

BERRYESSA PLAZA NOISE AND VIBRATION ASSESSMENT

San José, California

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INTRODUCTION

The Berryessa Plaza project proposes the construction of a 47,000 square foot (sf) neighborhood retail center east of the intersection of Berryessa Road and Flickinger Avenue/N. Jackson Avenue in San José, California. This report evaluates the project's potential to result in significant noise or vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory criteria, and discusses existing noise conditions in the project vicinity; and, 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and recommends mitigation measures to reduce project impacts to less-than-significant levels.

SETTING

Fundamentals of Environmental Noise

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

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

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

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

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

Effects of Noise

Sleep and Speech Interference

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

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The DNL as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the

percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA DNL. At a DNL of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the DNL increases to 70 dBA, the percentage of the population highly annoyed increases to about 25-30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a DNL of 60-70 dBA. Between a DNL of 70-80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the DNL is 60 dBA, approximately 30-35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

TABLE 1 Definition of Acoustical Terms Used in this Report

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

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

TABLE 2 Typical Noise Levels in the Environment

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

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

Fundamentals of Groundborne Vibration

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

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

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

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

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

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

Regulatory Background - Noise

The State of California, Santa Clara County, and the City of San José have established regulatory criteria that are applicable in this assessment. The State CEQA Guidelines, Appendix G, Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan, and the City of San José General Plan are used to assess the potential significance of impacts. A summary of the applicable regulatory criteria is provided below.

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

- (a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;
- (b) Generation of excessive groundborne vibration or groundborne noise levels; or
- (c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

CEQA does not define what noise level increase would be considered substantial. Typically, an increase in the DNL noise level resulting from the project at noise-sensitive land uses of 3 dBA or greater would be considered a significant impact when projected noise levels would exceed those considered acceptable for the affected land use. An increase of 5 dBA DNL or greater would be considered a significant impact when projected noise levels would remain within those considered acceptable for the affected land use.

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan adopted by the Santa Clara County Airport Land Use Commission contains standards for projects within the vicinity of San José International Airport, which are relevant to this project:

4.3.2.1 Noise Compatibility Policies

Policy N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (2022 Aircraft Noise Contours).

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies with the goal of minimizing the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies in the City of San José. The following policies are applicable to the proposed project:

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain “Normally Acceptable;” or
- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the “Normally Acceptable” level.

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise-sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City’s Municipal Code.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City’s Municipal Code. The City considers significant construction

noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

- EC-1.11** Require safe and compatible land uses within the Mineta San José International Airport noise zone (defined by the 65 CNEL contour as set forth in State law) and encourage aircraft operating procedures that minimize noise.

Regulatory Background – Vibration

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of San José. The following policies are applicable to the proposed project:

- EC-2.3** Require new development to minimize continuous vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, including ruins and ancient monuments or building that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction. Equipment or activities typical of generating continuous vibration include but are not limited to: excavation equipment; static compaction equipment; vibratory pile drivers; pile-extraction equipment; and vibratory compaction equipment. Avoid use of impact pile drivers within 125 feet of any buildings, and within 300 feet of historical buildings, or buildings in poor condition. On a project-specific basis, this distance of 300 feet may be reduced where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction. Transient vibration impacts may exceed a vibration limit of 0.08 in/sec PPV only when and where warranted by a technical study by a qualified professional that verifies that there will be virtually no risk of cosmetic damage to sensitive buildings from the new development during demolition and construction.

Existing Noise Environment

Figure 1 shows the project site plan overlaid on an aerial image of the site vicinity. Berryessa Road bounds the site to the northwest and North Jackson Avenue bounds the site to the southwest. Multi-family residential land uses are located to the northeast, opposite Pepper Road, and along the southeast boundary of the site. Interstate 680 is located approximately one-quarter mile to the northeast.

Due to Shelter-in-Place restrictions implemented by the State of California¹ at the time of this study, traffic volumes along the surrounding roadways were substantially lower and not representative of typical conditions. A noise monitoring survey was not completed to document ambient noise levels during this time period because resultant noise levels would not be representative of typical conditions.

In order to establish the environmental baseline for the project, noise data contained in the City of San José General Plan were reviewed. A review of these data indicates that the noise environment in the project vicinity is primarily the result of vehicular traffic along Berryessa Road. In 2008, Berryessa Road produced a noise level of approximately 67 dBA DNL at 75 feet from the near direction of travel.² The General Plan noise contour information shows that noise levels at boundaries of the site nearest to Berryessa Road typically range from 65 to 75 dBA DNL, as shown in Figure 2. Noise levels are not projected to measurably increase along Berryessa Road by 2035.

¹ Cal. Exec. Order No. N-33-20, (Mar. 19, 2020).

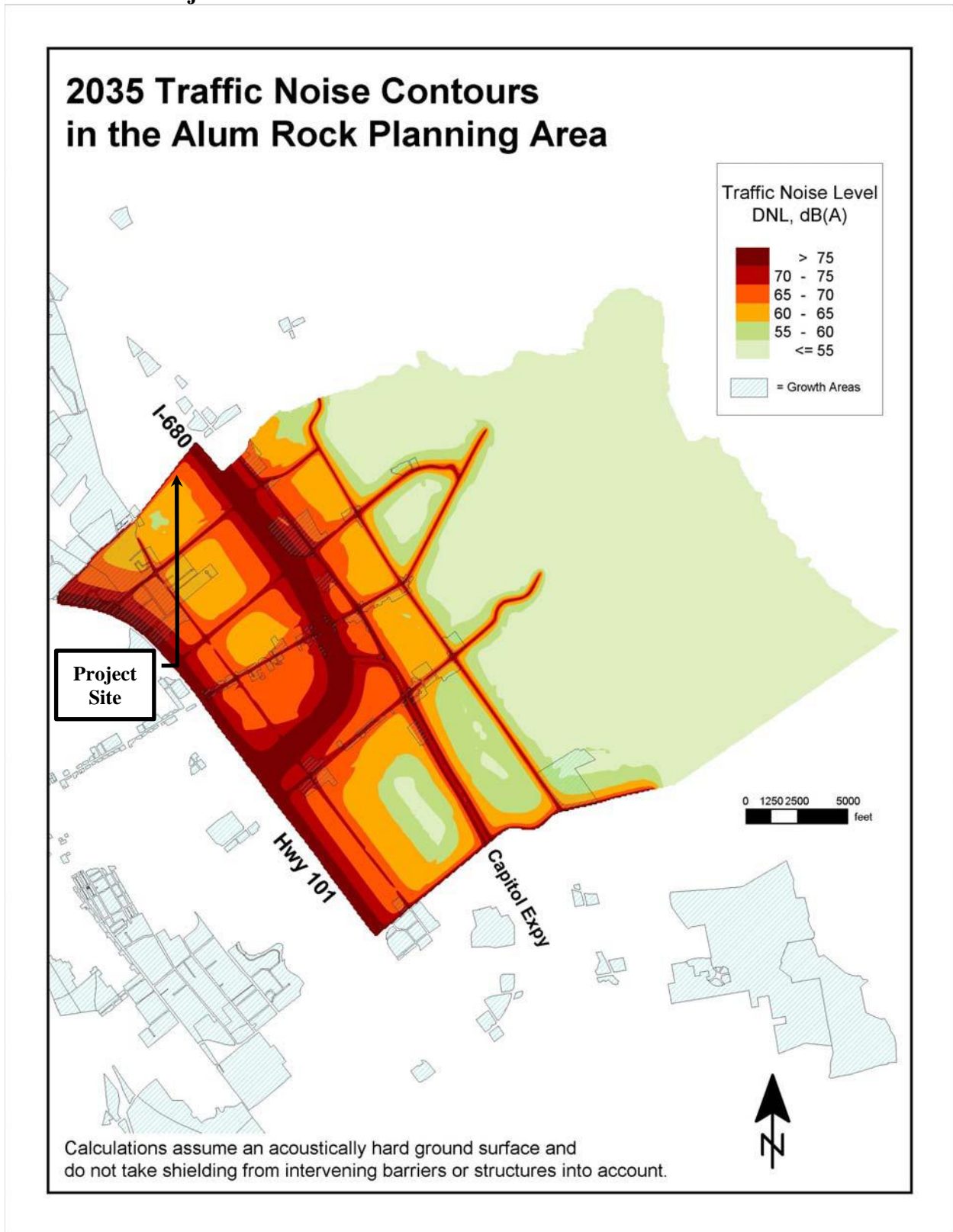
² Illingworth & Rodkin, Inc., “Envision San Jose 2040 General Plan Comprehensive Update Environmental Noise Assessment,” December 2010.

FIGURE 1 Berryessa Plaza Site and Vicinity



Source: Google Earth, July 27, 2020 and LPMD Architects, January 17, 2020.

FIGURE 2 Project Site in Relation to 2035 General Plan Noise Contours



Source: Illingworth & Rodkin, Inc., "Envision San José 2040 General Plan Comprehensive Update Environmental Noise Assessment," December 2010.

NOISE IMPACTS AND MITIGATION MEASURES

This section describes the significance criteria used to evaluate project impacts under CEQA, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- **Temporary or Permanent Noise Increases in Excess of Established Standards.** A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan at existing noise-sensitive receptors surrounding the project site.
 - Temporary Noise Increase. A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The City of San José considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices.
 - Permanent Noise Increase. A significant permanent noise level increase would occur if project-generated traffic would result in: a) a noise level increase of 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) a noise level increase of 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater.
 - Operational Noise in Excess of Standards. A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan.
- **Generation of Excessive Groundborne Vibration.** A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. For sensitive historic structures, including ruins and ancient monuments or buildings that are documented to be structurally weakened, a continuous vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A continuous vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

- **Excessive Aircraft Noise.** A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: Temporary Construction Noise. Existing noise-sensitive land uses in the project vicinity would be exposed to a substantial temporary increase in ambient noise levels due to project construction activities. **This is a significant impact.**

Policy EC-1.7 of the City's General Plan requires that all construction operations within the City to use best available noise suppression devices and techniques and to limit construction hours near residential uses per the Municipal Code allowable hours, which are between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday when construction occurs within 500 feet of a residential land use. Further, the City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The construction of the proposed project would involve grading, excavation to lay foundations, trenching, building erection, and paving. The hauling of imported and exported soil and materials would generate truck trips on local roadways as well.

During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at 50 feet are shown in Tables 4 and 5. Table 4 shows the average noise level ranges, by construction phase, and Table 5 shows the maximum noise level ranges for different construction equipment. Most construction noise falls with the range of 80 to 90 dBA at 50 feet from the source.

As shown in Table 4, construction noise levels produced by the project would typically range from 77 to 89 dBA L_{eq} at a distance of 50 feet from the source with all pertinent equipment present at the site. With the minimum required equipment present at the site, construction noise levels produced by the project would typically range from 71 to 83 dBA L_{eq} at a distance of 50 feet from the source. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors. The nearest noise-sensitive residential land uses would be located approximately 130 feet southeast of the proposed buildings, which would conservatively represent the acoustic center of the construction noise source. Construction noise levels at a distance of 130 feet would range from 69 to 81 dBA L_{eq} with all pertinent equipment present at the site and from 63 to 75 dBA L_{eq} with the minimum required equipment present at the site, which would clearly exceed ambient daytime noise levels in the area by more than 5 dBA L_{eq} .

Ambient noise levels at the surrounding land uses would be substantially increased during various times throughout the duration of construction, which is estimated to be just greater than 12 months. Per Policy EC-1.7 of the City's General Plan, the temporary construction impact would be

significant because the project would involve substantial noise-generating activities continuing for more than 12 months.

TABLE 4 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.

II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 5 Construction Equipment 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA) ^{1,2}	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor ³	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact

Equipment Category	L _{max} Level (dBA) ^{1,2}	Impact/Continuous
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

¹ Measured at 50 feet from the construction equipment, with a “slow” (1 sec.) time constant.

² Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

³ Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

Source: Mitigation of Nighttime Construction Noise, Vibrations and Other Nuisances, National Cooperative Highway Research Program, 1999.

Mitigation Measure 1a:

The potential short-term noise impacts associated with construction of the project would be mitigated by the implementation of General Plan Policy EC-1.7. This policy states:

Construction operations within the City will be required to use available noise suppression devices and techniques and continue to limit construction hours near residential uses per the City’s Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

The following standard noise control measures shall be implemented:

- Construction will be limited to the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday for any on-site or off-site work within 500 feet of any residential unit. Construction outside of these hours may be approved through a development permit based on a site-specific “construction noise mitigation plan” and a finding by the Director of Planning, Building and Code Enforcement that the construction noise mitigation plan is adequate to prevent noise disturbance of affected residential uses.
- The contractor shall use “new technology” power construction equipment with state-of-the-art noise shielding and muffling devices. All internal combustion engines used on the project site shall be equipped with adequate mufflers and shall be in good mechanical condition to minimize noise created by faulty or poorly maintained engines or other components.
- The unnecessary idling of internal combustion engines shall be prohibited.
- Staging areas and stationary noise-generating equipment shall be located as far as possible from noise-sensitive receptors such as residential uses (a minimum of 200 feet).
- The surrounding neighborhood shall be notified early and frequently of the construction activities.
- A “noise disturbance coordinator” shall be designated to respond to any local complaints about construction noise. The disturbance coordinator would determine the cause of the noise complaints (e.g., beginning work too early, bad muffler, etc.) and institute reasonable measures warranted to correct the problem. A telephone number for the disturbance coordinator would be conspicuously posted at the construction site.

A “construction noise logistics plan,” in accordance with Policy EC-1.7, would be required. Typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Utilize ‘quiet’ models of air compressors and other stationary noise sources where technology exists.
- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.
- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment when located within 200 feet of adjoining sensitive land uses. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receptor and if the barrier is constructed in a manner that eliminates any cracks or gaps.

- If stationary noise-generating equipment must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) shall be used. Any enclosure openings or venting shall face away from sensitive receptors.
- Ensure that generators, compressors, and pumps are housed in acoustical enclosures.
- Locate cranes as far from adjoining noise-sensitive receptors as possible.
- During final grading, substitute graders for bulldozers, where feasible. Wheeled heavy equipment are quieter than track equipment and should be used where feasible.
- Substitute nail guns for manual hammering, where feasible.
- Substitute electrically-powered tools for noisier pneumatic tools, where feasible.
- The Construction Noise Logistic Plan, inclusive of the above shall be signed by a qualified acoustical specialist verifying that the implementation measures included in this Plan meets the reduction to noise levels as required by this mitigation measure.

With the implementation of GP Policy EC-1.7, Municipal Code requirements, and the above measures, the temporary construction noise impact would be reduced to a **less-than-significant** level.

Impact 1b: Permanent Noise Level Increase. The proposed project would not result in a permanent noise level increase at existing residential land uses in the project vicinity due to project-generated traffic. **This is a less-than-significant impact.**

A significant impact would result if traffic generated by the project would substantially increase noise levels at sensitive receptors in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA DNL or greater, with a future noise level of less than 60 dBA DNL, or b) the noise level increase is 3 dBA DNL or greater, with a future noise level of 60 dBA DNL or greater. The existing noise environment in the surrounding area would exceed 60 dBA DNL; therefore, a significant impact would occur if project-generated traffic would permanently increase noise levels by 3 dBA DNL. For reference, a 3 dBA DNL noise increase would be expected if the project would double existing traffic volumes along a roadway.

For the proposed project, peak hour turning movements were provided for the five study intersections. Background plus project traffic volumes were compared to existing volumes to conservatively estimate the project's contribution to the permanent noise level increase. Upon comparison of these traffic conditions, traffic noise increases of 0 to 1 dBA DNL were estimated for roadways serving the site. Traffic noise increases are summarized in Table 6, below. The project would neither result in a doubling of traffic volumes nor result in a permanent noise increase of 3 dBA DNL or more. This is a less-than-significant impact.

TABLE 6 Traffic Noise Increase Summary

Roadway	Segment	Existing PM Peak Hour Volume	Background Plus Project PM Peak Hour Volume	Relative Noise Level Increase, dBA DNL
Berryessa Road	West of Lundy Avenue	2117	2852	1
	Lundy Avenue to Flickinger Avenue/Jackson Avenue	2370	2731	1
	Flickinger Avenue/Jackson Avenue to I-680	2946	3208	0
	I-680 to Capitol Avenue	3087	3215	0
	East of Capitol Avenue	1800	1872	0
Lundy Avenue	North of Berryessa Road	1625	1853	1
	South of Berryessa Road	1528	1924	1
Flickinger Avenue/Jackson Avenue	North of Berryessa Road	1194	1299	0
	Berryessa Road to Mabury Road	1610	1767	0
	South of Mabury Road	1267	1338	0
Capitol Avenue	North of Berryessa Road	1812	1867	0
	South of Berryessa Road	2243	2394	0

Source: Hexagon Transportation Consultants and Illingworth & Rodkin, Inc., June 2020.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project could generate noise in excess of standards established in the City’s General Plan at the nearby sensitive receptors. The incorporation of standard conditions of project approval would result in a **less-than-significant** noise impact.

Mechanical Equipment

Various mechanical equipment for heating, ventilation, and cooling purposes, exhaust fans, and other similar equipment would likely be located on the roof of the proposed building. Noise levels received at nearby sensitive land uses would depend on system design level specifications including the equipment location, type, size, capacity, and enclosure design. These details are typically not available until later phases of the project design and development review process.

Based on measurements of rooftop equipment at similar commercial centers in the region, noise levels of 50 to 60 dBA could be expected at a distance of 50 feet from the largest pieces of equipment. Noise levels generated by smaller mechanical equipment would be much lower, ranging from 40 to 50 dBA at 50 feet from the equipment and/or ventilation openings. Based on these credible worst-case estimates, noise levels generated by the operation of project mechanical equipment could reach 52 dBA L_{eq} at the nearest property line if unshielded equipment were located along the southeast portion of the building. The DNL, assuming 24-hour per day operation of the rooftop mechanical equipment, could reach 58 dBA assuming credible worst-case estimates.

No equipment is anticipated for a project of this scale that would make meeting the applicable noise limits with standard noise control measures difficult. As a project condition of approval, mechanical equipment shall be selected and designed to reduce noise levels to meet the City’s 55

dBA DNL noise level requirement at the nearby noise-sensitive land uses. A qualified acoustical consultant shall be retained to review mechanical noise as these systems are selected to determine specific noise reduction measures necessary to reduce noise to comply with the City's General Plan and Municipal Code noise level requirements. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and installation of noise barriers, such as enclosures and parapet walls, to block the line-of-sight between the noise source and the nearest receptors. Other alternate measures may be optimal, such as locating equipment in less noise-sensitive areas, such as along the building façades farthest from adjacent neighbors, where feasible. Compliance with the City's General Plan and Municipal Code noise limits would result in a less-than-significant impact.

Parking Lot Activities

The center of the proposed parking lot would be located about 70 feet from the nearest noise-sensitive land uses. Noise associated with the use of the parking lot would include vehicular circulation, loud engines, car alarms, squealing tires, door slams, and human voices. The maximum sound (L_{max}) of a passing car at 15 mph typically ranges from 48 to 58 dBA at a distance of 70 feet. The noise generated during an engine start is similar. Door slams create lower noise levels. The hourly average noise level resulting from all of these noise-generating activities in a busy parking lot typically ranges from 43 to 53 dBA L_{eq} at a distance of 70 feet from the parking area. The parking lot would primarily be used between the hours of 7:00 a.m. and 10:00 p.m., yielding a DNL noise level of approximately 51 dBA, which under credible worst-case conditions, would be 4 dBA below the City's 55 dBA DNL noise level threshold. Parking lot noise levels would generally be below ambient traffic noise levels generated along Berryessa Road and even lower and likely inaudible at those noise-sensitive receptors located further from the site or shielded by intervening noise barriers. This would be a less-than-significant impact.

On-Site Delivery Truck Circulation and Loading Activities

Truck deliveries would be anticipated for all of the retail commercial uses, and goods would typically be delivered by medium sized trucks. The expected number of deliveries and anticipated delivery times is not yet available, but based on delivery schedules for similar projects, the number of daily deliveries would be minor and deliveries would likely occur during daytime hours. Truck circulation would generally take place approximately 100 feet from the nearest residential land uses near the small loading areas proposed by the project.

Noise levels generated during delivery truck circulation are dependent on the speed and type of trucks, but typical maximum (L_{max}) noise levels generated by slow moving medium duty trucks range from about 60 to 65 dBA at 50 feet. Low speed truck noise results from a combination of engine, exhaust, and tire noise, as well as the intermittent sounds of back-up alarms and releases of compressed air associated with truck/trailer air brakes. The noise levels produced by backup alarms can vary depending on the type and directivity of the sound, but maximum noise levels are typically in the range of 65 to 75 dBA L_{max} at a distance of 50 feet.

Based on a review of the project site plan and truck route on the site, constant speed delivery trucks traveling to the small loading areas in the parking lot southeast of the building could produce noise

levels that reach 59 dBA. Maximum unshielded noise levels from medium sized delivery trucks could reach 68 dBA at the closest adjacent noise sensitive uses. Considering the low number of daily deliveries, it is not expected that more than one truck would be on site in any given hour, and that each of these delivery trucks would produce the above maximum noise levels for less than one minute at any of the adjacent noise sensitive receptors while on the project site, the hourly L_{eq} produced by such activities would be 41 dBA or lower at all adjacent noise sensitive uses. Truck delivery noise occurring during three daytime hours would produce a DNL noise levels of approximately 38 dBA. Truck deliveries occurring at the proposed project site are not expected to generate levels exceeding 55 dBA DNL or existing ambient conditions at the nearby noise-sensitive land uses. This would be a less-than-significant impact.

Mitigation Measure 1c: No further mitigation required.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels could exceed 0.2 in/sec PPV at the nearest buildings of conventional construction. **This is a significant impact.**

According to Policy EC-2.3 of the City of San José General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historical structures, and a vibration limit of 0.2 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction. Cosmetic damage (also known as threshold damage) is defined as hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage is defined as hairline cracking in masonry or the loosening of plaster. Major structural damage is defined as wide cracking or the shifting of foundation or bearing walls. The vibration limits contained in this policy are conservative and designed to provide the ultimate level of protection for existing buildings in San José.

Construction activities associated with the project would include demolition, site preparation, foundation work, and new building framing and finishing. Foundation construction techniques involving impact or vibratory pile driving, which can cause excessive vibration, are not anticipated as part of the project. Heavy vibration-generating construction equipment, such as vibratory rollers or the dropping of heavy equipment (e.g., clam shovel drops), would have the potential to produce vibration levels of 0.08 in/sec PPV or more at historic buildings within 60 feet of the project site. This same equipment would have the potential to produce vibration levels of 0.2 in/sec PPV or more at buildings of normal conventional construction located within 30 feet of the project site.

Table 7 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet and summarizes the vibration levels at the nearest adjacent buildings surrounding the site. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

Construction vibration received at off-site buildings would be dependent on the distance between individual pieces of equipment on the project site and the off-site building. For example, a vibratory roller operating near the project site boundary would generate the worst-case vibration levels for the building sharing that property line. Construction vibration impacts are assessed based on the potential for damage to buildings on receiving land uses, not at receptors at the nearest property lines. Therefore, the distances used to propagate construction vibration levels (as shown in Table 7) were estimated under the assumption that each piece of equipment could operate along the nearest boundary of the project site, representing the worst-case scenario.

A review of the City of San José Historic Resource Inventory³ indicates that the only property of historical significance in the site vicinity was the Berryessa Elementary School, which was located at located at 1171 Capitol Avenue, over one-quarter mile northeast of the project site. However, a review of historical aerial images of the project vicinity indicates that this historic resource was demolished and replaced with Villa Sport Gym in 2015. Therefore, this analysis assumes that the 0.2 in/sec PPV threshold would apply to all buildings in the immediate site vicinity.

All other structures surrounding the site are assumed to be of normal conventional construction and would be 15 feet or more from areas of the site where heavy equipment would be used. Table 7 presents vibration levels from construction equipment at the nearest buildings surrounding the site. Calculations were made to estimate vibration levels at distances of 15 feet to represent the nearest residential buildings to the south, as well as distances of 50, 110, and 150 feet from the site to represent other nearby buildings. Vibration levels are highest close to the source, and then attenuate with increasing distance at the rate of $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet, and D_{ref} is the reference distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. At a distance of about 15 feet, vibration levels due to construction are conservatively calculated to reach up to 0.4 in/sec PPV, which would exceed the 0.2 in/sec PPV threshold for conventional buildings.

The US Bureau of Mines has analyzed the effects of blast-induced vibration on buildings in USBM RI 8507,⁴ and these findings have been applied to vibrations emanating from construction equipment on buildings.⁵ As shown on Figure 3, these studies indicate a less than 5% probability of “threshold damage” (referred to as cosmetic damage elsewhere in this report) at vibration levels of 0.4 in/sec PPV or less and no observations of “minor damage” or “major damage” at vibration levels of 0.4 in/sec PPV or less. Figure 3 presents the damage probability, as reported in USBM RI 8507 and reproduced by Dowding assuming a maximum vibration level of 0.4 in/sec PPV. Based on these data, cosmetic or threshold damage would be manifested in the form of hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. However, minor damage (e.g., hairline cracking in masonry or the loosening of plaster) or major structural damage (e.g., wide cracking or shifting of foundation or bearing walls) would not occur at the adjacent commercial buildings, assuming a maximum vibration level of 0.4 in/sec PPV. Other buildings of normal conventional construction are located approximately 50 to 150

³ <https://www.sanjoseca.gov/your-government/departments/planning-building-code-enforcement/planning-division/historic-preservation/historic-resources-inventory>

⁴ Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration from Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.

⁵ Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

feet from the project site. At these distances, vibration levels would be up to 0.098 in/sec PPV, which is below the 0.2 in/sec PPV threshold for normal buildings. Based on the data summarized in Figure 3, there were no observations of “threshold damage,” “minor damage,” or “major damage” at buildings of normal conventional construction when vibration levels were 0.2 in/sec PPV or less.

Project-generated vibration levels would be capable of cosmetically damaging the adjacent residential buildings to southeast but would fall below the General Plan threshold of 0.2 in/sec PPV at other surrounding conventional buildings located further than 30 feet from the project site. Neither cosmetic, minor, or major damage would occur beyond a distance of 30 feet. At these locations, and in other surrounding areas where vibration would not be expected to cause structural damage, vibration levels may still be perceptible. However, as with any type of construction, this would be anticipated and would not be considered significant, given the intermittent and short duration of the phases that have the highest potential of producing vibration. By use of administrative controls, such as notifying neighbors of scheduled construction activities, annoyance due to perceptible vibration levels can be kept to a minimum.

Mitigation Measure 2:

The following measures shall be implemented where vibration levels due to construction activities would exceed 0.2 in/sec PPV at nearby buildings to reduce the impact to a less-than-significant level:

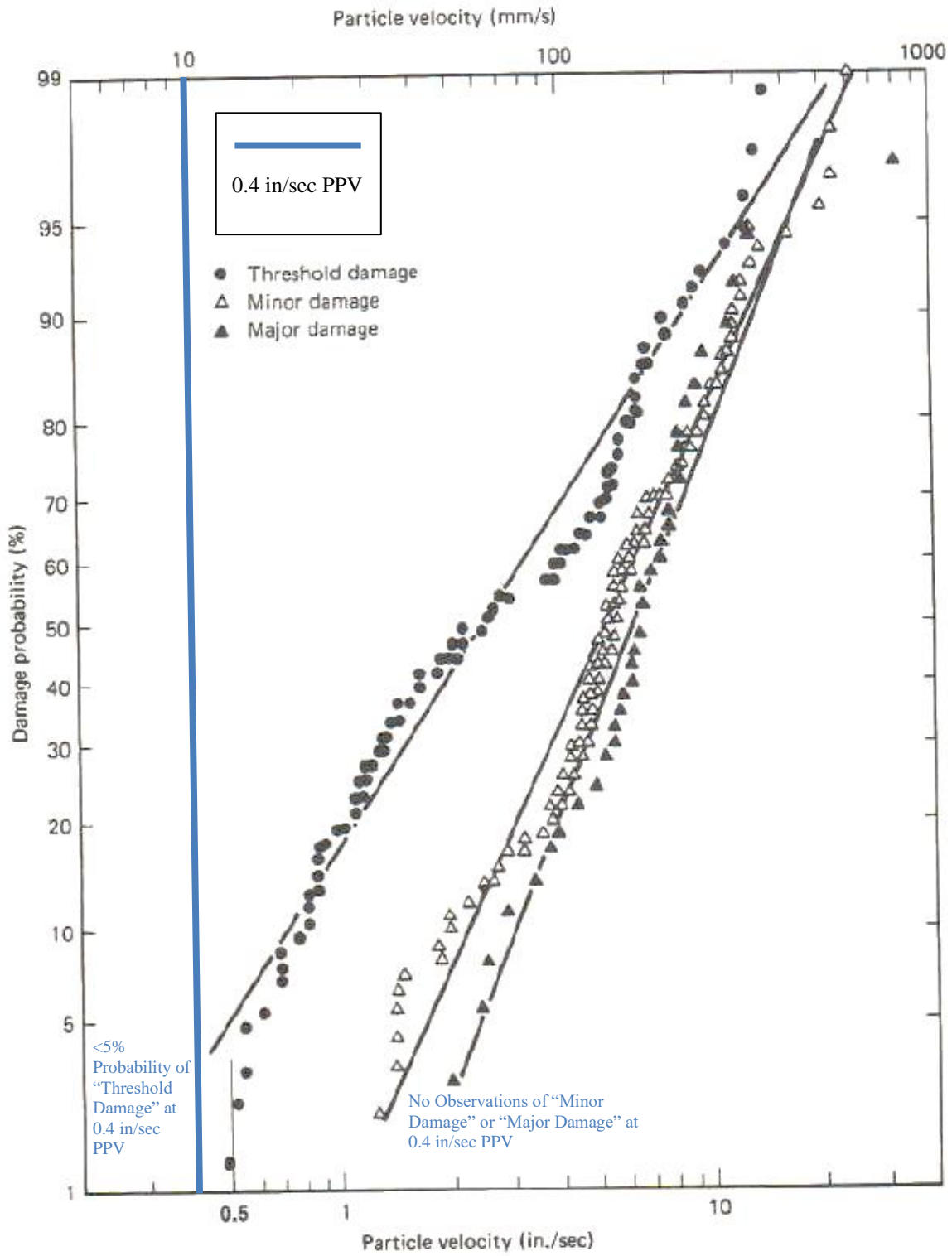
- Prohibit the use of heavy vibration-generating construction equipment within 30 feet of adjacent residential buildings.
- Use a smaller vibratory roller, such as the Caterpillar model CP433E vibratory compactor, when compacting materials within 30 feet of adjacent commercial buildings. Only use the static compaction mode when compacting materials within 15 feet of residential buildings.
- Avoid dropping heavy equipment and use alternative methods for breaking up existing pavement, such as a pavement grinder, instead of dropping heavy objects, within 30 feet of adjacent residential buildings.
- Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.

TABLE 7 Construction Vibration Levels at Nearby Buildings

Equipment	PPV (in/sec)					
	Source Level (25 ft)	Southeast Residential (15 ft)	Northeast Residential (50 ft)	Southwest Residential (110 ft)	Northwest Residential (150 ft)	
Clam shovel drop	0.202	0.354	0.094	0.040	0.028	
Hydromill (slurry wall)	in soil	0.008	0.014	0.004	0.002	0.001
	in rock	0.017	0.030	0.008	0.003	0.002
Vibratory Roller	0.210	0.368	0.098	0.041	0.029	
Hoe Ram	0.089	0.156	0.042	0.017	0.012	
Large bulldozer	0.089	0.156	0.042	0.017	0.012	
Caisson drilling	0.089	0.156	0.042	0.017	0.012	
Loaded trucks	0.076	0.133	0.035	0.015	0.011	
Jackhammer	0.035	0.061	0.016	0.007	0.005	
Small bulldozer	0.003	0.005	0.001	0.001	0.000	

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, FTA Report No. 0123, September 2018, as modified by Illingworth & Rodkin, Inc., July 2020.

FIGURE 3 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996 as modified by Illingworth & Rodkin, Inc., July 2020.

Impact 3: Excessive Aircraft Noise. The project site is located approximately 3 miles from the nearest airport, and the proposed project would not expose people residing or working at the site to excessive aircraft noise. **This is a less-than-significant impact.**

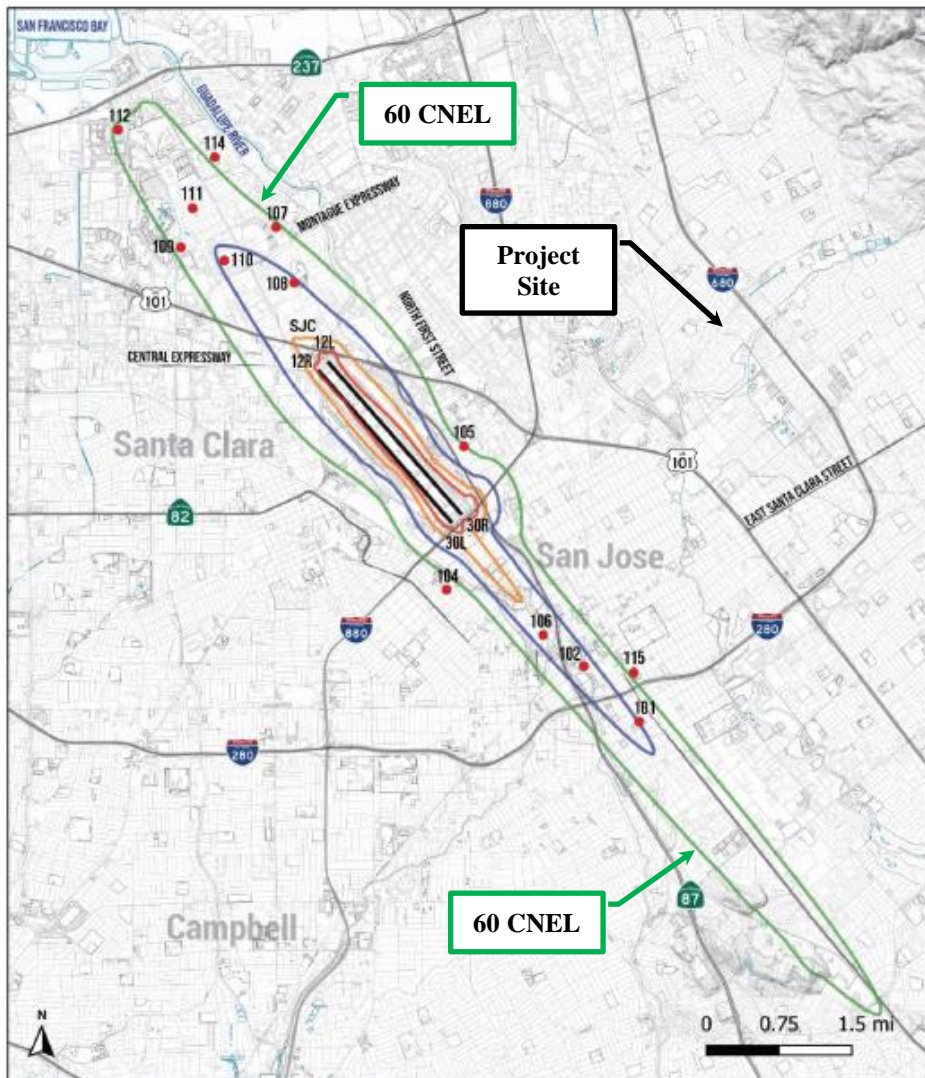
Norman Y. Mineta San José International Airport is a public-use airport located approximately 3 miles southwest of the project site. Figure 4 shows that the project site lies well outside the 2037 60 dBA CNEL noise contour of the airport, according to the City's new Airport Master Plan Environmental Impact Report.⁶ This means that future exterior noise levels due to aircraft would not exceed 60 dBA CNEL/DNL. According to Policy EC-1.11 of the City's General Plan, the required safe and compatible threshold for exterior noise levels would be at or below 65 dBA CNEL/DNL for aircraft. Similarly, Reid-Hillview Airport is located approximately 3.8 miles from the project site, and this airport produces considerably less environmental noise, as compared to Norman Y. Mineta San José International Airport. Noise levels produced by Reid-Hillview Airport aircraft are insignificant at the site and would be clearly compatible with the proposed land use. This is a less-than-significant impact.

Mitigation Measure 3: None required.

⁶ David J. Powers & Associates, Inc., Integrated Final Environmental Impact Report, Amendment to Norman Y. Mineta San Jose International Airport Master Plan, April 2020.

FIGURE 4 2037 CNEL Noise Contours for SJIA Relative to Project Site

Figure 5
Scenario 2: With Project 2037 Noise Contour Map



- Noise Monitoring Station
- 101 Site ID
- Runway
- 75 dBA and Greater CNEL Contour
- 70 dBA and Greater CNEL Contour
- 65 dBA and Greater CNEL Contour
- 60 dBA and Greater CNEL Contour

Figure 5 Scenario 2:
With Project 2037
Noise Contour Map

Appendix A
Qualifications of Technical Expert

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MICHAEL S. THILL

Mr. Thill is a principal of the firm with 22 years of professional experience in the field of acoustics. His expertise includes performing field research, analyzing data, and noise modeling. He has conducted numerous field surveys in a variety of acoustical environments to quantify airborne noise levels, groundborne vibration levels, and hydro-acoustic noise levels. He has analyzed and summarized complex sets of data for inclusion into noise models. Mr. Thill has been trained, and is a regular user of FHWA's Traffic Noise Model (TNM), and is familiar with federal and State procedures for preparing highway noise study reports.

Mr. Thill has authored technical noise reports for various land use proposals including residential, commercial, educational, and industrial developments. He has managed the General Plan Update noise studies for several communities in California and has recommended policy language in order to maintain compatible noise levels community-wide. Some of his recent major projects have included the assessment of noise and vibration from data center projects, quarry expansion projects, groundwater recharge projects, and winery projects where operations and special events have been of concern in rural settings. He has vast experience explaining acoustical concepts and the results of his analyses in public forums to the general public and project decision-makers.

Mr. Thill has also led traffic noise investigations for major transportation projects including the Route 4 Bypass project (2003 to 2013) and the I-680/Route 4 Interchange project (2014 to 2015) in Contra Costa County, California. He managed the noise study reports the US Highway 101 and State Route 85 Express Lanes projects for the Santa Clara County Valley Transit Authority (2011 to 2013), proposed along 66 miles, combined, of project study area between Mountain View and Morgan Hill, California. In 2013, Mr. Thill led the analyses of noise impacts due to the Jennings Avenue Pedestrian and Bicycle Rail Crossing Project, and in 2015, Mr. Thill led the analysis of noise impacts and noise abatement for the US Highway 101 / Hearn Avenue Interchange Project in Santa Rosa, California.

PROFESSIONAL EXPERIENCE

2009 - Present Principal	Illingworth & Rodkin, Inc. Petaluma, California
2005 - 2009 Senior Consultant	Illingworth & Rodkin, Inc. Petaluma, California
1998 - 2005 Staff Consultant	Illingworth & Rodkin, Inc. Petaluma, California

EDUCATION

1998	University of California at Santa Barbara B.S., Major: Environmental Science
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PROFESSIONAL SOCIETIES

Institute of Noise Control Engineering
Association of Environmental Professionals