APPENDIX B

ENVIRONMENTAL NOISE ASSESSMENT

Delta Fair Village

City of Antioch, California

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jcb Project # 2019-121

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INTRODUCTION

This report has been prepared to address the noise impacts due to, and upon the Delta Fair Mixed Use Project the city of Antioch, California. The site is currently developed with a retail center that would be partially removed, with the remaining buildings renovated as part of the project. The project would remove 73,550 square feet of existing retail uses and some parking. The project would include a 141,440 square foot parking garage, with 210 multi-family residential units above the garage. The project will also develop a new 4,000 square foot building as either a day care center or retail space. The remaining existing 87,535 square feet of retail would be renovated. Figure 1 shows the project location. Figure 2 shows the project site plan.

ENVIRONMENTAL SETTING

Background Information on Noise and Vibration

<u>*Fundamentals of Acoustics*</u>

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, but are expressed as dB, unless otherwise noted.

Figure 1
Project Location & Noise Monitoring Sites

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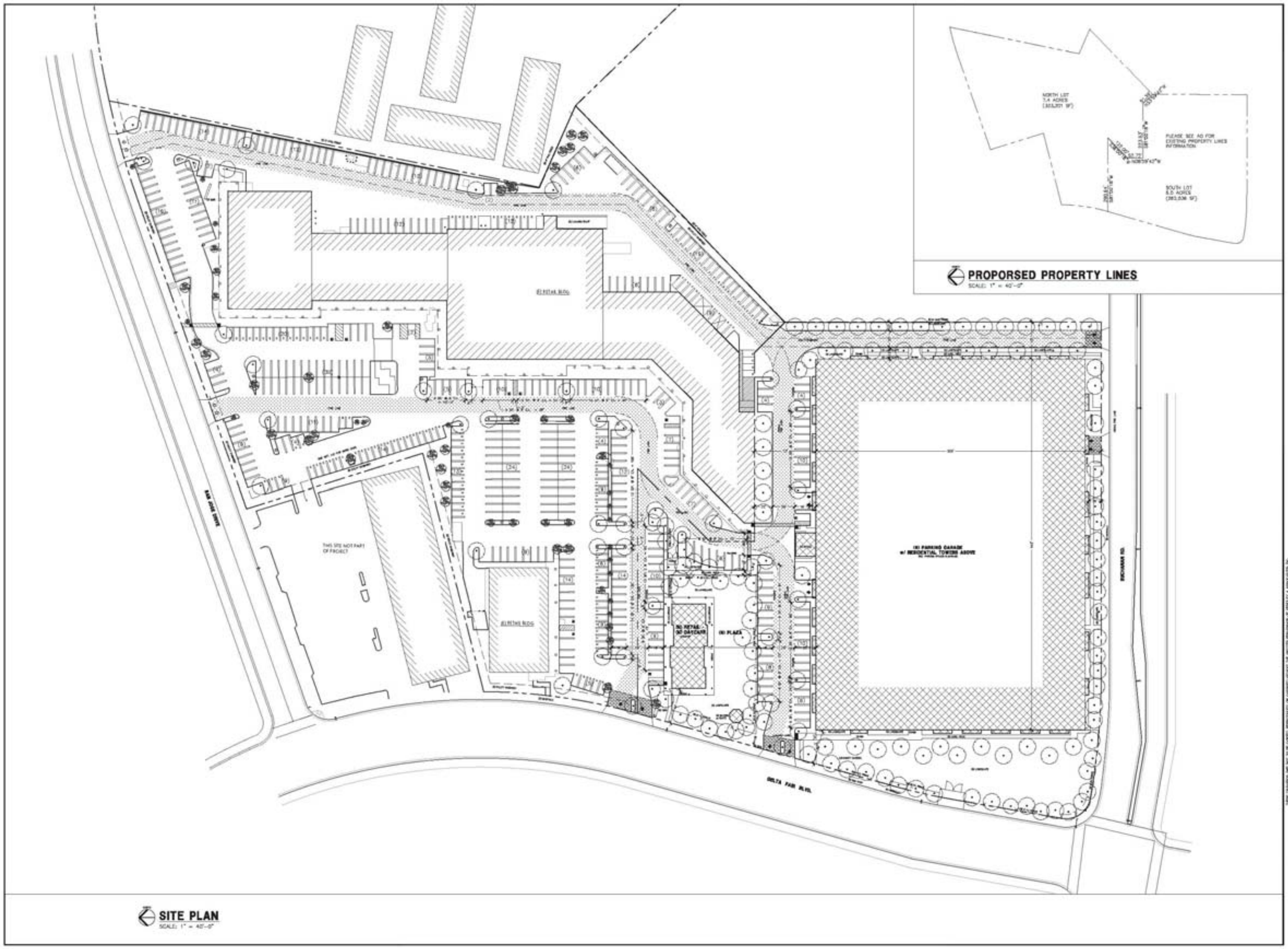

Figure 2
Project Site Plan

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The decibel scale is logarithmic, not linear. In other words, two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound, and twice as loud as a 60 dBA sound.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}), which corresponds to a steady-state A weighted sound level containing the same total energy as a time varying signal over a given time period (usually one hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The day/night average level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Table 1 lists several examples of the noise levels associated with common situations. Appendix A provides a summary of acoustical terms used in this report.

Effects of Noise on People

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

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as hearing loss or sudden startling

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

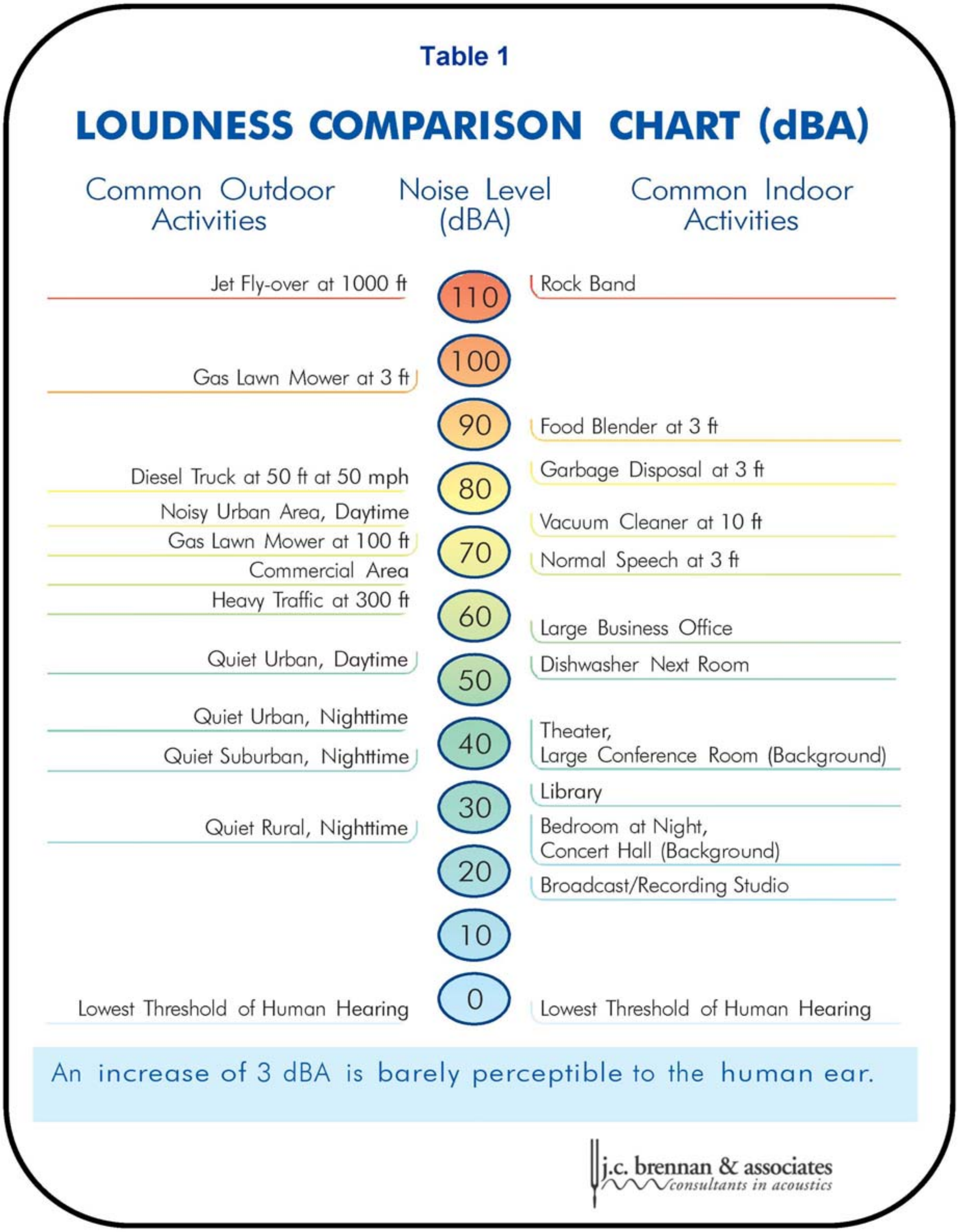
LOUDNESS COMPARISON CHART (dBA)
Common Outdoor Activities
Noise Level (dBA)
Common Indoor Activities
Jet Fly-over at 1000 ft
110
Rock Band
100
Gas Lawn Mower at 3 ft
90
Food Blender at 3 ft
Diesel Truck at 50 ft at 50 mph
80
Garbage Disposal at 3 ft
Noisy Urban Area, Daytime
Vacuum Cleaner at 10 ft
Gas Lawn Mower at 100 ft
70
Normal Speech at 3 ft
Commercial Area
Heavy Traffic at 300 ft
60
Large Business Office
Quiet Urban, Daytime
50
Dishwasher Next Room
Quiet Urban, Nighttime
40
Theater, Large Conference Room (Background)
Quiet Suburban, Nighttime
Library
30
Quiet Rural, Nighttime
Bedroom at Night, Concert Hall (Background)
20
Broadcast/Recording Studio
10
Lowest Threshold of Human Hearing
0
Lowest Threshold of Human Hearing
An increase of 3 dBA is barely perceptible to the human ear.
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Table 1

With regard to increases in A-weighted noise level, the following relationships occur:

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

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6 dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

Surrounding Land Uses

Residential uses are located to the east, retail uses to the north and west, and commercial to the south.

Existing Ambient Noise Levels

To quantify the existing ambient noise environment in the project vicinity, j.c. brennan & associates, Inc. staff conducted continuous 24-hour and short-term noise level measurements. The noise measurements were conducted on July 24th - 25th, 2019. See Figure 1 for noise measurement locations. The noise level measurements were conducted to determine typical background noise levels and for comparison to the project related noise levels. Table 2 shows a summary of the noise measurement results. Appendix B graphically shows the results of the 24-hour noise measurements.

Table 2: Summary of Ambient Noise Measurements

Continuous 24-hour Noise Measurement Site									
Site	**Location**	**Date**	**Average Measured Hourly Noise Levels, dBA**						
			CNEL	**Daytime (7:00 am-10:00 pm)**			**Nighttime (10:00 pm – 7:00 am)**		
				L_{eq}	**L_{50}**	**L_{max}**	**L_{eq}**	**L_{50}**	**L_{max}**
A	East Portion of Project Site	July 24-25, 2019	56 dBA	51.9	50.7	67.5	49.1	47.5	64.0

Short-term Noise Measurement Sites						
Site	**Location**	**Date**	**Time**	**L_{eq}**	**L_{50}**	**L_{max}**
1	Southeast Portion of Project Site	July 24, 2019	12:30 p.m.	55.2	54.0	61.9
		July 25, 2019	7:40 p.m.	58.1	57.0	69.0
2	West Portion of Project Site	July 24, 2019	1:15 p.m.	58.9	56.5	76.5
		July 25, 2019	7:00 p.m.	61.1	58.1	76.1
Source: j.c. brennan & associates, Inc. - 2019						

The sound level meters were programmed to record the maximum, median, and average noise levels at each site during the survey. The maximum value, denoted L_{max}, represents the highest noise level measured. The average value, denoted L_{eq}, represents the energy average of all of the noise received by the sound level meter microphone during the monitoring period. The median value, denoted L_{50}, represents the sound level exceeded 50 percent of the time during the monitoring period.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the ambient noise level measurement survey. The meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

Existing Roadway Noise Levels

To predict existing noise levels due to traffic, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. The model is based upon the Calveno reference noise emission factors for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions.

Traffic volumes for existing conditions were obtained from the traffic study prepared for the project (Fehr & Peers). Truck percentages and vehicle speeds on the local area roadways were estimated from field observations.

Traffic noise levels are predicted at the sensitive receptors located at 75-feet from the centerline along each project-area roadway segment. In some locations sensitive receptors may be located at distances which vary from the assumed calculation distance and may experience shielding from intervening barriers or sound walls. However, the traffic noise analysis is believed to be representative of the majority of sensitive receptors located closest to the project-area roadway segments analyzed in this report.

The actual distances to noise level contours may vary from the distances predicted by the FHWA model due to roadway curvature, roadway grade, shielding from local topography, sound walls or structures. The distances reported in Table 3 are generally considered to be conservative estimates of noise exposure along the project-area roadways.

Table 3 shows the existing traffic noise levels in terms of CNEL at 75-feet from the centerline along each roadway segment. This table also shows the distances to existing traffic noise contours. A complete listing of the FHWA Model input data is contained in Appendix C.

Table 3: Predicted Existing Traffic Noise Levels

Roadway	Segment	CNEL, dBA	Noise Levels (CNEL, dB)			
			Distance (feet)	Distance to Contours (feet) Existing (CNEL)		
				70	65	60
Somersville	South of Buchanan	64.8	75-feet	34	73	158
Somersville	Buchanan to Delta Fair	65.4	75-feet	37	80	171
Somersville	North of Delta Fair	68.5	75-feet	60	128	277
Buchanan	West of Somersville	66.2	75-feet	42	90	193
Buchanan	Somersville to Delta Fair	62.5	75-feet	24	51	109
Buchanan	Delta Fair to San Jose	63.3	75-feet	27	58	124
Buchanan	East of San Jose	63.2	75-feet	26	57	122
Delta Fair	West of Somersville	64.8	75-feet	34	73	156
Delta Fair	Somersville to Buchanan	64.9	75-feet	34	74	159

[1] Distances to traffic noise contours are measured in feet from the centerlines of the Roadways.
[2] Traffic noise levels do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.
Source: FHWA-RD-77-108 with inputs from Fehr & Peers and j.c. brennan & associates, Inc. - 2019

REGULATORY CONTEXT

Federal

There are no federal regulations related to noise that apply to the Proposed Project.

State

California Environmental Quality Act

The California Environmental Quality Act (CEQA) Guidelines, Appendix G, indicate that a significant noise impact may occur if a project exposes persons to noise levels in excess of local general plans or noise ordinance standards, or cause a substantial permanent or temporary increase in ambient noise levels.

California State Building Codes

The State Building Code, Title 24, Part 2 of the State of California Code of Regulations establishes uniform minimum noise insulation performance standards to protect persons within new buildings which house people, including hotels, motels, dormitories, apartment houses and dwellings other than single-family dwellings. Title 24 mandates that interior noise levels attributable to exterior sources shall not exceed 45 dB L_{dn} or CNEL in any habitable room.

Title 24 also mandates that for structures containing noise-sensitive uses to be located where the L_{dn} or CNEL exceeds 60 dB, an acoustical analysis must be prepared to identify mechanisms for limiting exterior noise to the prescribed allowable interior levels. If the interior allowable noise levels are met by requiring that windows be kept closed, the design for the structure must also specify a ventilation or air conditioning system to provide a habitable interior environment

City of Antioch General Plan

The Environmental Hazards Chapter of the City of Antioch General Plan sets forth noise and land use compatibility standards to guide development, and noise goals and policies to protect citizens from the harmful and annoying effects of excessive noise. Objectives and policies established in the Noise Element of the General Plan that are applicable to the proposed project include:

11.6.1 Noise Objective
Achieve and maintain exterior noise levels appropriate to planned land uses throughout Antioch as described below:

- Residential
  Single-Family: 60 dBA CNEL within rear yards
  Multi-Family: 60 dBA CNEL within exterior open space

- Schools
  Classrooms: 65 dBA CNEL
  Play and sports areas: 70 dB CNEL

- Hospitals, Libraries: 60 dBA CNEL

- Commercial/Industrial: 70 dBA CNEL at the front setback

11.6.2 Noise

Noise Compatible Land Use and Circulation Patterns

b. Maintain a pattern of land uses that separates noise-sensitive land uses from major noise sources to the extent possible, and guide noise-tolerant land uses into the noisier portions of the Planning Area.

Noise Analysis and Mitigation

e. When new development incorporating a potentially significant noise generator is proposed, require noise analyses to be prepared by a qualified acoustical engineer. Require the implementation of appropriate noise mitigation when the proposed project will cause new exceedances of General Plan noise objectives, or an audible (3.0 dBA) increase in noise in areas where General Plan noise objectives are already exceeded as the result of existing development.

f. In reviewing noise impacts, utilize site design and architectural design features to the extent feasible to mitigate impacts on residential neighborhoods and other uses that are sensitive to noise. In addition to sound barriers, design techniques to mitigate noise impacts may include, but are not limited to:

- Increased building setbacks to increase the distance between the noise source and sensitive receptor.
- Orient buildings which are compatible with higher noise levels adjacent to noise generators or in clusters to shield more noise sensitive areas and uses.

- Orient delivery, loading docks, and outdoor work areas away from noise sensitive uses.
- Place noise tolerant use, such as parking areas, and noise tolerant structures, such as garages, between the noise source and sensitive receptor.
- Cluster office, commercial, or multi-family residential structures to reduce noise levels within interior open space areas.
- Provide double glazed and double paned windows on the side of the structure facing a major noise source, and place entries away from the noise source to the extent possible.

g. Where feasible, require the use of noise barriers (walls, berms, or a combination thereof) to reduce significant noise impacts.

- The barrier must have sufficient mass to reduce noise transmission and high enough to shield the receptor from the noise source
- To be effective, the barrier needs to be constructed without cracks or openings.
- The barrier must interrupt the line-of-sight between the noise source and the receptor.
- The effects of noise “flanking” the noise barrier should be minimized by bending the end of the barrier back from the noise source
- Require appropriate landscaping treatment to be provided in conjunction with noise barriers to mitigate their potential aesthetic impacts.

h. Continue enforcement of California Noise Insulation Standards (Title 25, Section 1092, California Administration Code).

Temporary Construction

i. Ensure that construction activities are regulated as to hours of operation in order to avoid or mitigate noise impacts on adjacent noise-sensitive land uses.

j. Require proposed development adjacent to occupied noise sensitive land uses to implement a construction-related noise mitigation plan. This plan would depict the location of construction equipment storage and maintenance areas, and document methods to be employed to minimize noise impacts on adjacent noise sensitive land uses.

k. Require that all construction equipment utilize noise reduction features (e.g., mufflers and engine shrouds) that are no less effective than those originally installed by the manufacturer.

m. Prior to the issuance of any grading plans, the City shall condition approval of subdivisions and non-residential development adjacent to any developed/occupied noise sensitive land uses by requiring applicants to submit a construction-related noise mitigation plan to the City for review and approval. The plan should depict the location of construction equipment and how the noise from this equipment will be mitigated during construction of the project through the use of such methods as:

- The construction contractor shall use temporary noise-attenuation fences, where feasible, to reduce construction noise impacts on adjacent noise sensitive land uses
- During all project site excavation and grading on-site, the construction contractors shall equip all construction equipment, fixed or mobile, with properly operating and maintained mufflers, consistent with manufacturers' standards. The construction contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site.
- The construction contractor shall locate equipment staging in areas that will create the greatest distance between construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.
- The construction contractor shall limit all construction-related activities that would result in high noise levels to between the hours of 7:00 a.m. and 7:00 p.m. Monday through Saturday. No construction shall be allowed on Sundays and public holidays.

n. The construction-related noise mitigation plan required shall also specify that haul truck deliveries be subject to the same hours specified for construction equipment. Additionally, the plan shall denote any construction traffic haul routes where heavy trucks would exceed 100 daily trips (counting those both to and from the construction site). To the extent feasible, the plan shall denote haul routes that do not pass sensitive land uses or residential dwellings. Lastly, the construction-related noise mitigation plan shall incorporate any other restrictions imposed by the city.

City of Antioch Noise Ordinance

Section 9-5.1901 of the Antioch Zoning Ordinance sets forth noise attenuation requirements for stationary and mobile noise sources. The provisions applicable to the project include the following:

(A) *Stationary noise sources.* Uses adjacent to outdoor living areas (e.g., backyards for single-family homes and patios for multi-family units) and parks shall not cause an increase in background ambient noise which will exceed 60 CNEL.

(B) Mobile noise sources.

(1) Arterial and street traffic shall not cause an increase in background ambient noise which will exceed 60 CNEL.

(D) Noise attenuation. The city may require noise attenuation measures be incorporated into a project to obtain compliance with this section. Measures outlined in the noise policies of the General Plan should be utilized to mitigate noise to the maximum feasible extent.

The City of Antioch Zoning Ordinance (2005) provides noise attenuation requirements for construction activity. Specifically, Section 5-17.04 prohibits construction during sensitive evening, nighttime, and weekend hours. 5-17.04

Construction Noise Attenuation

(B) It shall be unlawful for any person to be involved in construction activity during the hours specified below:

- On weekdays prior to 7:00 a.m. and after 6:00 p.m.
- On weekdays within 300 feet of occupied dwellings, prior to 8:00 a.m. and after 5:00 p.m.
- On weekends and holidays, prior to 9:00 a.m. and after 5:00 p.m., irrespective of the distance from the occupied dwellings.

Vibration Standards

Vibration is like noise in that it involves a source, a transmission path, and a receiver. While vibration is related to noise, it differs in that in that noise is generally considered to be pressure waves transmitted through air, whereas vibration usually consists of the excitation of a structure or surface. As with noise, vibration consists of an amplitude and frequency. A person's perception to the vibration will depend on their individual sensitivity to vibration, as well as the amplitude and frequency of the source and the response of the system which is vibrating.

Vibration can be measured in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities in inches per second. Standards pertaining to perception as well as damage to structures have been developed for vibration levels defined in terms of peak particle velocities.

The City of Antioch does not contain specific policies pertaining to vibration levels. However, vibration levels associated with construction activities are discussed in this report.

Human and structural response to different vibration levels is influenced by a number of factors, including ground type, distance between source and receptor, duration, and the number of perceived vibration events. Table 4, which was developed by Caltrans, shows the vibration levels which would normally be required to result in damage to structures. The vibration levels are presented in terms of peak particle velocity in inches per second.

Table 4 indicates that the threshold for architectural damage to structures is 0.20 in/sec p.p.v. and continuous vibrations of 0.10 in/sec p.p.v., or greater, would likely cause annoyance to sensitive receptors.

Table 4: Effects of Various Vibration Levels on People and Buildings

Vibration Level (Peak Particle Velocity)*			
mm/s	in/sec	Human Reaction	Effect on Buildings
0.15-0.30	0.006-0.019	Threshold of perception; possibility of intrusion	Vibrations unlikely to cause damage of any type
2.0	0.08	Vibrations readily perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
2.5	0.10	Level at which continuous vibrations begin to annoy people	Virtually no risk of "architectural" damage to normal buildings
5.0	0.20	Vibrations annoying to people in buildings (this agrees with the levels established for people standing on bridges and subjected to relative short periods of vibrations)	Threshold at which there is a risk of "architectural" damage to normal dwelling - houses with plastered walls and ceilings Special types of finish such as lining of walls, flexible ceiling treatment, etc., would minimize "architectural" damage
10-15	0.4-0.6	Vibrations considered unpleasant by people subjected to continuous vibrations and unacceptable to some people walking on bridges	Vibrations at a greater level than normally expected from traffic, but would cause "architectural" damage and possibly minor structural damage.

Source: Transportation Related Earthborne Vibrations, Caltrans Experiences. Technical Advisory: TAV-02-01-R9601. February 20, 2002.

IMPACTS AND MITIGATION MEASURES

Methods of Analysis

Traffic Noise Impact Assessment Methodology

To describe future noise levels due to traffic, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. Direct inputs to the model included traffic volumes provided by Fehr & Peers. The FHWA model is based upon the Calveno reference noise factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions. To predict L_{dn}/CNEL values, it is necessary to determine the day/night distribution of traffic and adjust the traffic volume input data to yield an equivalent hourly traffic volume.

Construction / Demolition Noise and Vibration Impact Methodology

Construction noise and vibration was analyzed using data compiled for various pieces of construction equipment at a representative distance of 50 feet. Construction activities are discussed relative to the applicable City of Antioch General Plan noise policies and Noise Ordinance. Potential impacts and mitigation measures are discussed.

Thresholds of Significance

Appendix G of the CEQA Guidelines states that a project would normally be considered to result in significant noise impacts if noise levels conflict with adopted environmental standards or plans or if noise generated by the project would substantially increase existing noise levels at sensitive receivers on a permanent or temporary basis. Significance criteria for noise impacts are drawn from CEQA Guidelines Appendix G (Items XI [a-f]).

Additional thresholds included in the General Plan EIR also are shown.

Would the project:

a. Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

b. Expose persons to, or generate, excessive groundborne vibration or groundborne noise levels;

c. Cause a substantial permanent increase in ambient noise levels in the project vicinity above existing levels without the project;

d. Cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing levels without the project;

e. Expose persons residing or working in the project area to excessive noise levels if located within an airport land use plan or where such a plan has not been adopted within 2 miles of a public airport or public use airport; or

f. Expose persons residing or working in the project area to excessive noise levels if located within the vicinity of a private airstrip.

Additionally, the General Plan EIR included the following discussion regarding increases in ambient noise:

> *"CEQA does not define "substantial increase." Webster's Dictionary defines "substantial" as "considerable in quantity." As noted earlier in the discussion of noise definitions, the human ear can detect changes of 3 dBA and changes of less than 3 dBA, while audible under controlled circumstances, are not readily discernable in an outdoor environment. Thus a change of 3 dBA is considered a barely audible change. However, CEQA uses "substantial change" as its criterion. Because most people can readily hear a change of 5 dBA L_{dn} in an exterior environment, this value was established for the proposed General Plan as the CEQA criterion for substantial change. As a point of reference, Caltrans defines a noise increase as substantial when the predicted noise level with the project would exceed existing noise levels by 12 dBA L_{eq}."*

Thus, the proposed project could result in potentially significant impacts related to noise if it would exceed any of the thresholds of significance described below.

- An increase in long-term ambient noise by 5 dBA CNEL/L_{dn} or more, where existing noise levels do not exceed the City's 60 dBA CNEL exterior noise level standard (*General Plan DEIR*), or:

- An increase in long-term ambient noise by 3 dBA CNEL/L_{dn} or more, where existing noise levels exceed the City's 60 dBA CNEL exterior noise level standard (*General Plan Noise Element, Policy E*).

The proposed project is not located within two miles of a public or private airport or airstrip. Therefore, aircraft noise is not discussed further in this analysis.

Project-Specific Impacts and Mitigation Measures

Impact 1 Construction / Demolition Noise at Sensitive Receptors

Demolition and Construction of the Proposed Project would temporarily increase noise levels. This would be a ***potentially significant*** impact.

During the demolition and construction of the project, noise from these activities would add to the noise environment in the project vicinity. This is particularly true at the residences adjacent to the east property line. Activities involved in demolition and construction would generate maximum noise levels, as indicated in Table 5, ranging from 76 to 90 dB at a distance of 50 feet. Construction activities would be temporary in nature and are anticipated to occur during normal daytime working hours.

Noise would also be generated during the construction phase by increased truck traffic on area roadways. A substantial project-generated noise source would be truck traffic associated with transport of heavy materials and equipment to and from construction sites. This noise increase would be of short duration, and would likely occur primarily during daytime hours.

Table 5: Construction Equipment Noise

Type of Equipment	Maximum Level, dB at 50 feet
Backhoe	78
Compactor	83
Compressor (air)	78
Concrete Saw	90
Dozer	82
Dump Truck	76
Excavator	81
Generator	81
Jackhammer	89
Pneumatic Tools	85
Source: *Roadway Construction Noise Model User's Guide*. Federal Highway Administration. FHWA-HEP-05-054. January 2006.	

Construction activities are conditionally exempt from the Noise Ordinance during certain hours. Construction activities are exempt from the noise standard from 7 a.m. to 6 p.m. Monday through Friday, and from 9 a.m. to 5 p.m. on Saturdays. No construction is allowed on Sundays and federal holidays.

Mitigation for Impact 1:

The following mitigation measures are required for the Proposed Project to minimize demolition and construction noise impacts.

MM 1a: Demolition and Construction activities shall comply with the City of Antioch Noise Ordinance with regards to hours of operations.

MM 1b: Locate fixed construction equipment such as compressors and generators as far as possible from sensitive receptors. Shroud or shield all impact tools, and muffle or shield all intake and exhaust ports on power construction equipment.

MM 1c**:** Designate a disturbance coordinator and conspicuously post this person's number around the project site and in adjacent public spaces. The disturbance coordinator will receive all public complaints about construction noise disturbances and will be responsible for determining the cause of the complaint, and implement any feasible measures to be taken to alleviate the problem.

MM 1d: Develop a construction-related noise mitigation plan, consistent with the General Plan.

Significance after Mitigation: **Less-than-significant**

Impact 2 Demolition and Construction Vibration at Sensitive Receptors

The proposed project has the potential to expose sensitive receptors to substantial vibration associated with construction activities. This would be a ***less-than-significant*** impact.

The primary vibration-generating activities associated with the proposed project would occur during construction when activities such as grading and utility placement.

Construction vibration impacts include human annoyance and building structural damage. Human annoyance occurs when construction vibration rises significantly above the threshold of perception. Building damage can take the form of cosmetic or structural. Table 6 shows the typical vibration levels produced by construction equipment.

Sensitive receptors could be impacted by construction related vibrations, especially vibratory compactors/rollers. The nearest receptors are located approximately 50 feet or further from any areas of the project site that might require grading or paving. At this distance construction vibrations are not predicted to exceed acceptable levels. Additionally, construction activities would be temporary in nature and would likely occur during normal daytime working hours.

Table 6: Vibration Levels for Varying Construction Equipment

Type of Equipment	Peak Particle Velocity @ 25 feet (inches/second)	Peak Particle Velocity @ 50 feet (inches/second)	Peak Particle Velocity @ 100 feet (inches/second)
Large Bulldozer	0.089	0.031	0.011
Loaded Trucks	0.076	0.027	0.010
Small Bulldozer	0.003	0.001	0.000
Auger/drill Rigs	0.089	0.031	0.011
Jackhammer	0.035	0.012	0.004
Vibratory Hammer	0.070	0.025	0.009
Vibratory Compactor/roller	0.210	0.074	0.026

Source: Federal Transit Administration, Transit Noise and Vibration Impact Assessment Guidelines, May 2006

The Table 6 data indicate that construction vibration levels anticipated for the project are less than the 0.1 in/sec criteria at distances of 50 feet. Therefore, construction vibrations are not predicted to cause damage to existing buildings or cause annoyance to sensitive receptors. Implementation of the proposed project would have a **less than significant** impact.

Mitigation for Impact 2: None required

Impact 3 Transportation Noise at Existing Sensitive Receptors

Traffic generated by the Proposed Project will not generate traffic noise increases exceeding the substantial increase criteria, as outlined in the Thresholds of Significance criteria above. This would be a ***less-than-significant*** impact.

Tables 7 through 9 show the predicted traffic noise level increases on the local roadway network for Existing, Near-Term, and Cumulative scenarios under No-Project and Project conditions.

Table 7: Existing No Project vs. Existing + Project Traffic Noise Levels

Roadway	Segment	Traffic Noise Levels (CNEL, dB)			Distance to Noise Level Contours (feet)					
		Existing No Project	Existing + Project	Δ Change	Existing No Project (CNEL, dB)			Existing + Project (CNEL, dB)		
					70	65	60	70	65	60
Somersville	South of Buchanan	64.8	64.9	+0.1	34	73	158	34	74	158
Somersville	Buchanan to Delta Fair	65.4	65.4	0	37	80	171	37	80	172
Somersville	North of Delta Fair	68.5	68.6	+0.1	60	128	277	61	131	282
Buchanan	West of Somersville	66.2	66.4	+0.2	42	90	193	43	93	200
Buchanan	Somersville to Delta Fair	62.5	62.7	+0.2	24	51	109	24	53	113
Buchanan	Delta Fair to San Jose	63.3	63.3	0	27	58	124	27	58	125
Buchanan	East of San Jose	63.2	63.2	0	26	57	122	26	57	123
Delta Fair	West of Somersville	64.8	64.9	+0.1	34	73	156	34	74	160
Delta Fair	Somersville to Buchanan	64.9	65.3	+0.4	34	74	159	37	79	170

[1] Traffic noise levels are modeled at 75-feet from the centerlines of the Roadways
[2] Distances to traffic noise contours are measured in feet from the centerlines of the Roadways.
[3] Traffic noise levels do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.
Bold indicates a potential significant increase in traffic noise levels.
Source: FHWA-RD-77-108 with inputs from Fehr & Peers and j.c. brennan & associates, Inc. - 2019

Table 8: Near Term No Project vs. Near Term + Project Traffic Noise Levels

Roadway	Segment	Traffic Noise Levels (CNEL, dB)			Distance to Noise Level Contours (feet)					
		Near Term No Project	Near Term + Project	Δ Change	Near Term No Project (CNEL, dB)			Near Term + Project (CNEL, dB)		
					70	65	60	70	65	60
Somersville	South of Buchanan	65.8	65.8	0	39	84	182	39	85	182
Somersville	Buchanan to Delta Fair	66.9	66.9	0	47	100	216	47	100	216
Somersville	North of Delta Fair	69.5	69.6	+0.1	69	149	320	70	151	325
Buchanan	West of Somersville	67.5	67.5	0	51	110	236	51	111	239
Buchanan	Somersville to Delta Fair	63.4	63.6	+0.2	27	58	126	28	60	129
Buchanan	Delta Fair to San Jose	64.0	64.0	0	30	64	138	30	65	140
Buchanan	East of San Jose	63.9	63.9	0	29	63	136	30	64	137
Delta Fair	West of Somersville	65.3	65.4	+0.1	36	78	169	37	80	172
Delta Fair	Somersville to Buchanan	65.2	65.6	+0.4	36	78	167	38	82	178

[1] Traffic noise levels are modeled at 75-feet from the centerlines of the Roadways
[2] Distances to traffic noise contours are measured in feet from the centerlines of the Roadways.
[3] Traffic noise levels do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.
Bold indicates a potential significant increase in traffic noise levels.
Source: FHWA-RD-77-108 with inputs from Fehr & Peers and j.c. brennan & associates, Inc. - 2019

Table 9: Cumulative No Project vs. Cumulative + Project Traffic Noise Levels

Roadway	Segment	Traffic Noise Levels (CNEL, dB)			Distance to Noise Level Contours (feet)					
		Cumulative No Project	Cumulative + Project	Δ Change	Cumulative No Project (CNEL, dB)			Cumulative + Project (CNEL, dB)		
					70	65	60	70	65	60
Somersville	South of Buchanan	67.2	67.2	0	49	105	226	49	106	227
Somersville	Buchanan to Delta Fair	67.5	67.6	+0.1	51	111	239	51	111	239
Somersville	North of Delta Fair	70.1	70.2	+0.1	76	164	353	77	166	357
Buchanan	West of Somersville	67.5	67.5	0	51	110	236	51	110	238
Buchanan	Somersville to Delta Fair	63.6	63.8	+0.2	28	61	130	29	62	134
Buchanan	Delta Fair to San Jose	64.1	64.2	+0.1	30	65	141	31	66	142
Buchanan	East of San Jose	64.1	64.2	+0.1	31	66	142	31	66	143
Delta Fair	West of Somersville	65.8	65.9	+0.1	39	85	183	40	86	186
Delta Fair	Somersville to Buchanan	65.7	66.0	+0.3	39	83	179	41	88	189

[1] Traffic noise levels are modeled at 75-feet from the centerlines of the Roadways
[2] Distances to traffic noise contours are measured in feet from the centerlines of the Roadways.
[3] Traffic noise levels do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.
Bold indicates a potential significant increase in traffic noise levels.
Source: FHWA-RD-77-108 with inputs from Fehr & Peers and j.c. brennan & associates, Inc. - 2019

The project does not result in an increase in long-term ambient noise by 3 dBA CNEL/L_{dn} or more, where existing noise levels exceed the City's 60 dBA CNEL exterior noise level standard (*General Plan Noise Element, Policy E*).

Mitigation for Impact 3: None Required.

Impact 4 Transportation Noise at New Sensitive Receptors

The proposed project does not expose new noise-sensitive uses on the project site to transportation noise levels that exceed the City of Antioch exterior and interior noise level standards. This is considered to be a ***less than significant*** impact.

Exterior Traffic Noise Level Impacts:

The FHWA traffic noise prediction model was used to predict Cumulative traffic noise levels at the proposed residential portion of the project site. Tables 10 shows the predicted traffic noise levels at the proposed residential uses adjacent to Buchanan Road and Delta Fair Avenue.

Based upon Table 10, traffic noise levels will exceed the 60 dBA CNEL standard at the individual patios facing the roadways. However, Noise Objective 11.6.1 of the General Plan applies the noise level standard at the exterior open space for Multi-Family uses. The center courtyard of the project provides a common outdoor area, and those traffic noise levels will comply with the exterior noise level standard of 60 dBA CNEL.

Interior Traffic Noise Level Impacts:

Typical construction will result in an exterior to interior noise level reduction of 25 dBA, provided that air conditioning is provided to allow residents to close windows and doors for the appropriate acoustical isolation. It is assumed that all residences will provide air conditioning for occupants. Predicted cumulative exterior noise levels are expected to be less than 70 dBA CNEL. Therefore, interior noise levels are expected to comply with the interior noise level standard of 45 dBA CNEL.

Mitigation for Impact 4: None Required.

Table 10: Cumulative + Project
Transportation Noise Levels at Proposed Residential Uses

Noise Source	Receptor Description	Approximate Distance to Center of Outdoor Activity Area, feet[1]	ADT	Predicted Exterior Traffic Noise Levels, CNEL (dBA)
Buchanan Road	Building Facade / Patios	100-feet	11,140	64 dBA
Buchanan Road	Courtyard Outdoor Area	200-feet	11,140	54.5 dBA*
Delta Fair Avenue	Building Facade / Patios	100-feet	17,120	66 dBA
Delta Fair Avenue	Courtyard Outdoor Area	200-feet	17,120	56.5 dBA

[1] Setback distances are measured in feet from the centerlines of the roadways.
* Assumes a minimum of -5 dBA shielding from building facades
Source: FHWA-RD-77-108 with inputs from Fehr & Peers and j.c. brennan & associates, Inc. - 2019

Impact 5 Stationary Noise Sources

The primary stationary noise source associated with the project is the proposed parking garage, adjacent to the residences to the east. However, since the entrance is located on the opposite side from the residences, the majority of the use is shielded. Only openings for ventilation are located on the east side of the parking garage. This is a **Less than Significant Noise Source**.

Mitigation for Impact 5:

MM 5a: None required

Cumulative Impacts and Mitigation Measures

Impact 6 Cumulative Noise Levels

The cumulative context for noise impacts associated with the Proposed Project consists of the existing and future noise sources that could affect the project or surrounding uses. Noise generated by construction would be temporary, and would not add to the permanent noise environment or be considered as part of the cumulative context. The total noise impact of the Proposed Project would be fairly small and would not be a substantial increase to the existing future noise environment. The mitigation measures described in this analysis would result in the Proposed Project having a ***less-than-significant cumulative impact.***

Mitigation for Impact 6: None required

Appendix A

Acoustical Terminology

Acoustics The science of sound.

Ambient Noise The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.

Attenuation The reduction of an acoustic signal.

A-Weighting A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.

Decibel or dB Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.

CNEL Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.

Frequency The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz).

L_{dn} Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.

L_{eq} Equivalent or energy-averaged sound level.

L_{max} The highest root-mean-square (RMS) sound level measured over a given period of time.

$L_{(n)}$ The sound level exceeded a described percentile over a measurement period. For instance, an hourly L_{50} is the sound level exceeded 50% of the time during the one hour period.

Loudness A subjective term for the sensation of the magnitude of sound.

Noise Unwanted sound.

NRC Noise Reduction Coefficient. NRC is a single-number rating of the sound-absorption of a material equal to the arithmetic mean of the sound-absorption coefficients in the 250, 500, 1000, and 2,000 Hz octave frequency bands rounded to the nearest multiple of 0.05. It is a representation of the amount of sound energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption.

Peak Noise The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the AMaximum@ level, which is the highest RMS level.

RT_{60} The time it takes reverberant sound to decay by 60 dB once the source has been removed.

Sabin The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 Sabin.

SEL Sound Exposure Level. SEL is s rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy into a one-second event.

STC Sound Transmission Class. STC is an integer rating of how well a building partition attenuates airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations.

Threshold of Hearing The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.

Threshold of Pain Approximately 120 dB above the threshold of hearing.

Impulsive Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.

Simple Tone Any sound which can be judged as audible as a single pitch or set of single pitches.

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Appendix B
2019-121 Delta Fair Village
24hr Continuous Noise Monitoring - Site A
07/24/2019 - 07/25/2019

Hour	Leq	Lmax	L50	L90
20:00	52	73	52	50
21:00	50	63	49	47
22:00	48	62	47	46
23:00	47	60	46	44
0:00	46	65	45	44
1:00	45	54	45	43
2:00	45	61	44	42
3:00	48	67	47	44
4:00	51	73	50	48
5:00	52	61	52	50
6:00	52	72	51	48
7:00	53	66	52	50
8:00	54	68	52	49
9:00	52	71	51	49
10:00	53	64	51	49
11:00	51	63	50	48
12:00	53	64	52	50
13:00	51	65	50	48
14:00	52	73	51	48
15:00	52	63	51	49
16:00	51	68	50	48
17:00	51	68	50	48
18:00	51	74	50	47
19:00	51	70	49	47

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	54.0	49.8	51.9	52.1	45.0	49.1
Lmax (Maximum)	74.4	62.6	67.5	73.1	54.1	64.0
L50 (Median)	52.2	49.2	50.7	51.7	44.3	47.5
L90 (Background)	50.1	47.4	48.6	49.8	42.3	45.6

Computed Ldn, dB	56.0
% Daytime Energy	76%
% Nighttime Energy	24%

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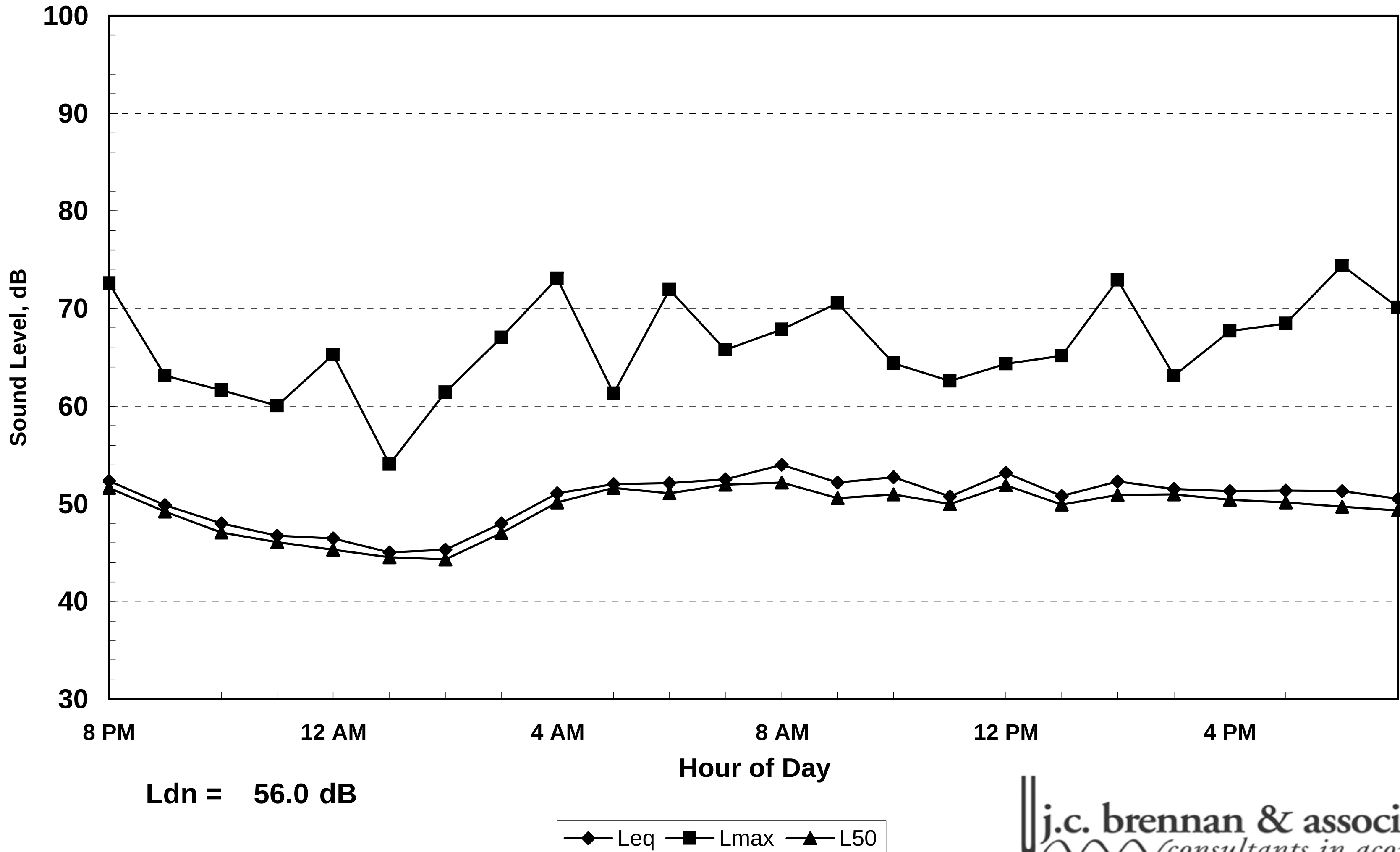
Appendix B

2019-121 Delta Fair Village

24hr Continuous Noise Monitoring - Site A

07/24/2019 - 07/25/2019



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Appendix C
FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2019-121
Description: Existing
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Somersville	South of Buchanan	13,040	77		23	2.5	1.5	35	75	
2	Somersville	Buchanan to Delta Fair	14,760	77		23	2.5	1.5	35	75	
3	Somersville	North of Delta Fair	30,300	77		23	2.5	1.5	35	75	
4	Buchanan	West of Somersville	17,680	77		23	2.5	1.5	35	75	
5	Buchanan	Somersville to Delta Fair	7,540	77		23	2.5	1.5	35	75	
6	Buchanan	Delta Fair to San Jose	9,090	77		23	2.5	1.5	35	75	
7	Buchanan	East of San Jose	8,860	77		23	2.5	1.5	35	75	
8	Delta Fair	West of Somersville	12,860	77		23	2.5	1.5	35	75	
9	Delta Fair	Somersville to Buchanan	13,220	77		23	2.5	1.5	35	75	
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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2019-121

Description: Existing

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Somersville	South of Buchanan	62.5	56.3	59.3	64.8
2	Somersville	Buchanan to Delta Fair	63.0	56.9	59.8	65.4
3	Somersville	North of Delta Fair	66.1	60.0	63.0	68.5
4	Buchanan	West of Somersville	63.8	57.6	60.6	66.2
5	Buchanan	Somersville to Delta Fair	60.1	53.9	56.9	62.5
6	Buchanan	Delta Fair to San Jose	60.9	54.8	57.7	63.3
7	Buchanan	East of San Jose	60.8	54.6	57.6	63.2
8	Delta Fair	West of Somersville	62.4	56.3	59.2	64.8
9	Delta Fair	Somersville to Buchanan	62.5	56.4	59.4	64.9

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Noise Contour Output

Project #: 2019-121

Description: Existing

Ldn/CNEL: CNEL

Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Somersville	South of Buchanan	16	34	73	158	340
2	Somersville	Buchanan to Delta Fair	17	37	80	171	369
3	Somersville	North of Delta Fair	28	60	128	277	596
4	Buchanan	West of Somersville	19	42	90	193	416
5	Buchanan	Somersville to Delta Fair	11	24	51	109	236
6	Buchanan	Delta Fair to San Jose	12	27	58	124	267
7	Buchanan	East of San Jose	12	26	57	122	263
8	Delta Fair	West of Somersville	16	34	73	156	337
9	Delta Fair	Somersville to Buchanan	16	34	74	159	343

Appendix C
FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2019-121
Description: Existing + Project
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Somersville	South of Buchanan	13,120	77		23	2.5	1.5	35	75	
2	Somersville	Buchanan to Delta Fair	14,790	77		23	2.5	1.5	35	75	
3	Somersville	North of Delta Fair	31,220	77		23	2.5	1.5	35	75	
4	Buchanan	West of Somersville	18,680	77		23	2.5	1.5	35	75	
5	Buchanan	Somersville to Delta Fair	7,930	77		23	2.5	1.5	35	75	
6	Buchanan	Delta Fair to San Jose	9,230	77		23	2.5	1.5	35	75	
7	Buchanan	East of San Jose	89,300	77		23	2.5	1.5	35	75	
8	Delta Fair	West of Somersville	13,270	77		23	2.5	1.5	35	75	
9	Delta Fair	Somersville to Buchanan	14,600	77		23	2.5	1.5	35	75	
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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2019-121

Description: Existing + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Somersville	South of Buchanan	62.5	56.4	59.3	64.9
2	Somersville	Buchanan to Delta Fair	63.0	56.9	59.9	65.4
3	Somersville	North of Delta Fair	66.3	60.1	63.1	68.6
4	Buchanan	West of Somersville	64.0	57.9	60.9	66.4
5	Buchanan	Somersville to Delta Fair	60.3	54.2	57.1	62.7
6	Buchanan	Delta Fair to San Jose	61.0	54.8	57.8	63.3
7	Buchanan	East of San Jose	70.8	64.7	67.7	73.2
8	Delta Fair	West of Somersville	62.6	56.4	59.4	64.9
9	Delta Fair	Somersville to Buchanan	63.0	56.8	59.8	65.3

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Noise Contour Output

Project #: 2019-121

Description: Existing + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	-------- Distances to Traffic Noise Contours --------				
			75	70	65	60	55
1	Somersville	South of Buchanan	16	34	74	158	341
2	Somersville	Buchanan to Delta Fair	17	37	80	172	370
3	Somersville	North of Delta Fair	28	61	131	282	608
4	Buchanan	West of Somersville	20	43	93	200	432
5	Buchanan	Somersville to Delta Fair	11	24	53	113	244
6	Buchanan	Delta Fair to San Jose	13	27	58	125	270
7	Buchanan	East of San Jose	57	123	264	569	1226
8	Delta Fair	West of Somersville	16	34	74	160	344
9	Delta Fair	Somersville to Buchanan	17	37	79	170	366

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Appendix C
FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2019-121
Description: Near Term No Project
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Somersville	South of Buchanan	16,100	77		23	2.5	1.5	35	75	
2	Somersville	Buchanan to Delta Fair	20,900	77		23	2.5	1.5	35	75	
3	Somersville	North of Delta Fair	37,700	77		23	2.5	1.5	35	75	
4	Buchanan	West of Somersville	23,900	77		23	2.5	1.5	35	75	
5	Buchanan	Somersville to Delta Fair	9,300	77		23	2.5	1.5	35	75	
6	Buchanan	Delta Fair to San Jose	10,700	77		23	2.5	1.5	35	75	
7	Buchanan	East of San Jose	10,400	77		23	2.5	1.5	35	75	
8	Delta Fair	West of Somersville	14,400	77		23	2.5	1.5	35	75	
9	Delta Fair	Somersville to Buchanan	14,200	77		23	2.5	1.5	35	75	
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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2019-121

Description: Near Term No Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Somersville	South of Buchanan	63.4	57.2	60.2	65.8
2	Somersville	Buchanan to Delta Fair	64.5	58.4	61.4	66.9
3	Somersville	North of Delta Fair	67.1	60.9	63.9	69.5
4	Buchanan	West of Somersville	65.1	59.0	61.9	67.5
5	Buchanan	Somersville to Delta Fair	61.0	54.9	57.8	63.4
6	Buchanan	Delta Fair to San Jose	61.6	55.5	58.4	64.0
7	Buchanan	East of San Jose	61.5	55.3	58.3	63.9
8	Delta Fair	West of Somersville	62.9	56.8	59.7	65.3
9	Delta Fair	Somersville to Buchanan	62.8	56.7	59.7	65.2

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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Noise Contour Output

Project #: 2019-121

Description: Near Term No Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Somersville	South of Buchanan	18	39	84	182	391
2	Somersville	Buchanan to Delta Fair	22	47	100	216	465
3	Somersville	North of Delta Fair	32	69	149	320	690
4	Buchanan	West of Somersville	24	51	110	236	509
5	Buchanan	Somersville to Delta Fair	13	27	58	126	271
6	Buchanan	Delta Fair to San Jose	14	30	64	138	298
7	Buchanan	East of San Jose	14	29	63	136	292
8	Delta Fair	West of Somersville	17	36	78	169	363
9	Delta Fair	Somersville to Buchanan	17	36	78	167	360

Appendix C
FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2019-121
Description: Near Term + Project
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Somersville	South of Buchanan	16,180	77		23	2.5	1.5	35	75	
2	Somersville	Buchanan to Delta Fair	20,930	77		23	2.5	1.5	35	75	
3	Somersville	North of Delta Fair	38,620	77		23	2.5	1.5	35	75	
4	Buchanan	West of Somersville	24,240	77		23	2.5	1.5	35	75	
5	Buchanan	Somersville to Delta Fair	9,690	77		23	2.5	1.5	35	75	
6	Buchanan	Delta Fair to San Jose	10,860	77		23	2.5	1.5	35	75	
7	Buchanan	East of San Jose	10,560	77		23	2.5	1.5	35	75	
8	Delta Fair	West of Somersville	14,830	77		23	2.5	1.5	35	75	
9	Delta Fair	Somersville to Buchanan	15,580	77		23	2.5	1.5	35	75	
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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2019-121

Description: Near Term + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Somersville	South of Buchanan	63.4	57.3	60.2	65.8
2	Somersville	Buchanan to Delta Fair	64.5	58.4	61.4	66.9
3	Somersville	North of Delta Fair	67.2	61.0	64.0	69.6
4	Buchanan	West of Somersville	65.2	59.0	62.0	67.5
5	Buchanan	Somersville to Delta Fair	61.2	55.0	58.0	63.6
6	Buchanan	Delta Fair to San Jose	61.7	55.5	58.5	64.0
7	Buchanan	East of San Jose	61.6	55.4	58.4	63.9
8	Delta Fair	West of Somersville	63.0	56.9	59.9	65.4
9	Delta Fair	Somersville to Buchanan	63.3	57.1	60.1	65.6

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Noise Contour Output

Project #: 2019-121

Description: Near Term + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Somersville	South of Buchanan	18	39	85	182	392
2	Somersville	Buchanan to Delta Fair	22	47	100	216	466
3	Somersville	North of Delta Fair	33	70	151	325	701
4	Buchanan	West of Somersville	24	51	111	239	514
5	Buchanan	Somersville to Delta Fair	13	28	60	129	279
6	Buchanan	Delta Fair to San Jose	14	30	65	140	301
7	Buchanan	East of San Jose	14	30	64	137	295
8	Delta Fair	West of Somersville	17	37	80	172	370
9	Delta Fair	Somersville to Buchanan	18	38	82	178	383

Appendix C
FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2019-121
Description: Cumulative No Project
Ldn/CNEL: CNEL
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Somersville	South of Buchanan	22,400	77		23	2.5	1.5	35	75	
2	Somersville	Buchanan to Delta Fair	24,300	77		23	2.5	1.5	35	75	
3	Somersville	North of Delta Fair	43,600	77		23	2.5	1.5	35	75	
4	Buchanan	West of Somersville	23,900	77		23	2.5	1.5	35	75	
5	Buchanan	Somersville to Delta Fair	9,800	77		23	2.5	1.5	35	75	
6	Buchanan	Delta Fair to San Jose	11,000	77		23	2.5	1.5	35	75	
7	Buchanan	East of San Jose	11,100	77		23	2.5	1.5	35	75	
8	Delta Fair	West of Somersville	16,300	77		23	2.5	1.5	35	75	
9	Delta Fair	Somersville to Buchanan	15,800	77		23	2.5	1.5	35	75	
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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2019-121

Description: Cumulative No Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Somersville	South of Buchanan	64.8	58.7	61.7	67.2
2	Somersville	Buchanan to Delta Fair	65.2	59.0	62.0	67.5
3	Somersville	North of Delta Fair	67.7	61.6	64.5	70.1
4	Buchanan	West of Somersville	65.1	59.0	61.9	67.5
5	Buchanan	Somersville to Delta Fair	61.2	55.1	58.1	63.6
6	Buchanan	Delta Fair to San Jose	61.7	55.6	58.6	64.1
7	Buchanan	East of San Jose	61.8	55.6	58.6	64.1
8	Delta Fair	West of Somersville	63.4	57.3	60.3	65.8
9	Delta Fair	Somersville to Buchanan	63.3	57.2	60.1	65.7

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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Noise Contour Output

Project #: 2019-121

Description: Cumulative No Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Somersville	South of Buchanan	23	49	105	226	488
2	Somersville	Buchanan to Delta Fair	24	51	111	239	515
3	Somersville	North of Delta Fair	35	76	164	353	760
4	Buchanan	West of Somersville	24	51	110	236	509
5	Buchanan	Somersville to Delta Fair	13	28	61	130	281
6	Buchanan	Delta Fair to San Jose	14	30	65	141	303
7	Buchanan	East of San Jose	14	31	66	142	305
8	Delta Fair	West of Somersville	18	39	85	183	394
9	Delta Fair	Somersville to Buchanan	18	39	83	179	386

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2019-121

Description: Cumulative + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Somersville	South of Buchanan	22,580	77		23	2.5	1.5	35	75	
2	Somersville	Buchanan to Delta Fair	24,320	77		23	2.5	1.5	35	75	
3	Somersville	North of Delta Fair	44,470	77		23	2.5	1.5	35	75	
4	Buchanan	West of Somersville	24,130	77		23	2.5	1.5	35	75	
5	Buchanan	Somersville to Delta Fair	10,190	77		23	2.5	1.5	35	75	
6	Buchanan	Delta Fair to San Jose	11,140	77		23	2.5	1.5	35	75	
7	Buchanan	East of San Jose	11,260	77		23	2.5	1.5	35	75	
8	Delta Fair	West of Somersville	16,730	77		23	2.5	1.5	35	75	
9	Delta Fair	Somersville to Buchanan	17,120	77		23	2.5	1.5	35	75	
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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Predicted Levels

Project #: 2019-121

Description: Cumulative + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Somersville	South of Buchanan	64.9	58.7	61.7	67.2
2	Somersville	Buchanan to Delta Fair	65.2	59.0	62.0	67.6
3	Somersville	North of Delta Fair	67.8	61.7	64.6	70.2
4	Buchanan	West of Somersville	65.2	59.0	62.0	67.5
5	Buchanan	Somersville to Delta Fair	61.4	55.3	58.2	63.8
6	Buchanan	Delta Fair to San Jose	61.8	55.6	58.6	64.2
7	Buchanan	East of San Jose	61.8	55.7	58.7	64.2
8	Delta Fair	West of Somersville	63.6	57.4	60.4	65.9
9	Delta Fair	Somersville to Buchanan	63.7	57.5	60.5	66.0

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FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Noise Contour Output

Project #: 2019-121

Description: Cumulative + Project

Ldn/CNEL: CNEL

Hard/Soft: Soft

Segment	Roadway Name	Segment Description	-------- Distances to Traffic Noise Contours --------				
			75	70	65	60	55
1	Somersville	South of Buchanan	23	49	106	227	490
2	Somersville	Buchanan to Delta Fair	24	51	111	239	515
3	Somersville	North of Delta Fair	36	77	166	357	770
4	Buchanan	West of Somersville	24	51	110	238	512
5	Buchanan	Somersville to Delta Fair	13	29	62	134	288
6	Buchanan	Delta Fair to San Jose	14	31	66	142	306
7	Buchanan	East of San Jose	14	31	66	143	308
8	Delta Fair	West of Somersville	19	40	86	186	401
9	Delta Fair	Somersville to Buchanan	19	41	88	189	408