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NOISE ASSESSMENT STUDY

"ONE HAYWARD MIXED-USE"

ONE HAYWARD AVENUE, SAN MATEO

Prepared for
Meridian Investments

Prepared by
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Project No. 52-022-R3

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I. Executive Summary

This report presents the results of a noise assessment study, in compliance with the California Environmental Quality Act, for a planned mixed-use development at 1 Hayward Avenue at El Camino Real in San Mateo, as shown on the Site Plan, Ref. (a). This study includes an analysis of traffic noise impacts to the proposed development site, evaluations of the noise exposures against the standards of the City of San Mateo Noise Element, Ref. (b), and the State of California Code of Regulations, Title 24, Ref. (c). Short-term interior noise levels in the non-residential spaces were evaluated against the standards of the CalGreen Non-Residential Mandatory Measures of Title 24, Ref. (d). Project-generated noise from project traffic and construction were evaluated against the criteria of the California Environmental Quality Act (CEQA), Ref. (e), as administered by the City of San Mateo, and the City of San Mateo Municipal Code Noise Ordinance, Ref. (f).

The following report includes background information on acoustics, noise standards applicable to the project, existing and future noise exposure impacts to the project, analyses of project-generated noise and mitigation measures for noise impacted receptor locations. The results of this study reveal that the noise exposures at the site will be within the Conditionally Acceptable range of the City of San Mateo Noise Element. However, the noise exposures in the common area at the rear of the building will be within the Normally Acceptable range of the standards. The interior noise exposures in the living spaces will exceed the limits of the Noise Element and Title 24 standards. The interior noise levels in the commercial spaces will be within the limits of the CalGreen Non-Residential Mandatory Measures. Project-generated traffic noise impacts and roof-top mechanical equipment will be within the limits of the standards and will be Less-Than-Significant.

Noise mitigation measures for the noise impacted dwelling units will be required. The recommended measures are provided in Section VII of this report. Construction noise and vibration control measures are also provided herein.

Note: The traffic noise measurements were made during the height of the COVID-19 pandemic when traffic volumes were lower than normal. The noise data were adjusted to reflect recent traffic volume data.

In terms of the CEQA compliance checklist, the project results in the following:

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?	Less Than Significant With Mitigation
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	Less Than Significant With Mitigation
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	Less Than Significant
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	Less Then Significant With Mitigation
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?	No impact
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?	No impact

II. Background Information on Acoustics

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing.

Most of the sounds which we hear in our normal environment do not consist of a single frequency, but rather a broad range of frequencies. As humans do not have perfect hearing, environmental sound measuring instruments have an electrical filter built in so that the instrument's detector replicates human hearing. This filter is called the "A-weighting" network and filters out low and very high frequencies. All environmental noise is reported in terms of A-weighted decibels, notated as “dBA”. All sound levels used in this report are A-weighted unless otherwise noted. Table I, below, shows the typical human response and noise sources for A-weighted noise levels.

TABLE I

The A-Weighted Decibel Scale, Human Response, and Common Noise Sources

Noise Level, dBA	Human Response	Noise Source
120-150+	Painfully Loud	Sonic Boom (140 dBA)
100-120	Physical Discomfort	Discotheque (115 dBA) Motorcycle at 20 ft. (110 dBA) Power Mower (100 dBA)
70-100	Annoying	Diesel Pump at 100 ft. (95 dBA) Freight Train at 50 ft. (90 dBA) Food Blender (90 dBA) Jet Plane at 1000 ft. (85 dBA) Freeway at 50 ft. (80 dBA) Alarm Clock (80 dBA)
50-70	Intrusive	Average Traffic at 100 ft. (70 dBA) Vacuum Cleaner (70 dBA) Loud Conversation (60 dBA) Car Passby 15 ft. 10 mph (52-56 dBA)
0-50	Quiet	Normal Conversation (50 dBA) Light Traffic at 100 ft. (45 dBA) Refrigerator (45 dBA) Desktop Computer (40 dBA) Whispering (35 dBA) Leaves Rustling (10 dBA) Threshold of Hearing (0 dBA)

Although the A-weighted noise level may adequately indicate the level of noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a mixture of noise from distant sources that create a relatively steady background noise from which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_1, L_{10}, L_{50} and L_{90} are commonly used. They are the A-weighted noise levels exceeded for 1%, 10%, 50% and 90% of a stated time period. The continuous equivalent-energy level (L_{eq}) is that level of a steady state noise which has the same sound energy as a time-varying noise. It is often considered the average noise level and is used to calculate the Day-Night Levels (DNL) and the Community Noise Equivalent Level (CNEL) described below.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, the Day-Night Level (DNL) noise descriptor was developed. The DNL is also called the L_{dn}. Either is acceptable, however, DNL is more popular worldwide. The DNL divides the 24-hour day into the daytime period of 7:00 a.m. to 10:00 p.m. and the nighttime period of 10:00 p.m. to 7:00 a.m. The nighttime noise levels are penalized by 10 dB to account for the greater sensitivity to noise at night. The Community Noise Equivalent Level (CNEL) is another 24-hour average which includes a 5 dB evening (7:00 p.m. - 10:00 p.m.) penalty and a 10 dB nighttime penalty. Both the DNL and the CNEL average the daytime, evening and nighttime noise levels over a 24-hour period to attain a single digit *noise exposure*. The proper notations for the Day-Night Level and the Community Noise Equivalent Level are dB DNL and dB CNEL, respectively, as they can only be calculated using A-weighted decibels. It is, therefore, considered redundant to notate dB(A) DNL or dB(A) CNEL. Noise exposures are always rounded to the nearest whole number.

The effects of noise on people can be listed in three general categories:

- subjective effects of annoyance, nuisance, dissatisfaction;
- interference with activities such as speech, sleep, learning, relaxing;
- physiological effects such as startling, hearing loss.

The levels associated with environmental noise, in almost every case, produce effects only in the first two categories. Workers in industrial plants, airports, etc., can experience noise in the last category. Unfortunately, there is, as yet, no completely satisfactory way to measure the subjective effects of noise, or of the corresponding reactions of annoyance and dissatisfaction. This is primarily due to the wide variation in individual thresholds of annoyance and differing individual past experiences with noise.

An important way to determine a person's subjective reaction to a new noise is to compare it to the existing environment to which one has adapted, i.e., the "ambient". In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by the listeners.

With regard to increases in A-weighted noise level, the Environmental Protection Agency has determined the following relationships that will be helpful in understanding this report.

- Except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived.
- Outside of the laboratory, a 3 dB change is considered a just-perceptible difference.
- A change in level of at least 5 dB is required before any noticeable change in community response would be expected.
- A 10 dB change is subjectively heard as approximately a doubling in loudness, and would almost certainly cause an adverse change in community response.

The adding or subtracting of sound levels is not simple arithmetic. The sound levels, in decibels, must be converted to Bels, the anti-log's of which are then calculated. The manipulation is then performed (arithmetic addition or subtraction), the logarithm of the sum or difference is calculated. The final number is then multiplied by 10 to convert Bels to decibels. The formula for adding decibels is as follows:

$$Sum = 10\log(10^{SL/10} + 10^{SL/10})$$ where, SL is the Sound Level in decibels.

For example, 60 dB + 60 dB = 63 dB, and 60 dB + 50 dB = 60 dB. Two sound sources of the same level are barely noisier than just one of the sources by itself. When one source is 10 dB higher than the other, the less noisy source does not add to the noisier source.

III. Noise Standards, Goals & Policies

A. City of San Mateo General Plan

The noise assessment results presented in the findings were evaluated against the standards of the City of San Mateo Noise Element, which utilize the Day-Night Level (DNL/L_{dn}) descriptor. The noise standards, goals and policies of the Noise Element are shown below.

GOAL 1: Protect "noise sensitive" land uses from excessive noise levels.

POLICIES:

N 1.1: Interior Noise Levels 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 (L_{dn}) or above, as shown on Figure N-1. The maximum interior noise level shall net exceed 45 dB (L_{dn}) in any habitable rooms.

(Tables N-1and N-2 and Figure N-1 are not shown in this report)

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 (L_{dn}) or above, as shown on Figure N-1. Require an acoustical analysis that uses the peak hour L_{eq} for new parks and play areas. Incorporate necessary mitigation measures into residential project design to minimize common open space noise levels. Maximum exterior noise should not exceed 67 dB (L_{dn}) for residential uses and should not exceed 65 dB (L_{eq}) during the noisiest hour for the public park 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.

Most of San Mateo has existing noise levels that exceed the normally acceptable levels for "noise –sensitive" uses. Since the majority of the City is within the "conditionally acceptable" range of between 60 dB and 70 dB (L_{dn}), some form of noise mitigation will have to be incorporated into building and site design for new "noise-sensitive" land uses. While the State currently requires that multi-family dwellings in areas exceeding 60 dB (L_{dn}) incorporate mitigation measures to achieve an interior sound level of 45 dB (L_{dn}), the City of San Mateo will extend this requirement to single-family dwellings. In most cases, the necessary sound attenuation can be accomplished with sound-rated double-pane windows.

A few of San Mateo's residential neighborhoods that border highways, El Camino Real (SR 82), and the railway line are subject to sound levels exceeding 70 dB (L_{dn}), which is the "normally unacceptable" range for "noise-sensitive" uses. Rather than precluding new residential development in these areas, the City will require that building construction techniques be utilized that reduce interior sound to 45 dB (L_{dn}) or less (sic).

B. State of California Code of Regulations, Title 24

The State of California Code of Regulations, Title 24 (CBC) standards use the DNL descriptor (to be consistent with local standards) and specify an interior noise exposure limit in living spaces of multi-family housing to 45 dB DNL from exterior noise sources. This standard is the same as the City of San Mateo Noise Element standard described above.

The Title 24 standards also specify minimum sound insulation ratings for common partitions separating different dwelling units and dwelling units from interior common spaces. The standards specify that common walls must have a design Sound Transmission Class (STC) rating of 50 or higher. Common floor/ceiling assemblies must have design STC ratings of 50 or higher and Impact Insulation Class (IIC) ratings of 50 or higher. As the design details of the common interior partitions were not available at the time of this study, an evaluation of the interior partitions has not been performed.

The noise exposures shown in this study are without the application of mitigation measures and represent the noise environment for current, existing and future project site conditions.

C. California Environmental Quality Act (CEQA)

Environmental noise exposure changes due to aspects of the project were evaluated against the guidelines of the California Environmental Quality Act (CEQA). CEQA does not limit noise levels or noise exposures nor does it quantify noise exposure or noise level increases over the ambient to define noise impacts. CEQA evaluates a project as a significant noise impact if it "...caused a substantial increases in the ambient noise levels...". The quantification of the threshold of significance is left up to the local jurisdiction. The City of San Mateo, however, does not provide a threshold of significance in the General Plan. Therefore, for the purposes of this study, thresholds of significance used by many other local jurisdictions are recommended for adoption for this project. The thresholds of significance shall be applied at the existing residential areas along El Camino Real and Hayward Avenue.

These thresholds are:

(a) causing the DNL in existing residential areas to increase by 5 dB or more and remain below 60 dB DNL;

(b) causing the DNL in existing residential areas to increase by 3 dB or more and, thereby, exceed 60 dB DNL;

(c) causing the DNL in existing residential areas to increase by 1 dB or more if the current noise exposure exceeds 60 dB DNL.

If the project causes any of the above three criteria to occur, the project will be considered a significant noise impact to the areas where it occurs and mitigation measures will be required.

D. City of San Mateo Noise Ordinance

The following is the portion of the City of San Mateo Noise Ordinance Title 7 of the City of San Mateo Municipal Code - Health, Sanitation and Public Nuisances, Chapter 7.30, which is pertinent to the planned project. These noise limits, which are applied to the project-generated noise from mechanical equipment and construction, are based on the type of land use – in this case, mixed-use, designated as Noise Zone 2.

7.30.030 DESIGNATED NOISE ZONES.

The properties hereinafter described are hereby assigned the following noise zones:

Noise Zone 1. All property in any single family residential zone (including adjacent parks and open space) as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.

Noise Zone 2. All property in any commercial/mixed residential, multi-family residential, specific plan district or PUD as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.

Noise Zone 3. All property in any commercial or central business district as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.

Noise Zone 4. All property in any manufacturing or industrial zone as designated on the City's zoning map prepared pursuant to the provisions of Title 27, or any revisions thereto.

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 30 minutes in any hour;

(2) The noise level standard plus five dB for a cumulative period of more than 15 minutes in any hour;

(3) The noise level standard plus 10 dB for a cumulative period of more than five minutes in any hour;

(4) The noise level standard plus 15 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 20 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.

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.

7.30.060 SPECIAL PROVISIONS

Paragraphs (a)-(d) apply to sound performance, vehicles, alarms and emergencies and are not applicable to this project and are omitted for the sake of brevity.

(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 nine 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 90 dB at a distance of 25 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 25 feet from the equipment as possible.

(2) The noise level at any point outside of the property plane of the project shall not exceed 90 dB.

(3) The operation of leaf blowers shall additionally comply with Chapter 10.80, Operation of Leaf Blowers.

E. CalGreen Non-Residential Mandatory Measures

The CalGreen Non-Residential Mandatory Measures, which are part of Title 24, are applied to the commercial units of the project. Section 5.507 "Environmental Comfort" contains two methods for determining the interior noise levels. These methods impose different interior noise level requirements. When on-site noise level data are available, the "Performance Method" is used. The standards are outlined below.

5.507.4 Acoustical control. Employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E90 and ASTM E413 or Outdoor-Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E1332, using either the prescriptive or performance method in Section 5.507.4.1 or 5.507.4.2.

5.507.4 Exterior noise transmission. Wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 in the following locations:

Within the 65 CNEL noise contour of an airport

Exceptions:

1. L_{dn} or CNEL for military airports shall be determined by the facility Air Installation Compatible Land Use Zone (AICUZ) plan.

2. L_{dn} or CNEL for other airports and heliports for which a land use plan that has not been developed shall be determined by the local general plan noise element.

3. Within the 65 CNEL or Ldn noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway notice source as determined by the Noise Element of the General Plan.

5.507.4.1.1 Noise exposure where noise contours are not readily available. Buildings exposed to a noise level of 65 dB L_{eq}-1-hr during any hour of operation shall have building, addition or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).

5.507.4.2 Performance method. For buildings located as defined in Section 5.507.4.1 or 5.507.4.1.1, wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (Leq-1Hr) of 50 dBA in occupied areas during any hours of operations

5.507.4.2.1 Site features. Exterior features such as sound walls or earth berms may be utilized as appropriate to the building, addition or alteration project to mitigate sound migration to the interior.

5.507.4.2.2 Documentation of compliance. An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.

5.507.4.3 Interior sound transmission. Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

As noise level data for the site are available, the Performance Method of the CalGreen standards is used in this study.

IV. Acoustical Setting

A. Site and Traffic Descriptions

The planned development site is an approximate 0.29 acre parcel located at One Hayward Avenue at the northwest corner of El Camino Real in San Mateo. Currently, the site contains three duplex residential buildings and businesses. The site is relatively flat and at-grade with the surrounding roadways and land uses. Surrounding land uses include multi-family residential adjacent to the northeast and across Hayward Avenue to the southeast, St. Matthew Elementary School across El Camino Real to the southwest and a medical office building adjacent to the northwest.

The on-site noise environment is controlled primarily by traffic sources on El Camino Real, which carried an Average Daily Traffic (ADT) volume of approximately 24,720 vehicles, as determined by manual traffic counts made during the PM peak hour during the peak of COVID-19. The existing (2021) traffic volume, which is the most recent traffic datum available, indicates that the normal (non-COVID -19) volume is 35,230 vehicles ADT, as reported by AECOM, Ref. (g). The difference in the noise levels between last year's COVID-19 scenario and the current condition is 1.5 decibels.

B. Project Description

The planned project includes the construction of a four story building with below grade parking. The first floor will consist of office space. Eighteen residential units will be location on the second, third and fourth floors. Balconies will be provided for some of the dwelling units. The common exterior living or open space area is along the rear of the building extending from the stairwells at the west end to the bicycle rack toward the east end. The Site Plan is shown in Figure 1 on page 16.

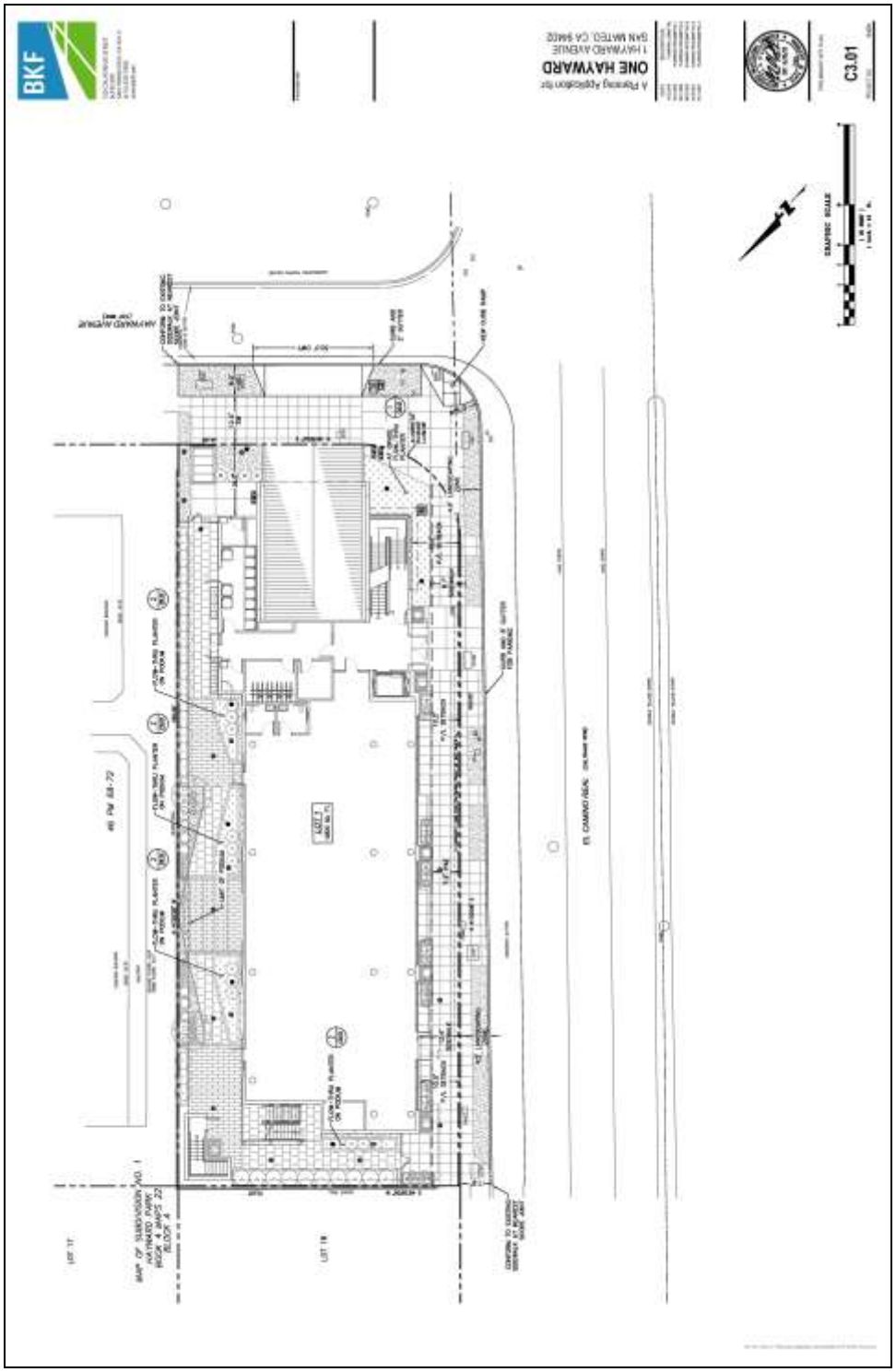

FIGURE 1 – Site Plan

V. Noise Impacts to the Project

A. COVID-19 Scenario Noise Levels

To determine the existing noise environment at the site, continuous recordings of the sound levels were made a location 51 ft. from the centerline of El Camino Real in the front yard of one of the existing homes on the site. The sound meter was placed on a sign at an elevation of 13 ft. above the ground for security of the sound measuring equipment. The noise measurement location is shown on Figure 2 on page 18. The measurements were made on August 26-27, 2020 for a continuous period of 24 hours and included representative hours during the daytime and nighttime periods of the DNL index. The noise level data were acquired using a Larson-Davis Model 812 Precision Integrating Sound Level Meter. The meter yields, by direct readout, a series of descriptors of the sound levels versus time, which are commonly used to describe community noise, as described in Appendix B. The measured descriptors include the L_1, L_{10}, L_{50}, and L_{90}, i.e., those levels exceeded 1%, 10%, 50% and 90% of the time. Also measured were the maximum and minimum levels and the continuous equivalent-energy levels (L_{eq}), which are used to calculate the DNL. The results of the measurements are shown in the data tables in Appendix C.

As shown in the data table, the L_{eq}'s at the time of the measurements at 51 ft. from the centerline of El Camino Real ranged from 61.8 to 72.3 dBA during the daytime and from 52.5 to 64.3 dBA at night.

Traffic noise diminishes at the rate of 3 to 6 decibels for every doubling of the distance from the source to the receiver. Thus, locations on the project at greater distances from El Camino Real will have lower noise levels.

FIGURE 2 - Noise Level Measurement Location

B. <u>Existing and Future Noise Levels</u>

As the traffic volume during last year's COVID-19 measurements was lower than the normal existing 2021 volume, the noise measurement data were adjusted upward to reflect the current existing traffic conditions. The traffic volume counted during the noise measurement period indicates that the traffic volume at that time was 24,720 vehicles ADT. The current traffic volume is 35,230 vehicles ADT. Thus, the current noise levels are 1.5 dB higher that those measured in 2020.

$10\log_{10}(35{,}230/24{,}720) = 1.5$ dB.

The future traffic volume for El Camino Real was provided by AECOM, which indicates cumulative traffic volume of 42,050 vehicles ADT. As the traffic volume during the noise measurement period was 24,720 vehicles ADT, the future noise levels will be 2.3 decibels higher than the measured noise levels. The future traffic noise increase over the existing condition volume of 35,230 vehicles ADT is 0.8 decibels.

$10\log_{10}(42{,}050/24{,}720) = 2.3$

$10\log_{10}(42{,}050/35{,}230) = 0.8$

C. Exterior Noise Exposures

The DNL for the survey location was calculated by decibel averaging of the L_{eq}'s as they apply to the daily time periods of the DNL index. The DNL is a 24-hour noise descriptor that uses the measured L_{eq} values to calculate a 24-hour time-weighted average noise exposure. The formula used to calculate the DNL is described in Appendix B. Adjustments were applied to the measured noise levels to account for the various setback distances from the measurement locations using methods established by the Highway Research Board, Ref. (h). As shown in subsection B, the noise levels under existing (2021) traffic conditions are 1.5 dB higher than the noise levels measured in 2020 during the height of the COVID-19 pandemic. This increase in the hourly average noise levels also extends to the 24-hour average DNL value. Likewise, the future traffic noise exposure will increase with the increases in the short term noise levels.

- The exterior noise exposure at the most noise impacted planned building setback, 60 ft. from the centerline of El Camino Real under existing 2021 conditions, is 69 dB DNL. Under future cumulative traffic conditions, the noise exposure is expected to increase to 70 dB DNL.

- The exterior noise exposure at the most noise impacted planned location of the common open space near the west end stairwells will be up to 55 and 56 dB DNL under existing 2021 and future cumulative traffic conditions, respectively. This area is 137 ft. from the centerline of El Camino Real along an angled line-of-sight past the westerly corners of the building. These noise exposures also include a 6 decibel reduction factor provided by the 6 ft. high property line barrier along the westerly property line.

- As the exterior noise exposures in the common open space will be within the 60 dB DNL limit of the standards, noise mitigation measures for the exterior area will not be required.

D. Interior Noise Exposures

To evaluate the interior noise exposures in the project living spaces, a 15 dB reduction was applied to the exterior noise exposure to represent the attenuation provided by the building shell under an *annual-average* condition. The annual average condition assumes that standard dual-pane thermal insulating windows are installed and are kept open up to 50% of the time for natural ventilation.

- The interior noise exposures in the most noise impacted living spaces will be up to 54 and 55 dB DNL under existing and future traffic conditions, respectively. Thus, the noise exposures will be up to 10 dB in excess of the limits of the City of San Mateo Noise Element and Title 24 standards.

As the noise exposures will exceed the 45 dB DNL limit of the City of San Mateo Noise Element and Title 24 standards, noise reduction measures for the interior living spaces will be required. The recommended measures are provided in Section VII of this report.

E. Exterior and Interior Noise Levels (CalGreen)

The 2020 (COVID-19 scenario) exterior hourly average noise levels at the planned setback of the office space of the project ranged from 52.5 to 72.4 dBA $L_{eq(h)}$ over the course of the 24 hour day. Adjusting the measured noise levels up by 1.5 dB to account for the increase in the noise levels under normal non-COVID-19 conditions, the hourly average noise levels are 54.0 to 73.9 dBA $L_{eq(h)}$. Under future traffic conditions, the noise levels are expected to increase by 0.81 dB to 54.8 to 74.7 dBA $L_{eq(h)}$. At the planned building setback of 60 ft. from the centerline of the road, the noise levels reduce by 1.1 dB to 53.7 to 73.6 dBA $L_{eq(h)}$.

The projected interior noise levels were calculated by subtracting 25 dB from the exterior noise levels at the planned setback of the non-residential spaces to account for the building shell attenuation under standard commercial construction.

The COVID-19 scenario noise levels measured at the measurement location, the current noise levels, the noise levels under future traffic conditions, the noise levels calculated for the setback of the office spaces and the interior noise levels in the offices spaces are shown in Table II, below.

TABLE II

CalGreen Non-Residential Mandatory Measures
Hourly Average Noise Levels, dBA Leq(h)

TIME	Exterior Measured	COVID 19 Adjusted	Exterior Future	Exterior @ Setback	Interior
7:00 AM	62.6	64.1	64.9	63.8	38.8
8:00 AM	63.1	64.6	65.4	64.3	39.3
9:00 AM	61.8	63.3	64.1	63.0	38.0
10:00 AM	72.3	73.9	74.7	73.6	48.6
11:00 AM	63.6	65.1	65.9	64.8	39.8
12:00 PM	67.8	69.3	70.1	69.0	44.0
1:00 PM	68.4	69.9	70.7	69.6	44.6
2:00 PM	69.0	70.5	71.3	70.2	45.2
3:00 PM	69.4	70.9	71.7	70.6	45.6
4:00 PM	69.6	71.1	71.9	70.8	45.8
5:00 PM	69.3	70.8	71.6	70.5	45.5
6:00 PM	70.8	72.3	73.1	72.0	47.0
7:00 PM	72.4	73.9	74.7	73.6	48.6
8:00 PM	68.8	70.3	71.1	70.0	45.0
9:00 PM	66.2	67.7	68.5	67.4	42.4
10:00 PM	64.3	65.8	66.6	65.5	40.5
11:00 PM	60.8	62.3	63.1	62.0	37.0
12:00 AM	57.6	59.1	59.9	58.8	33.8
1:00 AM	53.4	54.9	55.7	54.6	29.6
2:00 AM	52.5	54.0	54.8	53.7	28.7
3:00 AM	54.5	56.0	56.8	55.7	30.7
4:00 AM	55.8	57.3	58.1	57.0	32.0
5:00 AM	57.1	58.6	59.4	58.3	33.3
6:00 AM	61.3	62.8	63.6	62.5	37.5

Highest and Lowest Values

The interior hourly average noise levels under the worst-case future traffic scenario were calculated to range from 28.7 to 48.6 dBA. Thus, the interior noise levels will be within the 50 dBA $L_{eq(h)}$ limit of the CalGreen Non-Residential Mandatory Measures for the office spaces. Noise mitigation measures for the office spaces will not be required.

VI. Project-Generated Noise Impacts

Project-generated noise from this type of mixed-use development would be limited to project traffic and mechanical equipment

A. Project Traffic

Project traffic volumes were provided by AECOM. The impact of project-generated traffic noise is calculated by comparing the existing + project traffic volume to the existing traffic volume using the formula:

$\Delta dB = 10\log_{10}(V_1/V_2)$ where, V_1 = existing + project and V_2 = existing.

El Camino Real

The existing traffic volume for El Camino Real is 35,230 vehicles ADT.
The project traffic volume is 90 vehicles ADT.
The existing + project traffic volume is 35,320 vehicles ADT.

The increase in the noise environment along El Camino Real due to the project is 0.01 decibels, which is negligible.

Hayward Avenue

The existing traffic volume for Hayward Avenue is 540 vehicles ADT.
The project traffic volume is 140 vehicles ADT.
The existing + project traffic volume is 680 vehicles ADT.

The increase in the noise environment along Hayward Avenue due to the project is 1.0 decibels. The increase in traffic along Hayward Avenue due to the project will be within the "existing +2 decibel" limit of the CEQA policies as administered by the City of San Mateo. The project-generated noise impact will be Less Than Significant.

B. Project Mechanical Equipment

The planned roof-top air-conditioners have not been specified. The project dwelling units will range 640 sq. ft. to 890 sq. ft. Using a standard rule-of-thumb of 1-ton of cooling per 500-600 sq. ft., the roof-top AC units are likely to be 1-1/2 to 2-ton units. Common 1-1/2-ton and 2-ton air-conditioning condensing units or heat pumps will generate an A-weighted sound power level (L_{wa}) of up to 76 dB, such as the Ruud RA14**W series, the Carrier 24ACA4 series or the Bryant 284ANV series. The reference sound data for the Carrier unit is provided in Appendix C. The Roof Plan shows 12 air-conditioners in a straight row along the long axis of the building 16 ft. from the north parapet. There will be three air-conditioners perpendicular to the north parapet toward the easterly end of the building.

The most noise impacted receiver location in this analysis is a person standing on the third floor balcony of the residential development adjacent to the north directly across from the approximate center of the planned project building where there is the most exposure to the roof-top air-conditioners. The residential receiver elevation (ear height) is 58.58 ft.

The building roof elevation is 44.75 ft. with a parapet height of 46.75ft. The noise source height is 3.4 ft. (assuming horizontally mounted fans on the AC units).

The mechanical equipment sound levels at the receiver location were calculated using an attenuation rate of $L_{wa} - 11 + 20\log10(5/r)$, where r = distance from the air-conditioner to the receiver.

A noise barrier Insertion Loss (IL) is determined by the difference in sound path length from the straight line distance from the source to the receiver and the sound path created from the source to the top of the barrier then to the receiver. The difference is sound path length is designated as “d”.

The amount of sound reduction is frequency dependent and is calculated using the Fresnel diffraction equation:

Sound Reduction or Insertion Loss = $10\log_{10}(3+10(2f/c)(d)$ where, f = frequency (octave bands are adequate for air-conditioner noise), c = speed of sound in air (1,128 ft./sec.) and d = sound path length difference.

Table III on page 26 provides the analysis of the roof-top mechanical equipment. Shown in the Table are the assumed sound power level, the distance from the center of air-conditioner to the parapet wall, the distance from the parapet to the most impacted residential receiver location, the A-weighted sound pressure level at 5 ft., the sound level at the residential receiver location without the barrier adjustment, the amount of sound reduction provided by the parapet and the final sound level at the residential receiver location. The combined sound level of all air-conditioners in operation simultaneously is shown in the black cell.

As shown in Table III, the project-generated noise levels will be up to 46 dBA at the most noise impacted residential receiver location adjacent to the project. Thus, the noise levels will be within the 55 dBA limit of the City of San Mateo Noise Ordinance. Noise mitigation measures for project-generated mechanical equipment noise will not be required.

TABLE III								
Mechanical Equpment Analysis, dBA								
Limit = 55 dBA								
	Rated	Distance	Dist	Dist	Sound Level	Sound Level	Barrier	Final
	Lwa	AC to Parapet	Parapet to Rec.	AC to Rec.	@ 5 ft.	@ Receiver	Reduction	Sound Level
1	76	27	45	72	65	42	9	33
2	76	27	41	68	65	42	9	33
3	76	25	38	63	65	43	10	33
4	76	21	34	55	65	44	10	34
5	76	24	32	56	65	44	10	34
6	76	18	30	48	65	45	10	35
7	76	17	27	44	65	46	11	36
8	76	16	26	42	65	47	11	36
9	76	16	26	42	65	47	11	36
10	76	16	27	43	65	46	11	36
11	76	17	29	46	65	46	10	35
12	76	18	30	48	65	45	10	35
13	76	17	44	61	65	43	9	34
14	76	29	40	69	65	42	8	34
15	76	37	37	74	65	42	8	33
							TOTAL	46

C. Construction Phase Impacts

Short-term noise impacts may be created during demolition of the existing structures on the site and construction of the project. Demolition and construction equipment are typically similar, with the exception of paving equipment and pile drivers (impact hammers). However, pile driving is not expected on this project. The noise levels generated by the two phases will be similar over the course of entire process. With the exception of pile driving, blasting, vibratory compacting or rolling, construction equipment expected to be used on the site generates groundborne vibration level lower than 0.02 in/sec. peak particle velocity (ppv) at distances greater than 13 ft. The nearest structures are 10 ft. to the northeast, 130 ft. to the southeast, 131 ft. to the southwest and 78 ft. to the northwest.

Table 7.1 from the Federal Transit Administration (FTA) construction noise and vibration study, Ref. (i), showing standard construction equipment noise levels at a distance of 50 ft. is provided on page 27. At a distance of 25 ft., the equipment noise levels presented in the Table are increased by 6 decibels, to range from 82 to 107 dBA. From the information provided in the Table, items of equipment shown to produce a noise level of 84 dBA or higher would be restricted from use on the site. Much of the equipment necessary to construct a residential building exceed the 90 dBA @ 25 ft. limit of the City of San Mateo Noise Ordinance.

Table 7-1 Construction Equipment Noise Emission Levels *

Equipment	Typical Noise Level 50 ft. from Source, dBA
Air Compressor	80
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	82
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	80
Paver	85
Pile-driver (Impact)	101
Pile-driver (Sonic)	95
Pneumatic Tool	85
Pump	77
Rail Saw	90
Rock Drill	95
Roller	85
Saw	76
Scarifier	83
Scraper	85
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	84

**This Table is copied from the FTA Transit Noise and Vibration Impact Assessment Manual, pg. 176.

Tables IV-A and IV-B on page 29 provide a list of construction equipment with their sound levels at a reference distance of 50 ft., their sound levels at a distance of 25 ft. and the distance at which the equipment reaches 90 dBA. Also shown are the maximum, hourly average and average DNL noise levels. The noise limit of the City of San Mateo Noise Ordinance will be exceeded at distances closer that those shown in the shaded column for that particular item of equipment, activity or operation.

Due to the close proximity of the site with construction operations as close as 13 ft. from the residential building to the northeast, which is 131 ft. from the centerline of El Camino Real, the noise exposure due to construction of the project is likely to add 1 decibel to the existing noise environment at the adjacent residential building.

The existing noise exposure at the residential building to the northeast was calculated to the 64 dB DNL. With the expected construction noise exposure of up to 58 dB DNL, the combined noise exposure could be up to 65 dB DNL.

The noise exposure due to construction activity could result in a Significant Noise Impact. Thus, noise control measures to reduce the construction noise exposure to no more than 54 dB DNL where it would no longer add to the existing noise environment, are recommended. The recommended measures are described in Section VII of this report.

TABLE IV-A

Project-Generated Construction Noise Levels, dBA

						Residential PL Northeast		Residential PL Southeast	
	Reference		Sound Level	Distance at	40% usage	Near Dist. = 1 ft.	Far Dist. = 76 ft.	Near Dist. = 100 ft.	Far Dist. = 305 ft.
Equipment	Level	Dist., ft.	25 ft.	90 dBA	Leq(h) @ 25 ft.	Sound Level Range		Sound Level Range	
Paving Machine	85	50	**91**	56	73	**119**	81	61	52
Water Truck	84	50	90	50	72	**118**	80	60	51
Compactive Rollers	85	50	**91**	56	73	**119**	81	61	52
Scrapers	85	50	**91**	56	73	**119**	81	61	52
Graders	83	50	89	45	71	**117**	79	59	50
Wheel Loader	80	50	86	32	68	**114**	76	56	47
Track Loader	85	50	**91**	56	73	**119**	81	61	52
Backhoe	80	50	86	32	68	**114**	76	56	47
Bulldozer	85	50	**91**	56	73	**119**	81	61	52
Haul Trucks	84	50	90	50	72	**118**	80	60	51
Crane	83	50	89	45	71	**117**	79	59	50
Excavator	85	50	**91**	56	73	**119**	81	61	52
Skid Steer	78	50	74	8	56	**102**	64	44	35
Air Compressor	80	50	86	32	68	**114**	76	56	47
Generator	82	50	88	40	70	**116**	78	58	49
Jackhammer	88	50	**94**	76	76	**122**	84	64	54
Air Tools	78	85	89	43	71	**117**	79	59	49
Pumps	77	50	83	22	65	**111**	73	53	44
Nail Gun	81	50	87	35	69	**115**	77	57	48
						DNL	**58**	**DNL**	**45**

TABLE IV-B

Project-Generated Construction Noise Levels, dBA

						Commercial PL Northwest		School PL Southwest	
	Reference		Sound Level	Distance at	40% usage	Near Dist. = 1 ft.	Far Dist. = 205 ft.	Near Dist. = 97 ft.	Far Dist. = 170 ft.
Equipment	Level	Dist., ft.	25 ft.	90 dBA	Leq(h) @ 25 ft.	Sound Level Range		Sound Level Range	
Paving Machine	85	50	**91**	56	73	**119**	73	61	57
Water Truck	84	50	90	50	72	**118**	72	60	56
Compactive Rollers	85	50	**91**	56	73	**119**	73	61	57
Scrapers	85	50	**91**	56	73	**119**	73	61	57
Graders	83	50	89	45	71	**117**	71	59	55
Wheel Loader	80	50	86	32	68	**114**	68	56	52
Track Loader	85	50	**91**	56	73	**119**	73	61	57
Backhoe	80	50	86	32	68	**114**	68	56	52
Bulldozer	85	50	**91**	56	73	**119**	73	61	57
Haul Trucks	84	50	90	50	72	**118**	72	60	56
Crane	83	50	89	45	71	**117**	71	59	55
Excavator	85	50	**91**	56	73	**119**	73	61	57
Skid Steer	78	50	74	8	56	**102**	56	44	40
Air Compressor	80	50	86	32	68	**114**	68	56	52
Generator	82	50	88	40	70	**116**	70	58	54
Jackhammer	88	50	**94**	76	76	**122**	75	64	59
Air Tools	78	85	89	43	71	**117**	70	59	54
Pumps	77	50	83	22	65	**111**	65	53	49
Nail Gun	81	50	87	35	69	**115**	69	57	53
						DNL	**50**	**DNL**	**50**

Table V, below, provides the noise levels and noise exposures at the most impacted adjacent land uses under a worst-case scenario if equipment operates right up to the property lines.

TABLE V			
Construction Noise Levels			
Location	L_{max}	L_{eq}	DNL
Northeast Residential	64-119 dBA	52-72 dBA	41-61 dB
Southeast Residential	35-61 dBA	39-49 dBA	28-48 dB
Northwest Commercial	56-119 dBA	47-64 dBA	36-53 dB
Southwest School	40-61 dBA	44-64 dBA	33-53 dB

The construction noise levels will exceed the limits of the City of San Mateo Noise Ordinance limit for equipment noise levels.

Demolition and construction activities can produce varying amounts of ground-borne vibration, which depend on the type of equipment used and various methods. Vibration is produced by the equipment operation and the vibrational waves travel through the ground/soil that diminishes over distance. It is rare that construction vibration is intense enough to cause damage to existing structures. However, due to the close proximity of the neighbors to the northeast, a quantitative analysis of vibration is warranted.

Ground-borne vibration is typically reported in terms of “peak particle velocity” or PPV, and sometimes reported in terms of decibels of vibration, notated as VdB, which is a level of vibration (L_v). The use of PPV is more common for construction equipment and methods.

Table VI on the following page provides building damage criteria from construction vibration established by the Federal Transit Administration, Ref. (f).

TABLE VI		
Construction Vibration Damage Criteria		
Building Category	PPV (in/sec)	Approx. L_v (VdB)
I. Reinforced-concrete, steel or timber (no plaster)	0.50	102
II. Engineered concrete and masonry (no plaster)	0.30	98
III. Non-engineered timber and masonry buildings	0.20	94
IV. Buildings extremely susceptible to vibration damage	0.12	90
** RMS velocity in decibels (VdB) re: 1 micro-inch/second		

The adjacent residential building to the northeast is a large, 3-story wood framed structure over a concrete podium with a parking garage below. This building is 10 ft. from the site property line.

The building across Hayward Avenue is similar to the building adjacent to the northeast except it has four floors of residential spaces. This building is located 130 ft. from the site property line.

The commercial building to the northwest is stucco sided building most likely metal frame and is 78 ft. from the site property line.

The buildings across El Camino Real are older, stucco/plaster sided structures. The nearest building is 131 ft. from the site property line.

These structures to the northwest and southwest fall into Building Category III where the vibration limit is 0.20 in/sec PPV. The buildings to the northeast and southeast fall under Category 1 where the vibration limit is 0.5 in./sec. PPV. There are no buildings adjacent to or near the site that would fall under Categories II or IV.

The contractors used for the demolition of the site and construction of the project have not yet been selected, nor has a construction schedule and list of equipment been developed. Table VII on page 33 provides a list of typical construction equipment, some of which will likely not be used on this project, such as pile driving, their vibration levels at 25 ft., and the vibration levels at the building setback of the closest residence or commercial use to the northeast, southeast, southwest and northwest. Also shown are the distances each item of equipment must stay away from the respective adjacent structures to limit the vibration levels to no more than 0.20 in/sec. at the vibration sensitive buildings and to no more than 0.50 in./sec. at the large residential buildings..

As shown in Table VII, the equipment expected to be used on this project could generate ground-borne vibration levels in excess of the 0.20 in/sec criterion, as shown by the **RED** text. **This is a potentially significant temporary impact.**

Noise and vibration mitigation measures are recommended to minimize potential noise and vibration impacts from construction associated with the project.

TABLE VII

Construction Equipment Vibration Levels, in/sec PPV

Dist. to Res. To Northeast, ft.	13
Dist to Res. To Southeast, ft.	130
Dist. to School To Southwest, ft.	131
Dist to Comm. to Northwest, ft.	78

EQUIPMENT d =	Reference Vibration at d, ft. 25	Dist for 0.50 PPV limit	Dist for 0.20 PPV limit	Vibration Level @ Residence to Northeast (0.50 PPV)	Vibration Level @ Residence to Southeast (0.50 PPV)	Vibration Level @ School to Southwest (0.20 PPV)	Vibration Level @ Commercial to Northwest (0.20 PPV)
Excavator	0.089	8	15	0.24	0.01	0.01	0.02
Vibratory Roller	0.210	14	26	**0.56**	0.02	0.02	0.04
Hoe Ram	0.089	8	15	0.24	0.01	0.01	0.02
Large Bulldozer	0.089	8	15	0.24	0.01	0.01	0.02
Loaded Trucks	0.076	7	13	0.20	0.01	0.01	0.01
Jackhammer	0.035	4	8	0.09	0.00	0.00	0.01
Small Bulldozer	0.003	1	2	0.01	0.00	0.00	0.00
Backhoe	0.088	8	14	0.23	0.01	0.01	0.02
Compactor	0.240	15	28	**0.64**	0.02	0.02	0.04
concrete Mixer	0.080	7	14	0.21	0.01	0.01	0.01
Concrete Pump	0.080	7	14	0.21	0.01	0.01	0.01
Crane	0.008	2	3	0.02	0.00	0.00	0.00
Dump Truck	0.080	7	14	0.21	0.01	0.01	0.01
Front End Loader	0.088	8	14	0.23	0.01	0.01	0.02
Grader	0.088	8	14	0.23	0.01	0.01	0.02
Hydra Break Ram*	0.040	5	9	0.11	0.00	0.00	0.01
Soil Sampling Rig	0.088	8	14	0.23	0.01	0.01	0.02
Paver	0.080	7	14	0.21	0.01	0.01	0.01
Pickup Truck	0.080	7	14	0.21	0.01	0.01	0.01
Slurry Trenching	0.016	3	5	0.04	0.00	0.00	0.00
Tractor	0.080	7	14	0.21	0.01	0.01	0.01
Vibratory Roller (lge)	0.477	24	45	**1.27**	0.04	0.04	0.09
Vibratory Roller (sm)	0.176	12	23	0.47	0.01	0.01	0.03
Clam Shovel*	0.208	14	26	**0.55**	0.02	0.02	0.04
Rock Drill	0.088	8	14	0.23	0.01	0.01	0.02

* Transient vibration levels

VII. Mitigation Measures

A. Traffic Noise Impacts to the Project - Interior

To achieve compliance with the 45 dB DNL limits of the City of San Mateo Noise Element and Title 24, the following window controls will be required. In addition, general building shell controls are also recommended, as described in Appendix B.

- Maintained closed at all times all windows and glass doors of living spaces with a direct or side view of El Camino Real (southeast, southwest and northwest facades). At living spaces within 72 ft. of the centerline, install windows and glass doors rated minimum Sound Transmission Class (STC) 35. At living spaces between 72 ft. and 118 ft. of the centerline, install windows and glass doors rated minimum STC 31. These window sound rating apply to all floor elevations. Provide some type of mechanical ventilation for these spaces. All other windows and glass doors of the project may have any type of glass and do not need to be sound-rated.

Please see Figure 3 for the locations of the recommended noise control windows and glass doors.

When windows and glass doors are maintained closed at all times for noise control, some type of mechanical ventilation must be provided. The mechanical ventilation system shall conform to the requirements of the California Mechanical Code, as described in Appendix C, and shall not compromise the acoustical integrity of the building shell.


FIGURE 3
Locations of the noise impacted living spaces requiring closed windows and minimum Sound Transmission Class (STC) ratings for the windows and glass doors. The third and fourth floors are similar
STC 35
STC 31
SECOND LEVEL FLOOR PLAN

The windows and glass doors specified above to be maintained closed shall be operable as the requirement does not imply a fixed or inoperable condition. All other windows of the development may be kept open as desired with the exception of bathrooms that are an integral part of a living space and not separated by a closeable door, such as those common in master bedroom suites.

In addition, the windows and doors shall be installed in an acoustically-effective manner. To achieve an acoustically-effective window and door construction, the operable window panels must form an air-tight seal when in the closed position and the window frames must be caulked to the wall opening around their entire perimeter with a non-hardening caulking compound to prevent sound infiltration. Do not use expandable foam products.

Please be aware that many dual-pane and triple-pane window assemblies have inherent noise reduction problems in the traffic noise frequency spectrum due to resonance that occurs within the air space between the window lites, and the noise reduction capabilities vary from manufacturer to manufacturer. Therefore, the acoustical test report of all sound rated windows should be reviewed by a qualified acoustician to ensure that the chosen windows will adequately reduce traffic noise to acceptable levels.

The implementation of the above recommended measures will reduce interior noise exposures to 45 dB DNL or lower.

B. Construction Phase Noise and Vibration Impacts

Reduction of the demolition/construction phase noise at the site can be accomplished by using quiet or "new technology" equipment. The greatest potential for noise abatement of current equipment should be the quieting of exhaust noises by use of improved mufflers. It is recommended that all internal combustion engines used at the project site be equipped with a type of muffler recommended by the vehicle manufacturer. In addition, all equipment should be in good mechanical condition so as to minimize noise created by faulty or poorly maintained engine, drive-train and other components. Demolition and construction noise can also be mitigated by the following:

OPERATIONAL AND SITUATIONAL CONTROLS

- All work on site should be restricted to 7:00 AM to 7:00 PM Weekdays, 9:00 AM to 5:00 PM Saturdays and 12:00 PM to 4:00 PM Sundays and Holidays, per the requirements of the City of San Mateo Noise Ordinance.

- All construction noise control measures currently imposed on the project, if any, shall be maintained unless the measures outlined herein are more restrictive.

- Minimize material movement along the north side of the site.

- Locate stockpiles adjacent to neighbors as much as possible to help shield people from on-site noise generation.

- Music shall not be audible off site.

- Dirt berming and stockpiling materials whenever possible can also help reduce noise to sensitive receptor locations.

- Keep mobile equipment (haul trucks, concrete trucks, etc.) off of local streets near residences as much as possible.

- Keep vehicle paths graded smooth as rough roads and paths can cause significant noise and vibration from trucks (particularly empty trucks) rolling over rough surfaces. Loud bangs and ground-borne vibration can occur.

INTERIOR WORK

- For interior work, the windows of the interior spaces facing neighbors where work is being performed should be kept closed while work is proceeding.

- Noise generating equipment indoors should be located within the building to utilize building elements as noise screens.

EQUIPMENT

- Earth Removal: Use scrapers as much as possible for earth removal, rather than the noisier loaders and hauling trucks.

- Backfilling: Use a backhoe for backfilling, as it is less costly and quieter than either dozers or loaders.

- Ground Preparation: Use a motor grader rather than a bulldozer for final grading. Wheeled heavy equipment is less noisy than track equipment. Utilize wheeled equipment rather than track equipment whenever possible, with the exception of work within the vibration distances shown in Table V. The soil conditions at the site indicate that wheeled equipment may generate higher levels of ground vibration than tracked equipment. Small, rubber tracked equipment, such as skid steers, would produce the lowest levels of noise and vibration

- Building Construction: Nail guns should be used where possible as they are less noisy than manual hammering.

- Generators and Compressors: Use generators, compressors and pumps that are housed in acoustical enclosures rather than weather enclosures or none at all.

- Utilize temporary power service from the utility company in lieu of generators wherever possible.

- All stationary equipment shall be rated no higher than 90 dBA @ 25 ft. under the equipment's most noisy condition.

- Circular saws, miter/chop saws and radial arm saws shall be used no closer than 50 ft. from any residential property line unless the saw is screened from view by any and all residences using an air-tight screen material of at least 2.0 lbs./sq. ft. surface weight, such as ¾" plywood.

- Use electrically powered tools rather than pneumatic tools whenever possible.

- Mitigation of the construction phase noise at the site can be accomplished by using quiet or "new technology" equipment.

- The greatest potential for noise abatement of current equipment should be the quieting of exhaust noises by use of improved mufflers.

- It is recommended that all internal combustion engines used at the project site be equipped with a type of muffler recommended by the vehicle manufacturer.

- All equipment shall be in good mechanical condition so as to minimize noise created by faulty or poorly maintained engines, drive-trains and other components. Worn, loose or unbalanced parts or components shall be maintained or replaced to minimize noise and vibration.

- Utilize wheeled equipment rather than tracked equipment whenever possible.

- Use the lowest vibration inducing equipment when within the distance limits shown in Table VII. Small grading and earth moving equipment, such as "Bobcat" size equipment should be used.

NOISE COMPLAINT MANAGEMENT

- Designate a noise complaint officer. The officer should be available at all times during construction hours via both telephone and email. Signs should be posted at site entries. A sample is shown below.

NOISE COMPLAINTS

FOR CONCERNS REGARDING CONSTRUCTION NOISE PLEASE CONTACT:

"CONSTRUCTION OFFICER"
Conoff@jobsite.com
OPERATIONS MANAGEMENT ENGINEER
CALL CENTER: (111) 111-1111

- Notify, in writing, all residential and noise sensitive commercial neighbors within 300 ft. of the site of construction. The notification shall contain the name, phone number and email address of the noise complaint officer. A flyer may be placed at the doors of the residences.

- A log of all complaints shall be maintained. The logs shall contain the name and address of the complainant, the date and time of the complaint, the nature/description of the noise source, a description of the remediation attempt or the reason remediation could not be attempted.

VIII. Conclusions

In conclusion, traffic noise impacts to the project will exceed the 45 dB DNL interior noise standard of the City of San Mateo Noise Element and Title 24. Noise reduction measures for these interior spaces will be required. There are no common exterior areas associated with the development that would be regulated by the City of San Mateo Noise Element. The noise levels in the office spaces of the projects will be within the limits of the CalGreen Non-Residential Mandatory Measures. Construction of the project may generate temporary noise and vibration impacts to nearby neighbors. Construction noise and vibration reduction measures are provided in this study to minimize the temporary impacts. Project-generated traffic and mechanical equipment noise impacts will be less than significant.

This report presents the results of a noise assessment study for the planned "One Hayward" mixed-use development along El Camino Real in San Mateo. The study findings for existing conditions are based on field measurements and other data and are correct to the best of our knowledge. Future noise projections are based on information provided by the consulting traffic engineer. However, significant deviations in the predicted traffic volumes, motor vehicle technology, site planning, noise regulations or other future changes beyond our control may produce long-range noise results different from our estimates.

Report Prepared By:

EDWARD L. PACK ASSOC., INC.

Jeffrey K. Pack
President

APPENDIX A

References

(a) Preliminary Site Plan, "One Hayward", by BKF, July 14, 2021

(b) City of San Mateo General Plan "Vision 2030", Chapter VIII, "Noise", October 18, 2010

(c) California Code of Regulations, Title 24, Volume 1, Part 2, Section 1206 "Sound Transmission", Subsection 1206.4 (Allowable Interior Noise Levels), Revised 2019

(d) California Code of Regulations, Title 24, Chapter 5, Section 5.507 "Environmental Comfort", Subsection 5.507.4.2 (Exterior Noise Transmission, Performance Method), Revised 2013

(e) The State of California CPRC 21000, California Environmental Quality Act, California Code of Regulations, Title 14, Division 6, Chapter 3, 1970

(f) City of San Mateo Municipal Code, Title 7, Chapter 7.30 "Noise Regulations", Section 7.30.060 (e/1,2,3), 2004

(g) El Camino Real and Hayward Avenue Traffic Volumes Provided by AECOM via the City of San Mateo Planning Department by email to Edward L. Pack Associates, Inc., August 5, 2021

(h) Highway Research Board, "Highway Noise – A Design Guide for Highway Engineers", Report, 117, 1971

(i) United States Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Report No. 0123, by John A. Volpe National Transportation Systems Center, September 2018

APPENDIX B

Noise Standards, Terminology, Instrumentation
Ventilation Requirements and General Building Shell Controls,

1. Noise Standards

City of San Mateo General Plan "Vision 2030" Noise Element Standards

NOISE IN SAN MATEO

A noise measurement survey was conducted in San Mateo during September 2008 to determine noise levels throughout the community. The results are represented as a contour map in Figure N-1. The noise contours show lines of equal sound level, but the contours are conservative since the shielding effect of buildings and local topography is not taken into account when creating the noise contours. Noise exposure in San Mateo is dominated by traffic and the Southern Pacific (SPRR)/Caltrain rail line. Aircraft activity associated with San Francisco International Airport does not significantly affect noise levels in San Mateo, although some neighborhoods in the northeastern portion of the City are impacted by the airport approach path. Localized noise sources include the San Mateo County Fairgrounds (when events are being held). Generally, noise created by manufacturing uses does not have a major impact on the community, although occasional complaints are received from neighbors immediately adjacent to the manufacturing sites.

The noise contour map is used to determine the suitability of land uses for different types of development, depending upon the extent of noise exposure in the area. The City of San Mateo has developed a list of "noise-sensitive" uses (see Tables N-1 and N-2), which include residential dwellings, schools, hospitals, hotels, and outdoor recreation areas. These uses should ideally be located in areas not exceeding 60 dB (L_{dn}) and 65 dB (L_{eq}) for outdoor recreational uses, but this is not reasonable in San Mateo where existing noise levels exceed 60 dB (L_{dn}) in all but a few of the western portions of the City (see Figure N-1). "Noise-sensitive" land uses could be located in areas having noise levels between 60 and 70 dB (L_{dn}) if noise mitigating construction measures are used to reduce interior sound levels to 45 dB (L_{dn}) or below as required by the State Building Code for multi-family dwellings, and extended by the City of San Mateo to new single-family dwellings. Exterior sound levels for new multi-family common open space should be reduced to below 67 dB (L_{dn}). For parks or playgrounds, the exterior sound level should be reduced to 65 dB (L_{eq}) during the noisiest hour; this can be accomplished by locating these spaces away from noise sources or buffering them by the placement of buildings between the noise source and the open space.

The areas of greatest noise impact in San Mateo, where 70 dB (L_{dn}) is exceeded and are therefore unsuitable for the location of new "noise-sensitive" uses, are in the residential neighborhoods adjacent to the Bayshore Freeway (US 101) and the SPRR/Caltrain rail corridor (see Figure N- 1). Narrow portions adjacent to SR 92 and El Camino Real (SR 82) also exceed the City's guidelines. The projected cumulative noise increases in the year 2030 are shown in Figure N-2, and are very similar to existing conditions, with noise increases generally due to traffic increases.

MITIGATING NOISE IMPACTS

Noise mitigation measures fall into two general categories: physical mitigation and administrative regulation. Physical mitigation involves reducing the noise level, ideally at the source, through methods such as enclosing a noisy piece of equipment with a barrier or by substituting quieter machinery. Reduction in the overall community sound level can also occur by limiting noise exposure of receivers to roadways and railways. This can be accomplished by installing sound walls, using sound-absorbing building materials, and through careful site planning (e.g., orienting buildings away from the noise source and eliminating narrow corridors open to the noise source). The walls and windows of a building typically reduce noise by approximately 20 dB. Noise barriers, such as sound walls and earthen berms provide varying reductions of noise, depending on their height and size. A solid wall that just breaks the line-of- sight between the noise source and receiver attenuates noise by 5 dB.

If noise cannot be reduced at the source as described above, the distance between the source and the receiver can be increased to attenuate the noise. A doubling of the distance from a fixed noise source (e.g., an air conditioning unit, train engine, or whistle) results in a 6 dB decrease in noise level; a doubling of distance from a linear source (e.g., a highway or roadway) results in a 3 dB decrease. Vegetation does little to reduce noise – a densely planted strip 50 feet wide is needed to reduce noise by 5 dB.

Administrative regulation reduces noise generation by limiting the operating hours or duration of the noise source, regulating locations where a noisy activity may occur, or enforcing State standards that limit noise emissions, such as automobile and boat muffler requirements.

TABLE N-1

NOISE SENSITIVE LAND-USE COMPATIBILITY GUIDELINES FOR COMMUNITY NOISE ENVIRONMENTS[1]

Land-Use Category	Normally Acceptable[2]	Conditionally Acceptable[3]	Normally Unacceptable[4]
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 Acceptable[2]	Conditionally Acceptable[3]	Normally Unacceptable[4]
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.

GOALS AND POLICIES

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 (L_{dn}) or above, as shown on Figure N-1. The maximum interior noise level shall not exceed 45 dB (L_{dn}) in any habitable rooms.

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 (L_{dn}) or above, as shown on Figure N-1. Require an acoustical analysis that uses peak hour L_{eq} for new parks and play areas. Require a feasibility analysis of noise reduction measures for public parks and play areas. Incorporate necessary mitigation measures into residential project design to minimize common open space noise levels. Maximum exterior noise should not exceed 67 dB (L_{dn}) for residential uses and should not exceed 65 dB (L_{eq}) during the noisiest hour for public park 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.

Lead: Planning Division reviews General Plan and consults with Building Division on scope of analysis. Building Division approves content of final report and administers conditions of project approval. (Ongoing)

Most of San Mateo has existing noise levels that exceed the normally acceptable levels for "noise-sensitive" uses. Since the majority of the City is within the "conditionally acceptable" range of between 60 dB and 70 dB (L_{dn}), some form of noise mitigation will have to be incorporated into building and site design for new "noise-sensitive" land uses. While the State currently requires that multi-family dwellings in areas exceeding 60 dB (L_{dn}) incorporate mitigation measures to achieve an interior sound level of 45 dB (L_{dn}), the City of San Mateo will attenuation can be accomplished with sound-rated double-pane windows.

A few of San Mateo's residential neighborhoods that border highways, El Camino Real (SR 82), and the railway line are subject to sound levels exceeding 70 dB (L_{dn}), which is in the "normally unacceptable" range for "noise-sensitive" uses. Rather than precluding new residential development in these areas, the City will require that building construction techniques be utilized that reduce interior sound to 45 dB (L_{dn}) or less.

Also of concern are outdoor recreation areas in new parks and schools. The City will require a feasibility study to determine whether measures to reduce exterior sound levels, such as sound walls, sheltering open space areas from noise sources by building walls, and placement of active use areas away from noise sources are feasible. Particular attention should be paid to the design of sound barriers so they are visually pleasing; this can often be accomplished through extensive landscape screening.

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

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, are abated 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.
Lead: Code Enforcement Division. (Ongoing)

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.

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.

Lead: Planning Division reviews the General Plan and consults with the Building Division on the scope of the analysis. The Building Division approves the content of the final report and administers the conditions of project approval. (Ongoing)

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]. Require adequate noise mitigation to be incorporated into the widening of SR 92 and US 101. 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.

Sound walls have been constructed along US 101. Preliminary design work has not yet started on the widening of SR 92; however, the issue of sound walls will be addressed during both the design and environmental review phases of the project. 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.

Lead: The Public Works Department coordinates sound wall construction with Caltrans. Planning and Building Divisions coordinate the review and application of conditions of approval for new development regarding compliance with this policy. (Ongoing)

The City recognizes that traffic will increase during the next 20 years, and that mitigating traffic noise is very difficult, except in certain instances. The installation of sound walls along highways is supported as an effective means of reducing this major impact. Sound walls are not appropriate, however, in residential neighborhoods or along major streets due to their visual impact and the need for street access points, which diminishes the effectiveness of the barriers.

N 2.5: Railroad Noise. Promote the installation of noise barriers along the railroad corridor where "noise-sensitive" land uses are adversely impacted by unacceptable noise levels [60 dB (L_{dn}) or greater]. Promote adequate noise mitigation to be incorporated into any rail service expansion or track realignment. Study the need of depressing the rail line to eliminate at-grade crossings or other mitigation measures to decrease noise levels prior to substantial expansion of the rail service.

Implementation N 2.5: Railroad Noise.

The Joint Powers Authority has completed a study of electrification of the rail lines, and has adopted a policy for its implementation. Electrification of the rail line, in conjunction with the elimination of at-grade crossings, would greatly reduce railroad noise impacts. Installation of noise barriers is analyzed on a project-by-project basis for development adjacent to the railroad. Noise impacts were also considered in the examination of alignment alternatives in the railroad corridor study.

Lead: The Public Works Department coordinates with the Joint Powers Authority on railroad alignment. The Planning and Building Divisions coordinate the review and application of conditions of approval for new development adjacent to the rail corridor regarding noise impacts. (Ongoing)

Another noise source that can be mitigated is the railroad corridor. The City supports the installation of sound walls along the rail line. If substantial increases in rail service occur as projected in the Circulation Element, the need for both noise mitigation and grade separation of the rail line and streets will increase. To achieve both objectives, the City and the Joint Powers Authority should consider depressing the rail line, particularly in the Downtown.

B. Title 24 Noise Standards

2019 California Building Code, Volume 1, Part 2
SECTION 1206 – SOUND TRANSMISSION

1206.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units and sleeping units or between dwelling units and sleeping units and adjacent public areas such as halls, corridors, stairways or service areas.

1206.2 Air-borne sound. Walls, partitions and floor/ceiling assemblies separating dwelling units and sleeping units from each other or from public or service areas shall have a sound transmission class of not less than 50, or not less than 45 if field tested, for air-borne noise when tested in accordance to ASTM E-90. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed lined, insulated or otherwise treated to maintain the required ratings. The requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

1206.3 Structure-borne sound. Floor/ceiling assemblies between dwelling units and sleeping units or between a dwelling unit or sleeping unit and a public or service area with the structure shall have an impact insulation class rating of not less than 50, or not less than 45 if field tested, when tested in accordance with ASTM E-492. Alternatively, the impact insulation class of floor-ceiling assemblies shall be established by engineering analysis based on a comparison of floor-ceiling assemblies having impact insulation class ratings as determined by the test procedures in ASTM E492.

Exception: *Impact sound insulation is not required for floor/ceiling assemblies over non-habitable rooms or spaces not designed to be occupied, such as garages, mechanical rooms or storage areas.*

1206.4 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 (Ldn) or the community noise equivalent level (CNEL), consistent with the noise element of the local general plan.*

1206.5 Acoustical control. [BSC-CG] *See California Green Building Standards code, Chapter 5, Division 5.5 for additional sound transmission requirements.*

2. Terminology

A. Statistical Noise Levels

Due to the fluctuating character of urban traffic noise, statistical procedures are needed to provide an adequate description of the environment. A series of statistical descriptors have been developed which represent the noise levels exceeded a given percentage of the time. These descriptors are obtained by direct readout of the sound measuring instruments. Some of the statistical levels used to describe community noise are defined as follows:

L_1 - A noise level exceeded for 1% of the time.

L_{10} - A noise level exceeded for 10% of the time, considered to be an "intrusive" level.

L_{50} - The noise level exceeded 50% of the time representing an "average" sound level.

L_{90} - The noise level exceeded 90 % of the time, designated as a "background" noise level.

L_{eq} - The continuous equivalent-energy level is that level of a steady noise having the same sound energy as a given time-varying noise. The L_{eq} represents the decibel level of the time-averaged value of sound energy or sound pressure squared and is the descriptor used to calculate the DNL and CNEL.

B. Day-Night Level (DNL)

Noise levels utilized in the standards are described in terms of the Day-Night Level (DNL). The DNL rating is determined by the cumulative noise exposures occurring over a 24-hour day in terms of A-Weighted sound energy. The 24-hour day is divided into two subperiods for the DNL index, i.e., the daytime period from 7:00 a.m. to 10:00 p.m., and the nighttime period from 10:00 p.m. to 7:00 a.m. A 10 dB weighting factor is applied (added) to the noise levels occurring during the nighttime period to account for the greater sensitivity of people to noise during these hours. The DNL is calculated from the measured L_{eq} in accordance with the following mathematical formula:

$$DNL = \left[[(10\log_{10}(10^{\Sigma Leq(7\text{-}10)})) \times 15] + [((10\log_{10}(10^{\Sigma Leq(10\text{-}7)})) + 10) \times 9]\right]/24$$

C. A-Weighted Sound Level

The decibel measure of the sound level utilizing the "A" weighted network of a sound level meter is referred to as "dBA". The "A" weighting is the accepted standard weighting system used when noise is measured and recorded for the purpose of determining total noise levels and conducting statistical analyses of the environment so that the output correlates well with the response of the human ear.

3. Instrumentation

The on-site field measurement data were acquired by the use of one or more of the precision acoustical instruments shown below. The acoustical instrumentation provides a direct readout of the L exceedance statistical levels including the equivalent-energy level (L_{eq}). Input to the meters was provided by a microphone extended to a height of 5 ft. above the ground. The meter conforms to ANSI S1.4 for Type 1 instruments. The "A" weighting network and the "Fast" response setting of the meter were used in conformance with the applicable ISO and IEC standards. All instrumentation was acoustically calibrated before and after field tests to assure accuracy.

Bruel & Kjaer 2231 Precision Integrating Sound Level Meter
Larson Davis LDL 812 Precision Integrating Sound Level Meter
Larson Davis 2900 Real Time Analyzer
Larson Davis 831 Precision Integrating Sound Level Meter

4. Mechanical Ventilation Requirements

California Mechanical Code Chapter 4- Ventilation Air

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, that 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.

5. Building Shell Controls

The following additional precautionary measures are required to assure the greatest potential for exterior-to-interior noise attenuation by the recommended mitigation measures. These measures apply at those units where closed windows are required:

- Unshielded entry doors having a direct or side orientation toward the primary noise source must be 1-5/8" or 1-3/4" thick, insulated metal or solid-core wood construction with effective weather seals around the full perimeter.

- If any penetrations in the building shell are required for vents, piping, conduit, etc., sound leakage around these penetrations can be controlled by sealing all cracks and clearance spaces with a non-hardening caulking compound.

- Ventilation openings shall not compromise the acoustical integrity of the building shell.

- Spray-in or expandable foams are not acceptable for use as an acoustical sealant or as an insulation material for sound absorption within a wall or floor/ceiling cavity.

APPENDIX C

Noise Measurement Data, Calculation Tables and Air-Conditioner Data Sheets

DNL CALCULATIONS

CLIENT: MERIDIAN INVESTMENTS
FILE: 52-022
PROJECT: ONE HAYWARD
DATE: 8/26-27/2020
SOURCE: EL CAMINO REAL

LOCATION 1	El Camino Real			
Dist. To Source	51 ft.			
TIME	Leq	10^Leq/10		
7:00 AM	62.6	1819700.9		
8:00 AM	63.1	2041737.9		
9:00 AM	61.8	1513561.2		
10:00 AM	72.3	17100153.2		
11:00 AM	63.6	2290867.7		
12:00 PM	67.8	6025595.9		
1:00 PM	68.4	6918309.7		
2:00 PM	69.0	7943282.3		
3:00 PM	69.4	8709635.9		
4:00 PM	69.6	9120108.4		
5:00 PM	69.3	8511380.4		
6:00 PM	70.8	12022644.3		
7:00 PM	72.4	17378008.3		
8:00 PM	68.8	7585775.8		
9:00 PM	66.2	4168693.8	SUM=	113149455.7
10:00 PM	64.3	2691534.8	Ld=	80.5
11:00 PM	60.8	1202264.4		
12:00 AM	57.6	575439.9		
1:00 AM	53.4	218776.2		
2:00 AM	52.5	177827.9		
3:00 AM	54.5	281838.3		
4:00 AM	55.8	380189.4		
5:00 AM	57.1	512861.4		
6:00 AM	61.3	1348962.9	SUM=	7389695.2
			Ln=	68.7
	Daytime Level=	80.5		
	Nighttime Level=	78.7		
	DNL=	**69**		
	24-Hour Leq=	67.0		

24ACA4
Comfort™ Series 14 Air Conditioner with Puron® Refrigerant
1–1/2 to 5 Tons (Sizes 18 To 60)

Carrier
Turn to the Experts

Product Data

Puron

Comfort SERIES

Carrier Air Conditioners with Puron® refrigerant provide a collection of features unmatched by any other family of equipment. The 24ACA has been designed utilizing Carrier's Puron refrigerant. The environmentally sound refrigerant allows you to make a responsible decision in the protection of the earth's ozone layer.

As an Energy Star® Partner, Carrier Corporation has determined that this product meets the Energy Star® guidelines for energy efficiency. Refer to the combination ratings in the Product Data for system combinations that meet Energy Star® guidelines.

NOTE: Ratings contained in this document are subject to change at any time. Always refer to the AHRI directory (www.ahridirectory.org) for the most up-to-date ratings information.

INDUSTRY LEADING FEATURES / BENEFITS

Efficiency

- 14 SEER / 11.5 – 12.0 EER
- Microtube Technology™ refrigeration system
- Indoor air quality accessories available

Sound

- Sound level as low as 74 dBA
- Compressor sound blanket

Comfort

- System supports Thermidistat™ or standard thermostat controls

Reliability

- Puron® refrigerant – environmentally sound, won't deplete the ozone layer and low lifetime service cost.
- Front-seating service valves
- Scroll compressor
- Internal pressure relief valve
- Internal thermal overload
- Low pressure switch
- High pressure switch
- Filter drier
- Balanced refrigeration system for maximum reliability

Durability

WeatherArmor™ protection package:

- Solid, Durable sheet metal construction
- Steel louver coil guard
- Baked-on, complete outer coverage, powder paint
- Color matched ceramic coated screws

Applications

- Long-line – up to 250 feet (76.2 m) total equivalent length, up to 200 feet (60.96 m) condenser above evaporator, or up to 80 ft. (24.38 m) evaporator above condenser (See Longline Guide for more information.)
- Low ambient (down to –20°F/–28.9°C)) with accessory kit

Warranty

- 10 year limited compressor warranty
- 5 year limited parts warranty

ELECTRICAL DATA

UNIT SIZE – SERIES	V/PH	OPER VOLTS*		COMPR		FAN	MCA	MIN WIRE SIZE†	MIN WIRE SIZE†	MAX LENGTH ft. (m)‡	MAX LENGTH ft. (m)‡	MAX FUSE** or CKT BRK AMPS
		MAX	MIN	LRA	RLA	FLA		60° C	75° C	60° C	75° C	
18–31	208/230/1	253	197	48.0	9.0	0.5	11.7	14	14	67 (20.4)	64 (19.5)	15
24–32				58.3	13.5	0.5	17.3	14	14	46 (14.0)	43 (13.1)	30
30–32				73.0	14.1	0.5	18.1	14	14	44 (13.4)	41 (12.5)	30
36–31				79.0	16.7	1.2	22.0	12	12	57 (17.4)	54 (16.5)	35
42–32				112.0	17.9	1.2	23.6	12	10	53 (16.2)	50 (15.2)	40
48–31				117.0	21.8	1.2	28.4	10	10	70 (21.3)	67 (20.4)	40
60–31				134.0	26.4	1.2	34.2	8	8	91 (27.7)	86 (26.2)	50

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

† If wire is applied at ambient greater than 30° C, consult table 310–16 of the NEC (ANSI/NFPA 70). The ampacity of non–metallic–sheathed cable (NM), trade name ROMEX, shall be that of 60° C conditions, per the NEC (ANSI/NFPA 70) Article 336–26. If other than uncoated (no–plated), 60 or 75° C insulation, copper wire (solid wire for 10 AWG or smaller, stranded wire for larger than 10 AWG) is used, consult applicable tables of the NEC (ANSI/NFPA 70).

‡ Length shown is as measured 1 way along wire path between unit and service panel for voltage drop not to exceed 2%.

** Time–Delay fuse.

FLA – Full Load Amps
LRA – Locked Rotor Amps
MCA – Minimum Circuit Amps
RLA – Rated Load Amps

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

24ACA4

SOUND POWER

UNIT SIZE – VOLTAGE, SERIES	STANDARD RATING (dBA)	TYPICAL OCTAVE BAND SPECTRUM (dB, without tone adjustment)						
		125	250	500	1000	2000	4000	8000
18–31	74	53.0	60.5	65.0	67.0	63.5	60.0	52.0
24–32	76	50.0	59.5	67.0	67.0	64.5	60.0	54.0
30–32	76	54.0	62.5	69.5	70.0	67.0	62.0	55.0
36–31	74	54.5	62.0	66.0	69.5	66.5	65.0	60.0
42–32	76	58.0	65.0	68.0	69.0	65.5	61.0	54.0
48–31	74	59.0	63.5	65.5	69.0	63.5	59.0	53.0
60–31	74	55.5	64.0	67.0	69.0	65.0	60.0	54.5

NOTE: Tested in accordance with ARI Standard 270–95. (Not listed with ARI).

CHARGING SUBCOOLING (TXV-TYPE EXPANSION DEVICE)

UNIT SIZE–SERIES	REQUIRED SUBCOOLING °F (°C)
18–31	10 (5.6)
24–32	10 (5.6)
30–32	11 (6.1)
36–31	10 (5.6)
42–32	12 (6.7)
48–31	9 (5.0)
60–31	9 (5.0)