield the outdoor use area from the traffic noise along Carolan Avenue. The total length of the proposed fence would be approximately 45.5 feet, stretching from unit 2A to unit 1G, with approximately 3.5 feet used as an access gate. The proposed fence would be continuous from grade to top, with no cracks or gaps, and have a minimum surface density of three lbs/ft^2 (e.g., one-inch thick marine-grade plywood, ½-inch laminated glass, concrete masonry units (CMU)). In their noise study report, there was no recommended height; however, a fence height of approximately six feet would be sufficient for reducing noise levels to 60 dBA L_{dn} or less. The fence height shall be measured relative to the elevation of the central courtyard. Figure 2 shows the proposed location of the fence. The final recommendations for mitigation shall be confirmed when detailed site plans and grading plans are available.

FIGURE 2 Proposed Fence Location



The following mitigation measures were recommended by *Charles M. Salter Associates, Inc.* and shall be incorporated into the project to reduce interior noise levels:

- A qualified acoustical consultant shall review final site plan, building elevations, and floor plans prior to construction to calculate expected interior noise levels. Project-specific acoustical analyses are required to confirm that the design results in interior noise levels reduced to 45 dBA L_{dn} or lower for all floors in each building on the project site. While the proposed sound wall extension to the east of the project site and the proposed fence along the northern boundary of the project site implemented for exterior noise purposes may help to reduce interior levels on the first and/or second floors, they would not be adequate to reduce levels on the higher floors. *Charles M. Salter Associates, Inc.* determined that the buildings on the project site would need sound-rated construction methods and building facade treatments to maintain interior noise levels at or below acceptable levels. These treatments would include, but are not limited to, sound-rated windows and doors, sound-rated wall constructions, acoustical caulking, protected ventilation openings, etc. *Charles M. Salter Associates, Inc.* calculated the windows and exterior doors Sound Transmission Class (STC)[2] ratings needed to meet the City's

[2] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

criterion with and without the proposed sound wall extension. Figure 3 shows the recommended STC ratings without the proposed sound wall extension. Assuming the proposed sound wall extension is constructed, Figures 4 and 5 show the recommended STC ratings for the first and second floors and for the third through fifth floors, respectively. The specific determination of what noise insulation treatments are necessary shall be conducted on a unit-by-unit basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City along with the building plans and approved design prior to issuance of a building permit.

- Building sound insulation requirements would need to include the provision of forced-air mechanical ventilation for all perimeter residential units, so that windows could be kept closed at the occupant's discretion to control noise.

The implementation of these mitigation measures would reduce the impact to a less-than-significant level.

FIGURE 3 Minimum Recommended STC Ratings for Windows and Exterior Doors for All Floors, Without the Proposed Sound Wall Extension

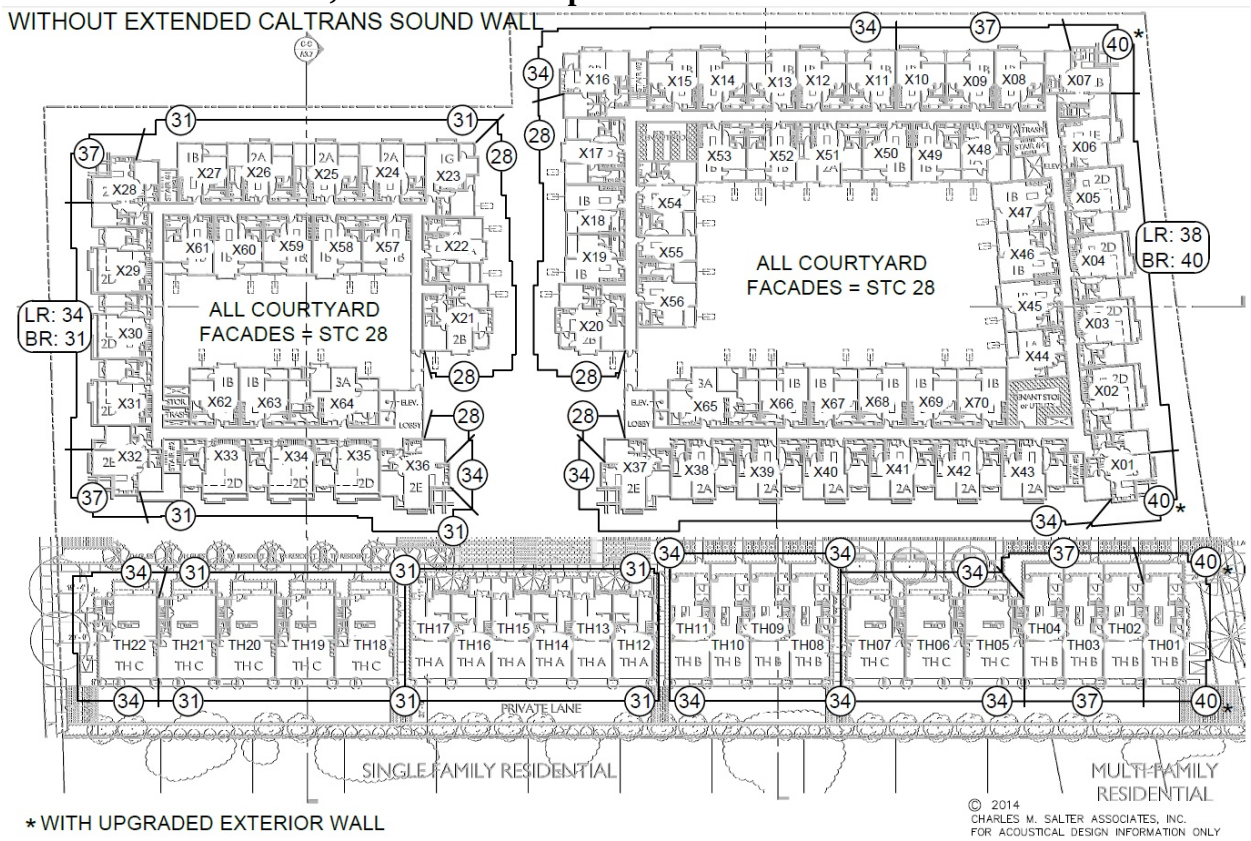


FIGURE 4 Minimum Recommended STC Ratings for Windows and Exterior Doors for the First and Second Floors, With the Proposed Sound Wall Extension

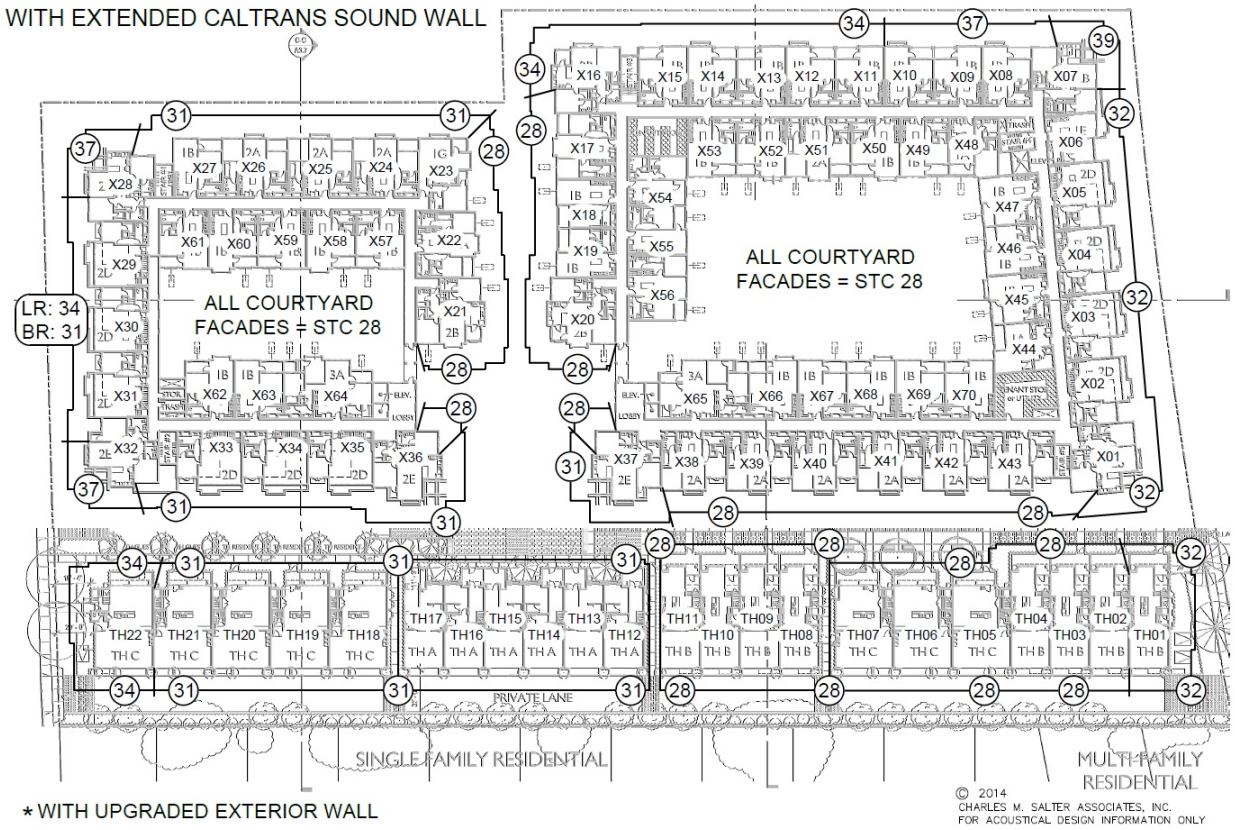
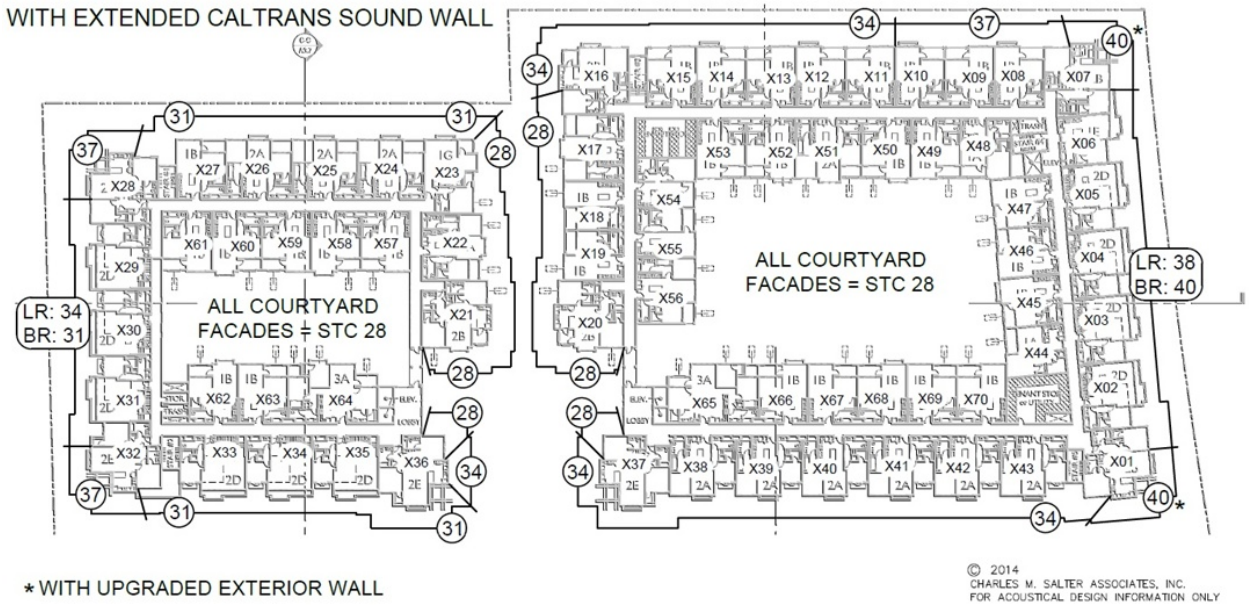


FIGURE 5 Minimum Recommended STC Ratings for Windows and Exterior Doors for the Third through Fifth Floors, With the Proposed Sound Wall Extension



Impact 2: **Exposure to Excessive Groundborne Vibration.** Construction-related vibration would not be excessive at nearby residential land uses. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include demolition, site preparation work, foundation work, and new building framing and finishing. The proposed project would not require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No ancient buildings or buildings that are documented to be structurally weakened adjoin the project site. Therefore, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 7 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. The nearby single- and multi-family residences are located approximately 35 to 80 feet from the proposed buildings located on the project site. Vibration levels at these distances would be expected to be less than 0.2 in/sec PPV, which would be below the 0.3 in/sec PPV significance threshold. Vibration generated by construction activities near the common property line would at times be perceptible, however, would not be expected to result in “architectural” damage to these buildings. This is a less-than-significant impact.

TABLE 7 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure 2: None required.

Impact 3: Project-Generated and Cumulative Traffic Noise. The proposed project would not result in a substantial permanent noise level increase or make a cumulatively considerable contribution to future noise levels at noise-sensitive land uses in the vicinity. **This is a less-than-significant impact.**

A significant impact would occur if project-generated traffic increased ambient noise levels at sensitive receptors in the project vicinity by 5 dBA L_{dn} or greater with future levels less than 60 dBA L_{dn} or by 3 dBA L_{dn} or greater with future levels of 60 dBA L_{dn} or greater.

Traffic along Carolan Avenue, Rollins Road, and U.S. Highway 101 dominates the noise environment in the area, with the occasional train activity along the Caltrain tracks. A traffic impact analysis was conducted for this project by *Hexagon Transportation Consultants, Inc.* and was used to estimate the noise level increase generated by the project. Vehicular traffic generated by the project would not increase noise levels substantially because the project traffic would make up a small percentage of the total traffic along the surrounding roadways. By comparing the Baseline and the Baseline Plus Project conditions to the Existing conditions, the calculated noise level increase due to the project-generated traffic would be less than 1 dBA L_{dn}. This is a less-than-significant impact.

Two cumulative scenarios were considered for this project: with and without the proposed project. Increases in traffic noise levels above existing levels were calculated to increase by approximately 2 dBA L_{dn} or less under both scenarios. Since both scenarios result in increases of less than 3 dBA L_{dn} and because there would be no measurable difference between the two

scenarios, this would not be a cumulatively considerable contribution to the projected increase in noise. This would be a less-than-significant impact.

Mitigation Measure 3: None required.

Impact 4: Temporary Construction Noise. Existing noise-sensitive land uses would not be exposed to construction noise levels in excess of the significance thresholds for a period of more than one year. **This is a less-than-significant impact**.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses in the project vicinity for a period exceeding one year, the impact would be considered significant.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 90 to 95 dBA L_{max} at a distance of 50 feet from the noise source. Typical hourly average construction-generated noise levels are about 81 to 88 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). Hourly average noise levels generated by the construction of residential units would range from about 65 to 88 dBA L_{eq} measured at a distance of 50 feet, depending upon the amount of activity at the site. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

Construction phases would include demolition, excavation, grading, building construction, paving, and architectural coating. Once construction moves indoors, minimal noise would be generated at off-site locations. Noise generated by construction activities would temporarily elevate noise levels at adjacent noise-sensitive receptors, but this would be considered a less-than-significant impact, assuming that construction activities are conducted in accordance with the provisions of the City of Burlingame General Plan and with the implementation of construction best management practices.

The following standard controls are assumed to be included in the project:

- Construction activities shall be limited to the daytime hours between 7:00 a.m. and 7:00 p.m., Monday through Friday, between 9:00 a.m. and 6:00 p.m. on Saturdays, and

between 10:00 a.m. and 6:00 p.m. on Sundays and holidays (as established in Chapter 18.07.110 of the City of Burlingame Municipal Code).

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from sensitive receptors. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses. Temporary noise barriers could reduce construction noise levels by 5 dBA.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction plan identifying the schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures, and recognizing that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels would be less-than-significant.

Mitigation Measure 4: **None required.**

Impact 5: **Noise and Land Use Compatibility (Aircraft).** The proposed project would be located in a compatible noise environment with respect to noise generated by San Francisco International Airport. **This is a less-than-significant impact**.

San Francisco International Airport (SFO) is a major international airport located approximately 1.5 miles north of the project site. Although aircraft-related noise would occasionally be audible at the project site, the project site lies outside the 65 dB CNEL contour for SFO, as established in the Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport.[3] The vehicular traffic noise levels measured at the project site exceeded 65 dBA L_{dn}; therefore, any overhead aircraft noise would not be significant over the local traffic noise. This is a less-than-significant impact.

Mitigation Measure 5: None Required.

[3] Ricondo & Associates, Inc., in association with Jacobs Consultancy and Clarion Associates, *Volume I: Comprehensive Airport Land Use Compatibility Plan for the Environs of San Francisco International Airport*, July 2012.