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Ms. Winnie Lam
Project Manager
L.F. George Properties
159 El Camino Real
Millbrae, CA 94030

Subject: Preliminary Noise Assessment Study - DRAFT -
2700 El Camino Real Condominiums, San Mateo, California

Dear Ms. Lam:

This report presents the results of a preliminary noise assessment study conducted for the 5 story mixed-use building with 68 high-end residential units and 17,000SF of commercial space known as Hillsdale Terrace to be constructed at 2700 El Camino Real in San Mateo. As the project is subject to revisions during the process leading up to permitting, some of the conclusions and recommendations should be interpreted as preliminary. A final set of recommendations can be provided in a more detailed and accurate report as design decisions for the project are finalized.

Applicable Legislation – Noise Study Criteria California Building Code

All new Multi-Family housing must comply with California Code of Regulations (CCR) Title 24 – included in the California Building Code (CBC), Section 1207, “Sound Transmission”. The California Building Code underwent a major reform in 2013 whereby Sections 1207.1 to 1207.13 which were in effect since 1974 were repealed and Section 1207 from the International Building Code were adopted instead. The IBC and hence the CBC, however, does not have any requirements for interior noise attributable to exterior sources, instead relying on local General Plan requirements.

The California Department of Housing and Community Development later amended Section 1207 of the Code by re-incorporating, under subsection 1207.4, *Allowable interior noise levels* the requirement limiting interior noise to no more than 45 L_{dn} or CNEL, as applicable so as to be consistent with the local jurisdiction’s Noise Element requirements.

The new language reads as follows:

1207.4 Allowable interior noise levels. Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric shall be either the day-night average sound level (L_{dn}) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.

Thus, our acoustical analysis uses 45 L_{dn} as the limiting metric for CBC compliance indoors.

City of San Mateo General Plan

The Noise Element of the City of San Mateo General Plan provides Goals and Policies regarding noise¹. Those relevant to this project are:

GOAL 1: Protect “noise sensitive” land uses from excessive noise levels

POLICIES:

N 1.1: Interior Noise Level Standard. Require submittal of an acoustical analysis and interior noise insulation for all “noise sensitive” land uses listed in Table N-1 that have an exterior noise level of 60 dB (Ldn) or above. The maximum interior noise level shall not exceed 45 dB (Ldn) in any habitable rooms. This is consistent with CBC requirements.

N 1.2: Exterior Noise Level Standard. Require an acoustical analysis for new parks, play areas, and multi-family common open space (intended for the use and the enjoyment of residents) that have an exterior noise level of 60 dB (Ldn) or above. Incorporate necessary mitigation measures into residential project design to minimize common open space noise levels. Maximum exterior noise should not exceed 67 dB (Ldn) for residential uses.

Implementation of N 1.1 and N1.2: Interior and Exterior Noise Level Standards.

As part of the development review process, an acoustical analysis is required for all new project types listed on Tables N-1 and N-2 when the site noise levels exceed the noise level standards established in the General Plan. Mitigation measures to reduce both exterior and interior noise to acceptable levels are required as part of the analysis, and are incorporated into the conditions of project approval.

GOAL 2: Minimize unnecessary, annoying, or unhealthful noise.

POLICIES:

N 2.1: Noise Ordinance. Continue implementation and enforcement of the City's existing noise control ordinance: a) which prohibits noise that is annoying or injurious to neighbors of normal sensitivity, making such activity a public nuisance, and b) restricts the hours of construction to minimize noise impact.

Implementation of N 2.1: Noise Ordinance.

Noise nuisances, as defined in the City's Municipal Code, through a standardized enforcement process, which includes referral to the Housing and Advisory Appeals Board. This includes noise generated by building construction and equipment at unauthorized times.

Enforcement of a noise control ordinance can reduce nuisance noise generated by commercial uses or from residential sources such as amplified music, parties, leaf blowers, or barking dogs. Construction activities also generate substantial short-term noise impacts, which can be limited to specified hours and days of the week.

N 2.2: Minimize Noise Impact. Protect all “noise-sensitive” land uses listed in Tables N-1 and N-2 from adverse impacts caused by the noise generated on-site by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit long-term exposure increases of 3 dB (L_{dn}) or greater at the common property line, or new uses which generate noise levels of 60 dB (L_{dn}) or greater at the property line, excluding existing ambient noise levels.

“Noise-sensitive” land uses, such as residential neighborhoods, hotels, hospitals, schools, and outdoor recreation areas must be protected from new development that causes discernable increases in noise levels as a result of on-site activities. Noise generators such as machinery or parking lots must be mitigated through physical measures or operational limits.

¹ *San Mateo Noise Element of the General Plan.* Adopted by the City Council on October 18, 2010.
Resolution No. 134-2010

N 2.3: Minimize Commercial Noise. Protect land uses other than those listed as “noise sensitive” in Table N-1 from adverse impacts caused by the on-site noise generated by new developments. Incorporate necessary mitigation measures into development design to minimize noise impacts. Prohibit new uses that generate noise levels of 65 dB (L_{dn}) or above at the property line, excluding existing ambient noise levels.

Commercial and industrial areas typically tolerate higher noise levels than residential neighborhoods. However, some control is necessary for new development within non-residential areas so that exceptionally noisy uses are restricted.

Implementation of N 2.2 and N 2.3: Minimize Noise.

Where the potential exists for noise impacts inconsistent with these policies, a noise report identifying noise impacts and mitigation measures is required as part of the development review process. Mitigation measures are then incorporated as conditions of the project approval.

N 2.4: Traffic Noise. Recognize projected increases in ambient noise levels resulting from traffic increases, as shown on Figure N-2. Promote the installation of noise barriers along highways where “noise-sensitive” land uses listed in Table N-1 are adversely impacted by unacceptable noise levels [60 dB (L_{dn}) or above]. Accept noise increases on El Camino Real at existing development, and require new multi-family development to provide common open space having a maximum exterior noise level of 67 dB (L_{dn}).

Implementation N 2.4: Traffic Noise.

Noise standards for development along El Camino Real are imposed on a case-by-case basis consistent with this policy's guidelines. New multi-family developments are required to comply with exterior noise standards as part of the development review process for consistency with the State Building Code.

TABLE N-1 NOISE SENSITIVE LAND-USE COMPATIBILITY GUIDELINES FOR COMMUNITY NOISE ENVIRONMENTS¹ Day-Night Average Sound Level (L_{dn}), Decibels			
Land-Use Category	Normally Acceptable²	Conditionally Acceptable³	Normally Unacceptable⁴
Single-Family Residential	50 to 59	60 to 70	Greater than 70
Multi-Family Residential	50 to 59	60 to 70	Greater than 70
Hotels, Motels, and Other Lodging Houses	50 to 59	60 to 70	Greater than 70
Long-Term Care Facilities	50 to 59	60 to 70	Greater than 70
Hospitals	50 to 59	60 to 70	Greater than 70
Schools	50 to 59	60 to 70	Greater than 70
Multi-Family Common Open Space Intended for the Use and Enjoyment of Residents	50 to 67	--	Greater than 67

TABLE N-2 NOISE GUIDELINES FOR OUTDOOR ACTIVITIES Average Sound Level (L_{eq}), Decibels			
Land Use Category	Normally Acceptable²	Conditionally Acceptable³	Normally Unacceptable⁴
Parks, Playgrounds	50 to 65*	--	Greater than 65*

- ¹ These guidelines are derived from the California Department of Health Services, Guidelines for the Preparation and Content of the Noise Element of the General Plan, 2003. The State Guidelines have been modified to reflect San Mateo's preference for distinct noise compatibility categories and to better reflect local land-use and noise conditions. It is intended that these guidelines be utilized to evaluate the suitability of land -use changes only and not to determine cumulative noise impacts. Land uses other than those classified as being "noise sensitive" are exempt from these compatibility guidelines.
- ² Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
- ³ Conditionally Acceptable – New construction should be undertaken only after a detailed analysis of the noise reduction requirement is conducted and needed noise insulation features included in the design.
- ⁴ Normally Unacceptable – New construction should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
- * Average Sound Level (L_{eq}) for peak hour.

City of San Mateo Noise Ordinance

The City of San Mateo has enacted a Noise Ordinance as part of their Municipal Code². This legislation limits the levels of noise that can be produced by sources, with special provisions for construction activities. The levels permissible vary depending on the "Noise Zone" where the property is located. Per the City of San Mateo Zoning Map³, the current project is located in a Noise Zone 2, defined as "*All property in any commercial/mixed residential, multifamily residential, specific plan district or PUD*"⁴.

The pertinent sections of the Ordinance area as follows:

7.30.040 MAXIMUM PERMISSIBLE SOUND LEVELS.

(a) It is unlawful for any person to operate or cause to be operated any source of sound at any location within the city or allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any other property to exceed:

- (1) The noise level standard for that property as specified in Table 7.30.040 for a cumulative period of more than thirty minutes in any hour;
- (2) The noise level standard plus five dB for a cumulative period of more than fifteen minutes in any hour;
- (3) The noise level standard plus ten dB for a cumulative period of more than five minutes in any hour;
- (4) The noise level standard plus fifteen dB for a cumulative period of more than one minute in any hour; or
- (5) The noise level standard or the maximum measured ambient level, plus twenty dB for any period of time.

(b) If the measured ambient level for any area is higher than the standard set in Table 7.30.040, then the ambient shall be the base noise level standard for purposes of subsection (a)(1) of this section. In such cases, the noise levels for purposes of subsections (a)(2) through (a)(5) of this section shall be increased in five dB increments above the ambient.

² San Mateo Municipal Code, Chapter 7.30, Ordinance No. 2004-16

³ <http://www.cityofsanmateo.org/DocumentCenter/Home/View/578>

⁴ San Mateo Municipal Code, Section 7.30.030 *Designated Noise Zones*

Table 7.30.040
NOISE LEVEL STANDARDS*

Noise Zone	Time Period	Noise Level (dB)
Noise Zone 1	10 p.m.--7 a.m.	50
	7 a.m.--10 p.m.	60
Noise Zone 2	10 p.m.--7 a.m.	55
	7 a.m.--10 p.m.	60
Noise Zone 3	10 p.m.--7 a.m.	60
	7 a.m.--10 p.m.	65
Noise Zone 4	Anytime	70

*Source: Adapted from "The Model Community Noise Control Ordinance," Office of Noise Control, California Department of Health.

7.30.050 INTERIOR NOISE LIMITS. It is unlawful for any person to operate or cause to be operated any source of sound, on multifamily residential property or multi-tenant commercial or industrial property at a noise level more than ten dB above the level allowed by Section 7.30.040 three feet from any wall, floor or ceiling inside any unit on the same property when the windows and doors of the unit are closed, except within the unit in which the noise source or sources is located.

7.30.060 SPECIAL PROVISIONS.

(e) Construction. Construction, alteration, repair or land development activities which are authorized by a valid city permit shall be allowed on weekdays between the hours of seven a.m. and seven p.m., on Saturdays between the hours of eight a.m. and five p.m., and on Sundays and holidays between the hours of noon and four p.m., or at such other hours as may be authorized or restricted by the permit, if they meet at least one of the following noise limitations:

- (1) No individual piece of equipment shall produce a noise level exceeding ninety dB at a distance of twenty-five feet. If the device is housed within a structure or trailer on the property, the measurement shall be made outside the structure at a distance as close to twenty-five feet from the equipment as possible.
- (2) The noise level at any point outside of the property plane of the project shall not exceed ninety dB.
- (3) The operation of leaf blowers shall additionally comply with Chapter 10.80 "Operation of Leaf Blowers".

7.30.070 EXCEPTION PERMITS. If the applicant can show to the city manager, or the manager's designee, that a diligent investigation of available noise abatement techniques indicates that immediate compliance with the requirements of this chapter would be impractical or unreasonable, a permit to allow exception from the provisions contained in this chapter may be issued, with appropriate conditions to minimize the public detriment caused by such exceptions. Any such permit shall be of as short duration as possible, but in no case for longer than six months. These permits are renewable upon a showing of good cause, and shall be conditioned by a schedule for compliance and details of compliance methods in appropriate cases.

California Environmental Quality Act (CEQA)

In the evaluation of environmental impacts, CEQA uses several checklists of issues which must be addressed. With regards to noise these are as follows:

XI. NOISE -- Would the project 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, would the project expose people residing or working in the project area to excessive noise levels?
- f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Present and Future Noise Environments

Noise measurements were conducted for several days at the site and in the near vicinity by means of unattended, precision, calibrated logging sound level meters. Noise meters were deployed at El Camino Blvd. and at 27th and 28th Avenues, the two streets bordering the site on the north and south, respectively. Figure 1 below presents an aerial photo of the area which indicates the locations where the survey took place. Hour-by-hour average (L_{eq}) noise levels observed are provided in graphical format in Appendix A at the end of this report.



Figure 1: Project site area and noise measurement locations

The Day-Night Noise Levels (DNL) observed and predicted future can be summarized as follows:

Location	DNL Measured [dB]	DNL Predicted 2024 [dB]
LT-1 (27 th Ave by Corte De Flores St.)	61	62
LT-2 (28 th Ave by #34)	61	62
LT-3 (El Camino Real by #2700)	70	71

Traffic information obtained from CALTRANS indicates that traffic volumes along SR82 (El Camino Real) between the Hillsdale Avenue and SR92 intersections has actually dropped in the last 10 years from an Average Annual Daily Traffic (AADT) of 40,000 vehicles in 2003⁵ to 35,000 vehicles in 2013⁶. This corresponds to a reduction in sound level of approximately 0.5 decibels, as traffic volume is related to changes in noise level through a logarithmic function expressed as:

$$\Delta_{Level} = 10 * \log_{10} \left(\frac{\text{traffic volume before}}{\text{traffic volume after}} \right)$$

Therefore, even seemingly large increases or decreases in traffic volumes result in moderate changes in daily average noise levels. This reduction could have been due to traffic realignments resulting from widening and better traffic management along nearby freeways. The 2010-2030 General Plan indicates an expected increase in traffic volumes in local streets of 15% by 2030⁷. This would conservatively result in a net increase of approximately 1 decibel in the next 10 years.

Project-generated future traffic noise

A traffic report for the project is currently not available. However, given the proximity of the project to a major Arterial road (El Camino) and a Collector road (28th Ave), to the relatively low volume of traffic usually generated by residential developments with a relatively small number of units (68 proposed) and small Commercial/Retail area proposed (18,000 s.f.), and the logarithmic relationship between traffic volumes and noise levels, we expect for this project to create a negligible increase in the noise environment of areas surrounding it. This assumes that most of the traffic created by the project will circulate on El Camino and 28th St.

Project-generated future operational noise

Multi-family residential and mixed use residential/commercial projects generate mechanical noise primarily. This noise is typically due to forced-air ventilation and air conditioning systems for the garage, commercial spaces such as restaurants, enclosed circulation spaces and for the residences. Given the prevailing level of environmental noise in the area surrounding the site, and providing that adequate noise abatement measures are implemented in the mechanical equipment to be serving the project so that it meets the requirements of the Municipal Code's Noise Ordinance by the nearest sensitive receivers, then no net increase in future noise levels is expected as a result of the project.

⁵ CALTRANS – 2003 Traffic Volumes on California State Highways
(www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm)

⁶ CALTRANS – 2013 Traffic Volumes on California State Highways
(www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm)

⁷ City of San Mateo 2010-2030 General Plan, Circulation Element, Appendix D *Traffic Management Mitigation*

Interior Noise due to Exterior Sources

The predicted future noise exposure at the various facades of the proposed building is summarized in graphical form in Figure 2 in the form of noise contours. As can be seen in this plan, those exposures exceed 60 DNL in most areas. As the typical reduction in noise that can be expected when windows in a room are kept open is 15 decibels or less⁸, meeting the maximum allowable interior noise of 45 DNL prescribed by the California Building Code and the City of San Mateo Noise Element of the General Plan will require for most windows to be closed. Further, as standard dual-glazed *thermally insulating* windows provide reductions in noise of 20 decibels or less, *acoustically-rated* windows and balcony doors will be necessary for most habitable rooms. As the levels of exterior noise are relatively high but not severe, most standard exterior wall and roof construction designs meant to comply with required Building Code thermal insulation standards will also provide the necessary acoustical isolation.

Forced ventilation requirement

As the maximum allowable interior noise limit at many units can only be attained by requiring that windows and balcony doors remain closed, a forced air ventilation system must be provided for those units. This system must not compromise the sound isolation properties of the building shell. Chapter 4 of the California Mechanical Code *Ventilation Air Supply* requires:

402.3 Mechanical Ventilation. Where natural ventilation is not permitted by this section or the building code, mechanical ventilation systems shall be designed, constructed, and installed to provide a method of supply air and exhaust air. Mechanical ventilation systems shall include controls, manual or automatic, to enable the fan system to operate wherever the spaces served are occupied. The system shall be designed to maintain minimum outdoor airflow as required by Section 403.0 under any load conditions.

Demolition and Construction Noise

The proposed site is currently occupied by a used car lot and contains two single-story buildings which will need to be demolished. Short-term noise impacts may be created during demolition of the existing structures and during construction of the project. Noise created by demolition and construction equipment is quite similar in terms of level and character.

Construction of the proposed project will require the excavation of three levels of parking below grade and the forming of columns and floor concrete slabs, among other noise-generating activities. However, given the early stages of the project, the means and methods to be utilized for its construction have not been determined yet.

The project is surrounded by the Hillsdale Apartments complex on the west which is a three story residential building atop a parking garage. This complex is located approximately 45 feet away from the proposed building at the nearest point. To the north, south and east the project is surrounded by commercial land uses; primarily automobile dealerships. Another three story over parking multifamily complex is located to the north-west end of the project, at the intersection of 27th Avenue and Edison St. Both of these buildings are constructed atop garages which are half way sunken into the ground; hence the first residential level is elevated by approximately six feet above street level.

⁸ World Health Organization (WHO), *Guidelines for Community Noise*, April 1999

This project will not require the use of impact pile driving equipment, as it will be built using a mat slab foundation system given the prevalent soil conditions at the site and the building characteristics. Demolition and construction noise will generally not exceed the 90 dBA limit imposed by the Noise Ordinance of the City of San Mateo.

Demolition and Construction Vibration

Vibration created by construction and demolition equipment is of concern due to two possible effects: damage to existing buildings and annoyance to people. Criteria for building damage is generally expressed in terms of Peak Particle Velocity (PPV) in inches/second, while that for people annoyance is generally expressed in terms of Root-Mean Squared (RMS) inches/second. Industry-accepted criteria⁹ for damage of timber buildings such as the nearest multi-family residential building to the west is 0.5 PPV in/sec¹⁰ and for annoyance it is 80 VdB¹¹. Criteria for ground-borne noise in residential buildings from infrequent sources is 48 dBA. Calculations indicate that vibration and ground-borne noise criteria could be exceeded very infrequently during the improvement and re-construction of the road between the two buildings. Therefore, compaction of the soil with vibratory rollers should be limited to non-vibratory use of the compactor.

CEQA Analysis

Would the project 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?*

The project is expected to generate noise levels in excess of standards established in the local Noise Ordinance for very brief periods of time by some construction equipment during the construction phase. No Standards are provided by the General Plan. See the predicted noise levels during construction in Table B1 in Appendix B. No pile driving is expected to be necessary during construction.

- b) *Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?*

Project operation will not expose persons to excessive Groundborne vibration or Groundborne noise levels. Project construction could exceed both for brief periods while the road between the two buildings is constructed or improved. See predicted levels in Table C1 in Appendix C.

- c) *A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?*

The project will create noise in the project vicinity of two primary types: increases in traffic noise due to occupants entering/leaving the project and mechanical noise due to equipment servicing the project such as garage exhaust fan(s) and cooling equipment for residential and commercial spaces. As indicated above, given the substantial volumes of

⁹ US Federal Transit Administration, *Transit Noise and Vibration Assessment Manual*, May 2006, Chapter 12.

¹⁰ US FTA, *Transit Noise and Vibration Assessment Manual*, May 2006, Chapter 12, Table 12-3.

¹¹ US FTA, *Transit Noise and Vibration Assessment Manual*, May 2006, Chapter 8, Table 8-1

traffic in the project vicinity, no permanent increase in traffic-related noise is expected as a result of the project.

Mechanical equipment noise shall be controlled by means of equipment selection, equipment location with respect to noise sensitive receptors and/or by means of sound screens so as to comply with the City of San Mateo Noise Ordinance's maximum permissible sound levels as indicated in Section 7.30.040. With these measures in place, the project is not expected to create a permanent increase in noise levels in the project vicinity. Quite the contrary, the project is expected to provide a significant benefit to residences behind it. Residences to the west (Hillside) as well as residences on Edison Ave. and on 27th Street will benefit from the shielding of El Camino Real traffic noise to be provided by the proposed building's massing.

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

The project will create temporary but not periodic increases in ambient noise levels in the project vicinity above levels existing without the project. These temporary increases will take place during construction.

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, would the project expose people residing or working in the project area to excessive noise levels?

The project is not within an airport land use plan. The nearest airport is San Francisco International at approximately 5.5 miles northwest of the project.

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

This project is not within the vicinity of a private airstrip and falls outside the CNEL 65 noise contour line of all nearby airports.

Recommended noise abatement measures

Exterior noise

The City's Noise Element, under Policy N 1.2 (see above) requires the incorporation of mitigation measures at *common spaces* in multi-family developments, requiring for the maximum level of exterior noise not to exceed 67 L_{dn} decibels. The present project does not have common spaces directly exposed to traffic noise. Rather the project's only common space is located on the center area of the 6th story roof where the roof's parapet provides significant shielding of street noises. Thus, we have calculated the expected level of noise at the rooftop common outdoor area to be approximately 55 L_{dn} decibels, which is within compliance of local legislation. Therefore, no mitigation measures are required to control outdoor noise at the project's outdoor common area.

Interior Noise

The City's Noise Element, under Policy N 1.1 as well as the CBC under section 1207.4 limit interior noise to no more than 45 L_{dn}. Given the levels of exterior noise at the various building exposures,

acoustically rated windows and balcony doors will be required at most but not all condominium units.

Glazing requirements

Figure 3 to Figure 6 present *preliminary* window and balcony door acoustical rating plans on a room by room basis for the various noise exposures to which the proposed building will be subject to. Windows can be of the fixed or operable type, as long as these possess the minimum sound isolation properties recommended when tested per ASTM Standard E-90. Some areas facing west will be subject to noise exposures lower than 60 DNL hence no special acoustical requirements will be necessary for those windows or balcony doors, which could also remain open yet still meet the interior noise criteria.

Exterior wall design requirements

The design for the exterior walls has not been decided yet. Typical exterior wall designs provide sound isolation ratings in excess of 30 OITC/40 STC points¹², which is in excess of the minimum required to achieve the limits imposed by current legislation. The proposed design should be evaluated as part of the final exterior-to-interior noise analysis.

Ventilation requirements

Provide a forced air ventilation system to all habitable spaces where the exterior noise exposure is expected to exceed 60 Ldn, as indicated in Figure 2. This system must not compromise the sound isolation properties of the building shell

Project-generated noise

Traffic

Although a traffic study for the project has not been completed yet, no mitigation measures are expected to be necessary due to the reasons indicated in the section on *Present and Future Noise Environments* above, as the project is not expected to create a substantial permanent increase in traffic noise in the project vicinity. Nevertheless, this should be verified by calculation once a project-specific traffic study is completed.

A qualified acoustical consultant should provide an analysis of traffic-generated noise.

Operational

A mechanical design for the proposed project is not yet available. However, in order to meet the requirements stated in the San Mateo Noise Ordinance, a qualified acoustical consultant should predict the expected level of noise from mechanical equipment and other sources of operational noise and provide recommendations for mitigation measures as necessary.

Typical measures could include the installation of sound attenuators at garage and commercial retail exhaust fans; the selection of quiet refrigeration and air conditioning systems; the erection of sound screens around noisy equipment; the relocation of noisier equipment to areas where shielding can be provided by building features, etc.

Demolition and Construction

The means and methods to be utilized for the construction of the project have not been determined yet. However, extreme noise generating techniques such as impact pile driving are not expected to be used. Table B1 in Appendix B provides predictions of the expected levels of noise to be produced by construction equipment commonly used in projects similar to this.

Demolition and Construction Noise Control Strategies

¹² Laboratory measurements of the sound insulation of building façade elements. National Research Council of Canada, report IRC IR-818.

Temporary acoustical barriers erected along the property line are commonly utilized means to shield sensitive receptors from construction noise. However, noise barriers *are only effective if they can interrupt the line of sight between the source of the noise and sensitive receptors*. As the nearest noise sensitive receptors, namely the Hillsdale Apartments and the Edison Condominiums are built atop partially sunken garages, windows and balconies in those buildings span in heights of approximately 6 to 14 feet above ground level for the first story units and higher for 2nd and 3rd stories. Therefore, it would not be possible to achieve meaningful reductions in noise for receptors on the 1st story by means of noise barriers of typical and practical heights (i.e. 6 to 12 feet) at this story and no benefit whatsoever would be achieved for receptors at 2nd and 3rd stories. Further, the underside of balconies will have the effect of reflecting construction noise towards the balcony's doors as these surfaces will have direct line of sight with most construction equipment most of the time. Therefore, given the prevailing geometries, attempting to provide effective noise mitigation with noise barriers of typical and reasonable height will not be effective.

In order to minimize possible adverse effects due to demolition and construction noise the following measures are instead recommended:

- Per the Noise Ordinance, Section 7.30.060(e), work shall be conducted during the hours of:
 - 7 am to 7 pm M-F;
 - 8 am to 5 pm on Saturdays
 - Noon to 4 pm on Sundays and holidays
- Use only construction equipment which produces no more than 90 dBA at 25ft if possible. (Noise Ordinance Section 7.30.060.(1))
- Limit noise at any point outside the property plane to 90 dBA (Noise Ordinance Section 7.30.060.(2)) if possible
- The operation of leaf blowers shall additionally comply with Chapter 10.80 of the Municipal Code "Operation of Leaf Blowers"
- Equipment and trucks used for project construction shall utilize the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds, wherever feasible)
- Limit circulation of equipment and trucks used for project construction to El Camino Real as much as possible as this road has the highest levels of traffic noise and is populated by less noise sensitive land uses.
- Impact tools (e.g., jack hammers, pavement breakers, and rock drills) used for project construction shall be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatic tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves shall be used if such jackets are commercially available, and this could achieve a reduction of 5 dBA. Quieter procedures shall be used, such as drills rather than impact equipment, whenever such procedures are available and consistent with construction procedures.
- Stationary noise sources shall be located as far from adjacent receptors as possible, and they shall be muffled and enclosed within temporary sheds, incorporate insulation barriers, or use other measures to provide equivalent noise reduction.
- Turn off all idling equipment when not in use especially during evening and early morning hours

- Use equipment of only necessary size and power, as larger equipment tends to generate more noise.
- Limit the equipment on site by keeping only that equipment necessary for the tasks at hand
- Use quieter backup alarms whenever possible such as manually adjustable, ambient-sensitive or broadband-type alarms
- Minimize drop height when loading excavated material onto trucks
- Pre-auger soldier piles so as to minimize noise and vibration during insertion/driving. Consider using auger cast-in-place techniques to minimize noise and vibration
- Designate an on-site construction noise complaint and enforcement manager for the project.
- Post signs on-site indicating the permitted construction days and hours and complaint procedures and who to notify in the event of a problem. The signs shall also include a listing of both the City and construction contractor's telephone numbers for the Public to contact during regular construction hours and during off-hours
- Notify neighbors and occupants within 300 feet of the project construction area at least 30 days in advance of extreme noise generating activities and provide an estimate of the duration of the activity
- A preconstruction meeting shall be held with the job inspectors and the general contractor/on-site project manager to confirm that noise measures and practices (including construction hours, neighborhood notification, posted signs, etc.) are completed

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Please do not hesitate to contact me if you have any questions.

Very truly yours

WILSON, IHRIG & ASSOCIATES, INC.



Pablo A. Daroux
Principal

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APPENDIX A

Exterior Noise Predictions and Building Shell Recommendations



Figure 2: Predicted future Day-Night Noise Levels (Ldn)

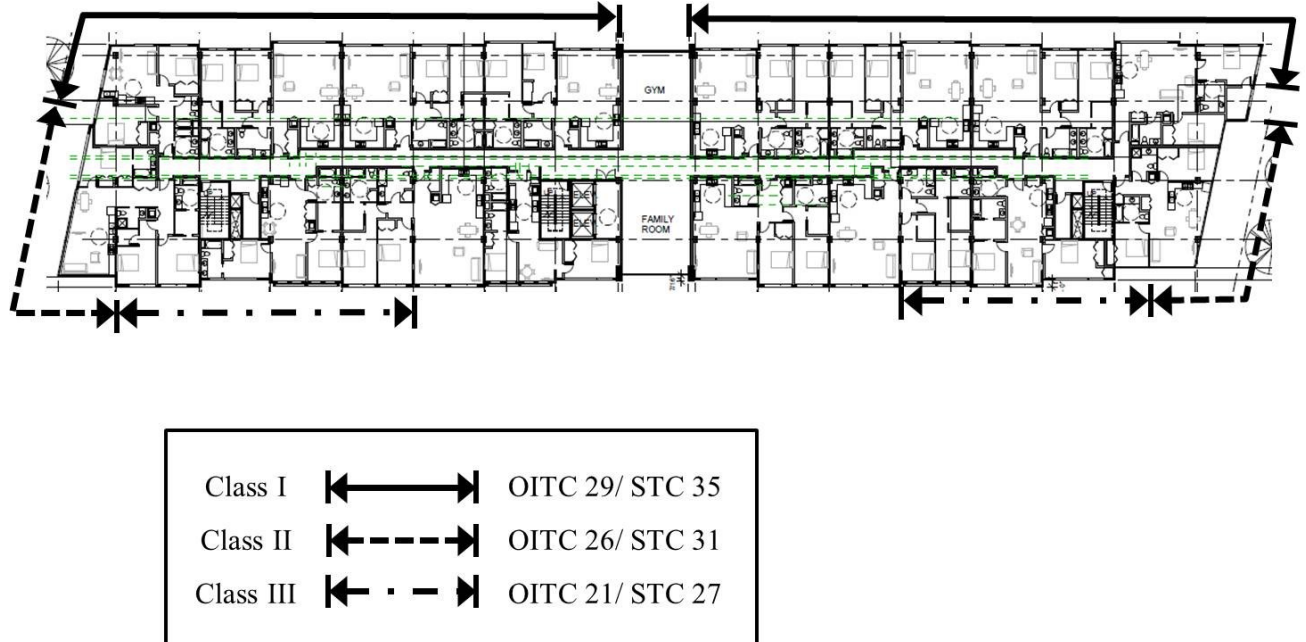


Figure 3: Recommended minimum acoustical rating for windows and balcony doors - Level 2 (preliminary). Rooms with no rating indicated do not require acoustically-rated windows as exterior noise is expected to be within the Normally Acceptable category of up to 59 Ldn

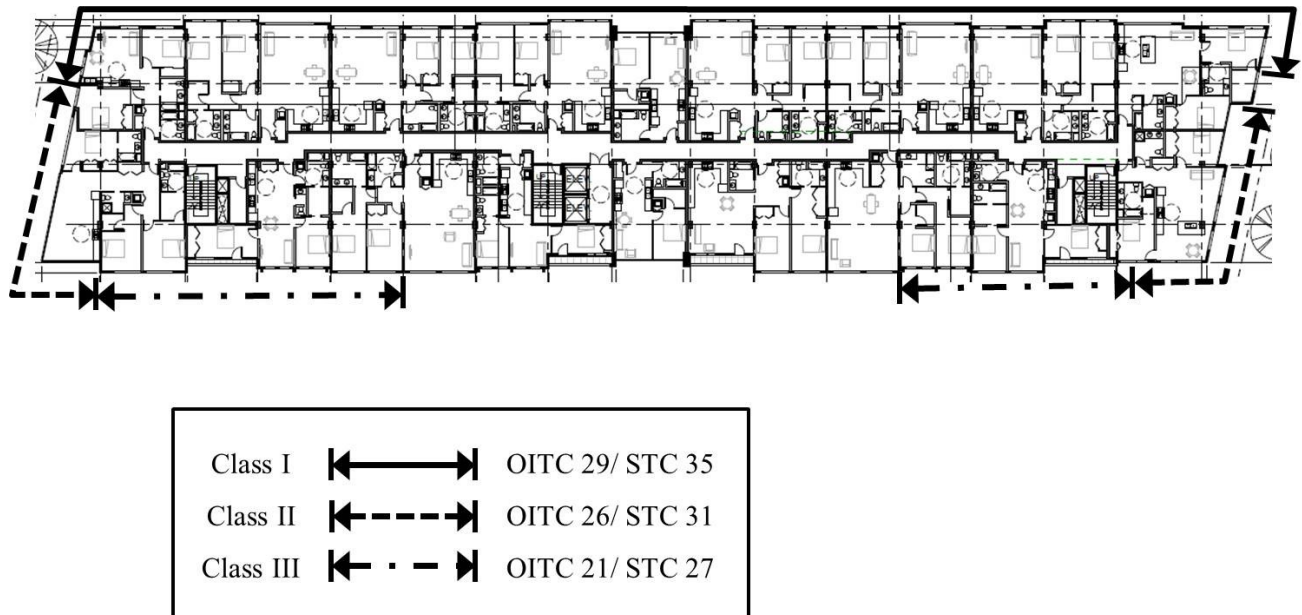


Figure 4: Recommended minimum acoustical rating for windows and balcony doors - Level 3 (preliminary). Rooms with no rating indicated do not require acoustically-rated windows as exterior noise is expected to be within the Normally Acceptable category of up to 59 Ldn

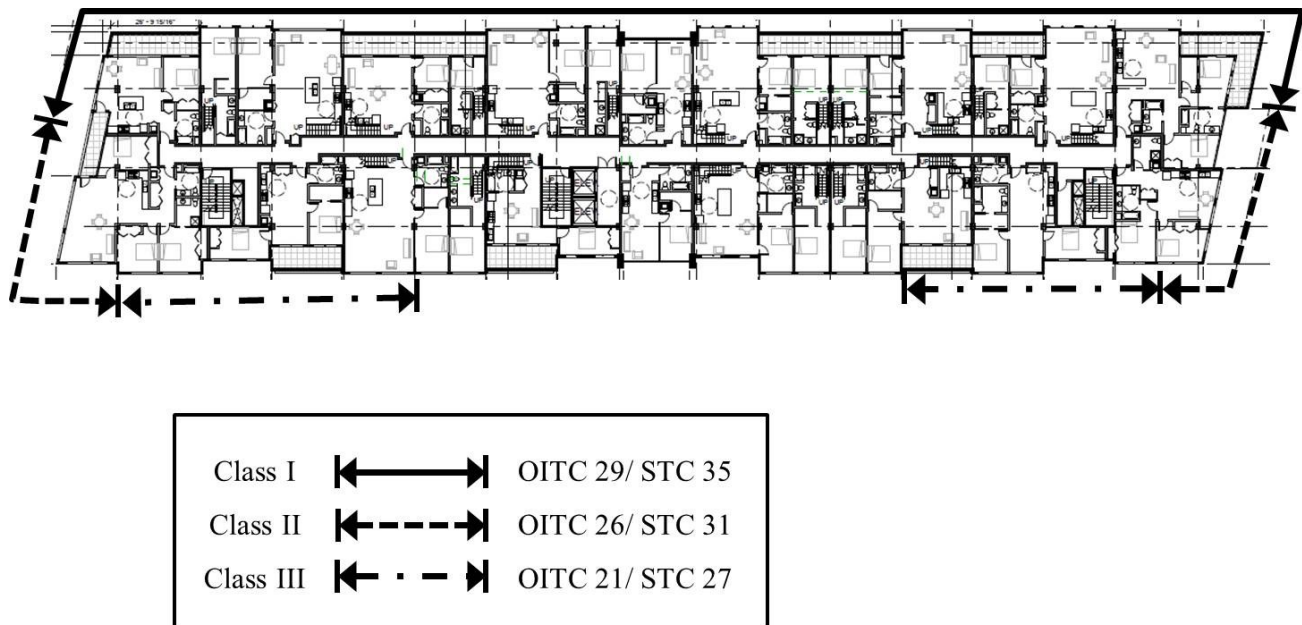


Figure 5: Recommended minimum acoustical rating for windows and balcony doors - Level 4 (preliminary). Rooms with no rating indicated do not require acoustically-rated windows as exterior noise is expected to be within the Normally Acceptable category of up to 59 Ldn

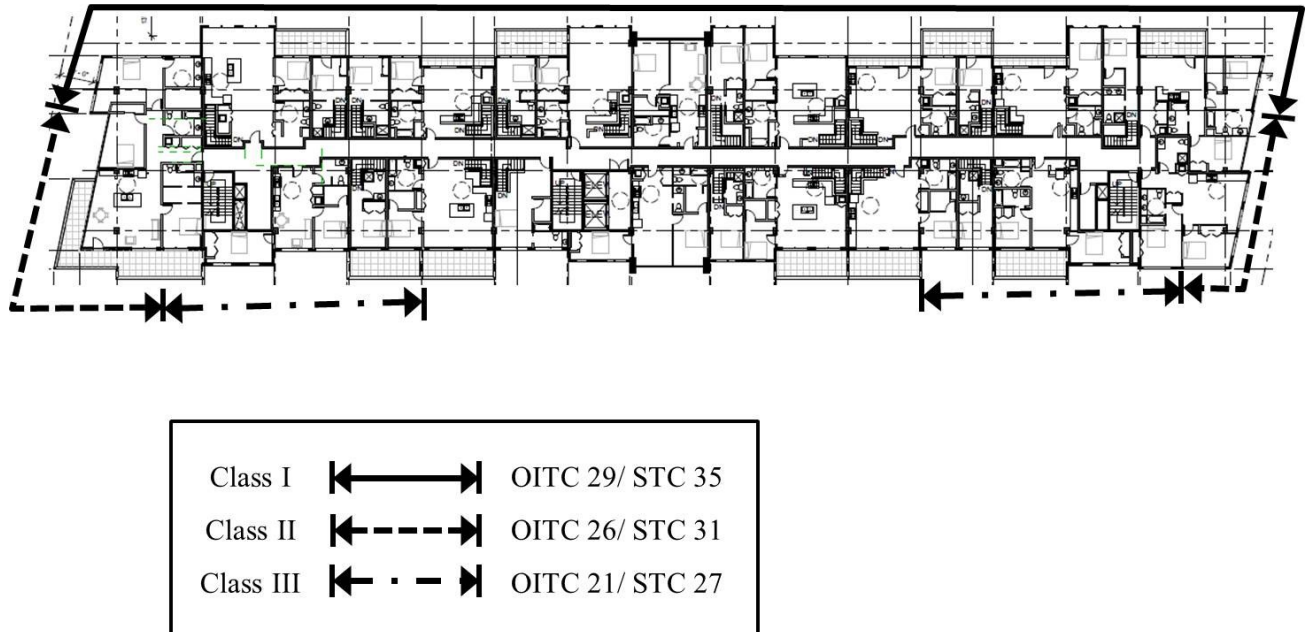


Figure 6: Recommended minimum acoustical rating for windows and balcony doors - Level 5 (preliminary). Rooms with no rating indicated do not require acoustically-rated windows as exterior noise is expected to be within the Normally Acceptable category of up to 59 Ldn

APPENDIX B

Construction Equipment Airborne Noise Predictions

Long-term noise projections for construction equipment have been made using the following formula:

$$\text{SPL} = \text{E.L.} - 20 \log(\text{D}/50) - 10\text{G} \log(\text{D}/50) - A_{\text{shielding}}$$

where:

E.L. = reference equipment noise emission level (based on L_{max} at 50 ft)

D = distance between source and receiver (ft)

G = ground effects constant (zero for acoustically hard ground surface conditions)

$A_{\text{shielding}}$ = attenuation provided by intervening buildings, barriers, etc.

A summary of calculations for the anticipated types of equipment operations is provided below in Table B1. The calculations assume general noise reference levels based on the Federal Highway Administration (FHWA) Roadway Construction Noise Model¹³. No acoustical shielding is assumed in these preliminary projections.

Table B1 Construction Equipment Noise Calculations for Nearest Receptor

Equipment	Reference Level, dBA	Distance to 90 dBA	Nearest Receptor	Horizontal Distance (feet)	Projected L_{max} , dBA
Paver	83 @ 50'	22'	Residential (West)	20 to 140	91
Dump/Haul truck	77 @ 50'	11'	Residential (West)	20 to 140	85
Backhoe	80 @ 50'	16'	Residential (West)	45 to 120	81
Excavator	85 @ 50'	27'	Residential (West)	45 to 120	86
Roller compactor	85 @ 50'	27'	Residential (West)	20 to 120	93
Skip Loader	80 @ 50'	16'	Residential (West)	45 to 120	81
Bolded values indicate potential exceedance over San Mateo's Construction Noise Standards.					

Review of these preliminary calculations indicates that some of the paving and ground compacting work could exceed the 90 dBA L_{max} noise standard at the nearest noise receptor during worst case conditions, when the work is closest to noise sensitive receptors and at ground level. However, this condition is not expected to last for a significant amount of time or occur on a routine basis, hence no additional mitigation is therefore recommended.

¹³ Federal Highway Administration – *FHWA Roadway Construction Noise Model. Final Report* January 2006.

APPENDIX C**Construction Equipment Vibration and Ground-borne Noise Predictions**

Vibration projections for damage to buildings from construction equipment were made using the following formula:

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

where:

PPV_{equip} is the peak particle velocity in in/sec of the equipment adjusted for distance

PPV_{ref} is the reference vibration level in in/sec at 25 feet

D is the distance from the equipment to the receiver

While predictions for human annoyance were made with the following formula:

$$L_v(D) = L_v(25 \text{ ft}) - 30 \log(D/25)$$

where:

$L_v(D)$ = Vibration level at distance D

$L_v(25 \text{ ft})$ = Vibration level at reference distance of 25 ft.

Predictions for ground-borne noise were made with the following formula:

$$L_{\text{GBnoise}} = L_v(D) - 40 \text{ dB (valid for stable alluvial soils)}$$

Table C1 Construction Equipment Vibration Calculations for Nearest Receptor

Equipment	Reference Level PPV/Lv @25'	Nearest Receptor	Horizontal Distance (feet)	Projected PPV	Projected Lv	Projected L_{GBnoise}
Dump/Haul truck	0.076 / 86	Residential (West)	45 to 140	0.06	78 VdB	38 dBA
Backhoe	0.089 / 87	Residential (West)	45 to 120	0.074	79 VdB	39 dBA
Excavator	0.089 / 87	Residential (West)	45 to 120	0.074	79 VdB	39 dBA
Roller compactor (non vibratory)	0.076 / 86	Residential (West)	20 to 120	0.14	89 VdB	48 dBA
Jackhammer	0.035 / 79	Residential (West)	20 to 120	0.06	82 VdB	81 VdB
Bolded values indicate potential exceedance over Criteria.						

Review of these calculations indicate that some of the compacting and possible jackhammering at areas very close to the residential building to the west could exceed annoyance vibration and Groundborne noise criteria. These operations will be related to the paving of the narrow road to be constructed between the two buildings. However, this condition is not expected to last for a significant amount of time or occur on a routine basis, hence no additional mitigation is therefore recommended.