HALE AVENUE EXTENSION AND SANTA TERESA COORIDOR WIDENING AND REALIGNMENT PROJECT (PHASE 1) ENVIRONMENTAL NOISE ASSESSMENT MORGAN HILL, CALIFORNIA

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Introduction

This report presents the results of an environmental noise assessment conducted for the Hale Avenue Extension and Santa Teresa Boulevard Corridor Widening and Realignment project in Morgan Hill, California. Hale Avenue is part of the Santa Teresa Corridor, which is a north-south arterial through Morgan Hill from Tilton Avenue to Watsonville Road that parallels US Highway 101. While the City's General Plan identifies this continuous corridor as Santa Teresa Boulevard, it is currently a disjointed thoroughfare with significant portions missing and other portions being made up of a series of north-south streets of different names. To make the Santa Teresa Corridor continuous, Hale Avenue needs to be extended and the Santa Teresa Corridor between Dewitt Avenue and Watsonville Road needs to be realigned and widened. These improvements would be constructed in two phases; Phase I and Phase II. Phase I is the extension of Hale Avenue from West Main Avenue to the Dewitt/Spring Avenue intersection and is anticipated to be constructed within the next three to four years. Phase II is the realignment and widening of the Santa Teresa Corridor from the Dewitt/Spring Avenue intersection to Watsonville Road, and is anticipated to be constructed in the next 10 to 15 years. This noise report focuses on Phase I (Hale Avenue Extension) of the project, which is entirely within the City of Morgan Hill.

The Hale Avenue Extension is adjoined primarily by residential uses, with some commercial, religious, and educational uses located along the western side of the project from West Dunne Avenue to West Main Avenue. The primary noise-related issue is the increase in noise levels resulting from the extension of Hale Avenue on the residential uses. This assessment presents the fundamentals of environmental noise and vibration, provides a discussion of policies and standards applicable to the project, presents the results of measurements conducted along the project alignment, and evaluates the potential significance of impacts resulting from the project. Noise reduction measures are presented, as needed, to mitigate all potentially significant impacts.

Fundamentals of Environmental Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in *decibels (dB)* with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in Table 1.

Most of the sounds which we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the facts that human hearing is less sensitive at low frequencies and extreme high frequencies than in the frequency mid-range. This is called "A" weighting, and the decibel level so measured is called the *A-weighted sound level (dBA).* In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and in industry are shown in Table 2 for different types of noise.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, L_{01}, L_{10}, L_{50}, and L_{90}, are commonly used. They are the A-weighted noise levels equaled or exceeded during 1%, 10%, 50%, and 90% of a stated time period. A single number descriptor called the L_{eq} is also widely used. The L_{eq} is the *average A-weighted noise level* during a stated period of time.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, *L_{dn}/DNL (day/night average sound level)*, was developed. The L_{dn} divides the 24-hour day into the daytime of 7:00 AM to 10:00 PM and the nighttime of 10:00 PM to 7:00 AM. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The *Community Noise Equivalent Level (CNEL)* is another 24-hour average which includes both an evening and nighttime weighting.

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 is the *Peak Particle Velocity (PPV)* and another is the *Root Mean Square (RMS)* velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this section, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce. The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Table 1: Definitions of Acoustical Terms Used in this Report

Term	Definitions
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, Leq	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	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

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

Table 3: Reactions of People and Damage to Buildings From Continuous or Frequent Intermittent Vibration Levels

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

Source: Transportation- and Construction-Induced Vibration Guidance Manual, Caltrans, June 2004.

Regulatory Background

The State of California and the City of Morgan Hill establish regulatory criteria designed to limit noise exposure at noise sensitive land uses. The State's CEQA guidelines are used to assess the potential significance of environmental noise impacts pursuant to local policies set forth in the City of Morgan Hill General Plan and Municipal Code.

State CEQA Guidelines

The California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of environmental noise impacts attributable to a proposed project. Applicable CEQA checklist questions[1] ask whether the project would result in:

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

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

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

[1] CEQA checklist questions e and f, regarding potential impacts from aircraft noise, are not applicable in the assessment and have been omitted.

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

CEQA does not define the noise level increase that is considered substantial. Typically, a permanent increase in the day-night average noise level of 3 dBA L_{dn} or greater at noise-sensitive receptors would be considered significant when projected noise levels would exceed those considered satisfactory for the affected land use. An increase of 5 dBA L_{dn} or greater would be considered significant when projected noise levels would continue to meet those considered satisfactory for the affected land use. A substantial temporary noise increase from construction is typically defined as noise levels exceeding 60 dBA L_{eq} and the ambient noise environment by at least 5 dBA L_{eq} for a period of more than one year.

The project is not located adjacent to any significant sources of ground-borne vibration and is located outside of the 55 dB noise contour for the South County Airport of Santa Clara in San Martin, which is four miles to the southeast of the project. Aircraft noise does not make a significant contribution to overall noise levels at the project site so no additional analysis of aircraft noise is included within this report. Checklist items (e) and (f) are not carried forward for further analysis.

City of Morgan Hill General Plan

The City of Morgan Hill's 2016 General Plan sets forth noise and land use compatibility standards for proposed land uses (General Plan Table SSI-1). Policy SSI-8.5 is directly applicable to the proposed project as it requires improvements to and extensions of City streets to develop and include noise reduction measures. Noise level increases resulting from traffic associated with new projects shall be considered significant if: a) the noise level increase is 5 dBA L_{dn} or greater, with a future noise level of less than 60 dBA L_{dn}, or b) the noise level increase is 3 dBA L_{dn} or greater, with a future noise level of 60 dBA L_{dn} or greater.

City of Morgan Hill Municipal Code

Chapter 8.28, Section 8.28.040 states that construction activities are not permitted except within the hours of 7:00 AM and 8:00 PM on weekdays and 9:00 AM and 6:00 PM on Saturdays. No construction is permitted on Sundays or holidays. Public work projects are exempt from this section and the public works director shall determine the hours of construction for public works projects.

Existing Noise Environment

The project alignment is part of the Santa Teresa Corridor and stretches along approximately 4,100 feet (0.93 miles) of new alignment between Dewitt Avenue to the south and West Main Avenue to the north in the City of Morgan Hill. Existing land uses adjoining the new alignment are primarily residential, with some open land and commercial uses located to the east and west of the alignment. To the west of the alignment there is Hillview Convalescent Hospital, a skilled nursing facility (Pacific Hills Manor), and a private school (Saint Catherine's School).

Two noise monitoring surveys were made to document existing ambient noise conditions; the first was from November 20 through 23, 2011 and the second was from March 29 through March 31, 2016. The noise monitoring surveys included four long-term (24-hour) measurements. Noise measurement locations are shown on Figure 1.

Ambient noise levels along Dewitt Avenue and along the project alignment were monitored over a 24-hour period at locations LT-1, LT-2, LT-A, and LT-B. A summary of the worst case levels are shown in Table 4. Site LT-1 was located near the end of Noble Court, approximately 300 feet from the centerline of the proposed roadway, and Site LT-2 was located near the intersection of Dewitt Avenue. LT-A was located near the center of the project limits on a light pole at the end of Edward Jones Court approximately 80 feet from the centerline of the proposed roadway, and LT-B was located across the street from 215 Nob Hill Terrace on a utility pole approximately 120 feet from the centerline of the proposed roadway. Hourly average noise levels at LT-1 ranged from 51 to 57 dBA $L_{eq(hr)}$ during daytime hours and dropped to a low of 41 dBA $L_{eq(hr)}$ during the 1:00 and 2:00 AM hours. The day-night average noise level at LT-1 was calculated to be 53 dBA L_{dn}. Hourly average noise levels at LT-2 ranged from 64 to 71 dBA $L_{eq(hr)}$ during daytime hours and dropped to a low of 52 dBA $L_{eq(hr)}$ during the 3:00 AM hour. The day-night average noise level at LT-2 was calculated to be 67 dBA L_{dn}. Hourly average noise levels at LT-A ranged from 46 to 60 dBA $L_{eq(hr)}$ during daytime hours and dropped to a low of 41 dBA $L_{eq(hr)}$ during the 1:00 AM hour. The day-night average noise level at LT-A was calculated to be 51 dBA L_{dn}. Hourly average noise levels at LT-B ranged from 46 to 52 dBA $L_{eq(hr)}$ during daytime hours and dropped to a low of 39 dBA $L_{eq(hr)}$ during the 12:00 AM through 2:00 AM hour. The day-night average noise level at LT-B was calculated to be 57 dBA $L_{dn.}$ The daily trend in noise levels over the noise-monitoring periods for LT-1, LT-2, LT-A, and LT-B are shown in Figures 2 and 5, respectively.

Figure 1: Noise Measurement and Modeled Receiver Locations (part 1)

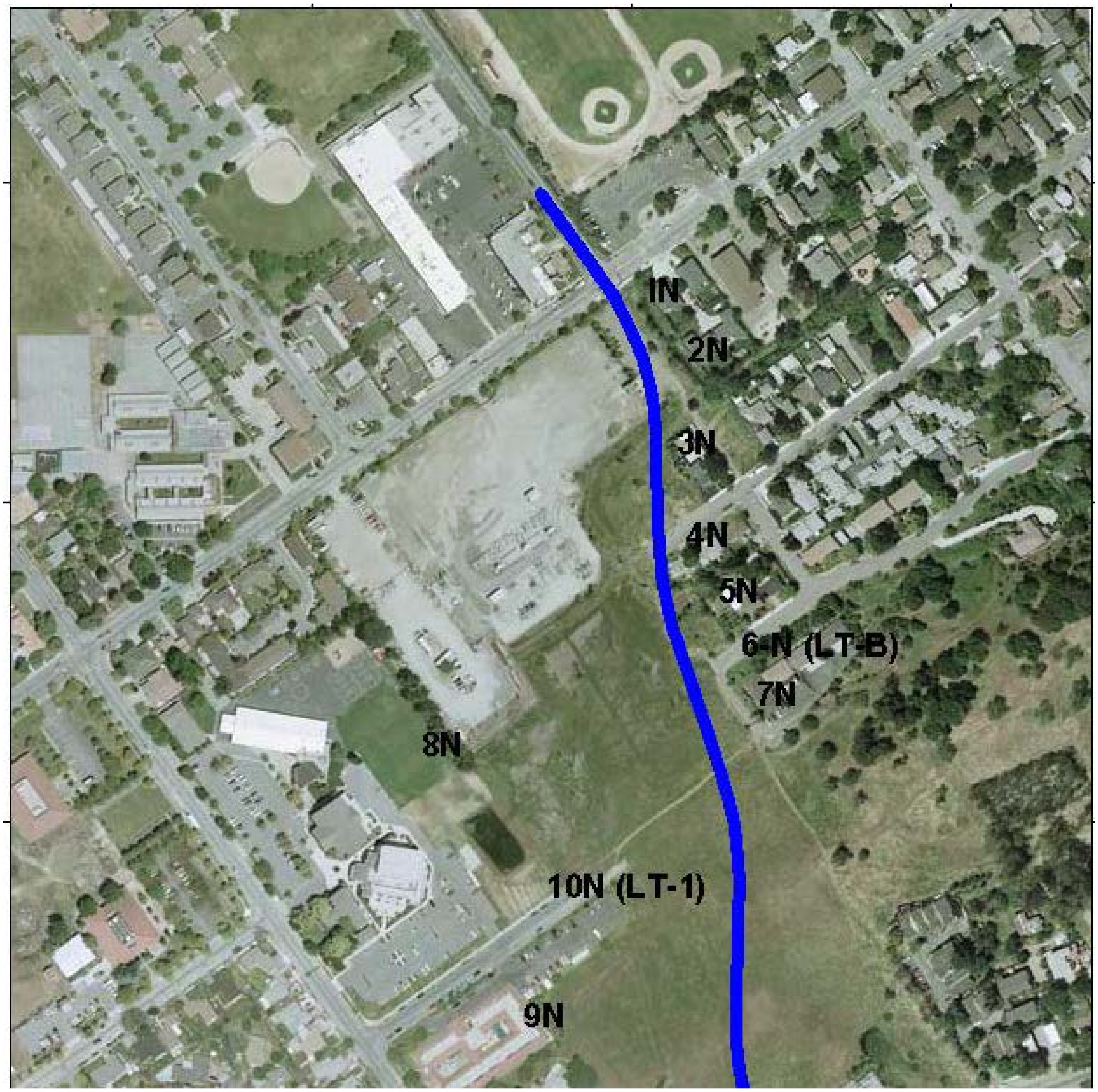


Figure 1: Noise Measurement and Modeled Receiver Locations (Part 2)

Table 4: Summary of Maximum Levels of One-Hour Data from Long-Term Noise Measurements Sites

ID	Location	Date	Measured Noise Levels, dBA					
			$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}	Ldn
LT-1	Near the End of Noble Court.	11/21/2011	68	66	60	52	57	53
LT-2	On a light pole across Dewitt Avenue from Buck Hill Court.	11/21/2011	92	76	67	55	71	67
LT-A	In Front of 16820 Edwin Jones Court on a light pole.	3/30/2016	83	76	59	54	64	54
LT-B	435 feet south of relay station on Nob Hill Terrace.	3/30/2016	78	69	68	62	61	57

Figure 2: Daily Trend in Noise Levels at LT-1

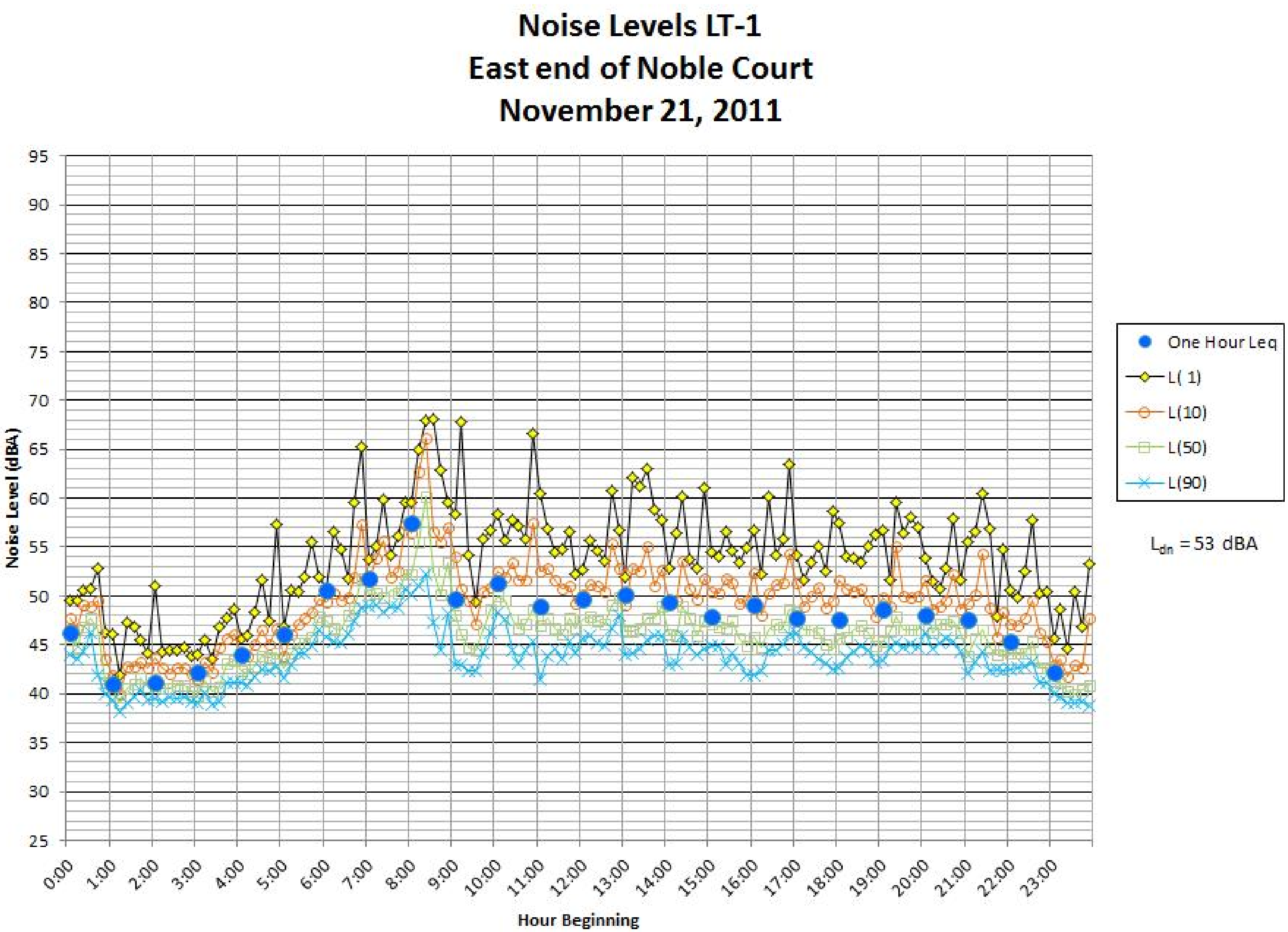


Figure 3: Daily Trend in Noise Levels at LT-2

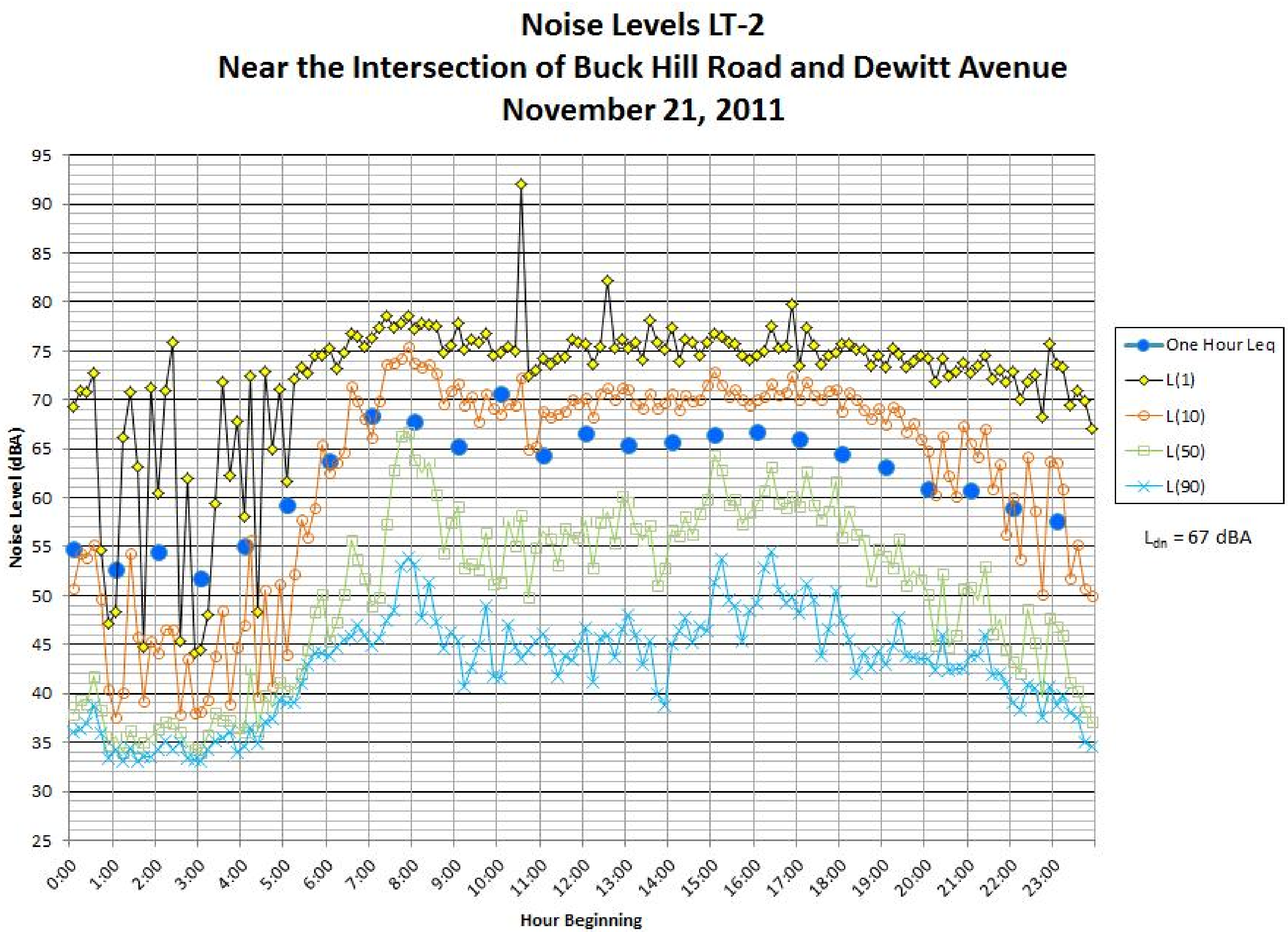


Figure 4: Daily Trend in Noise Levels at LT-A

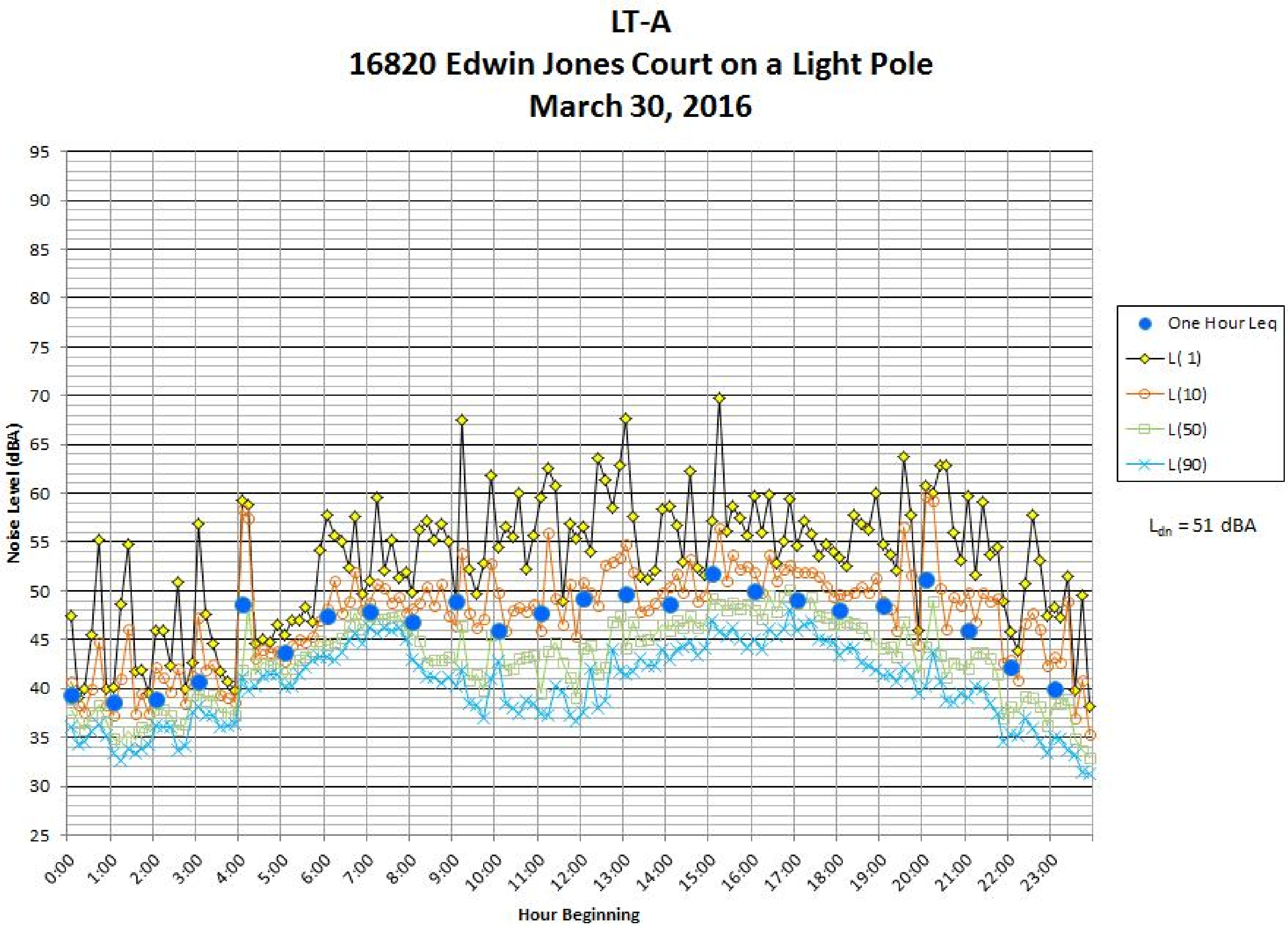
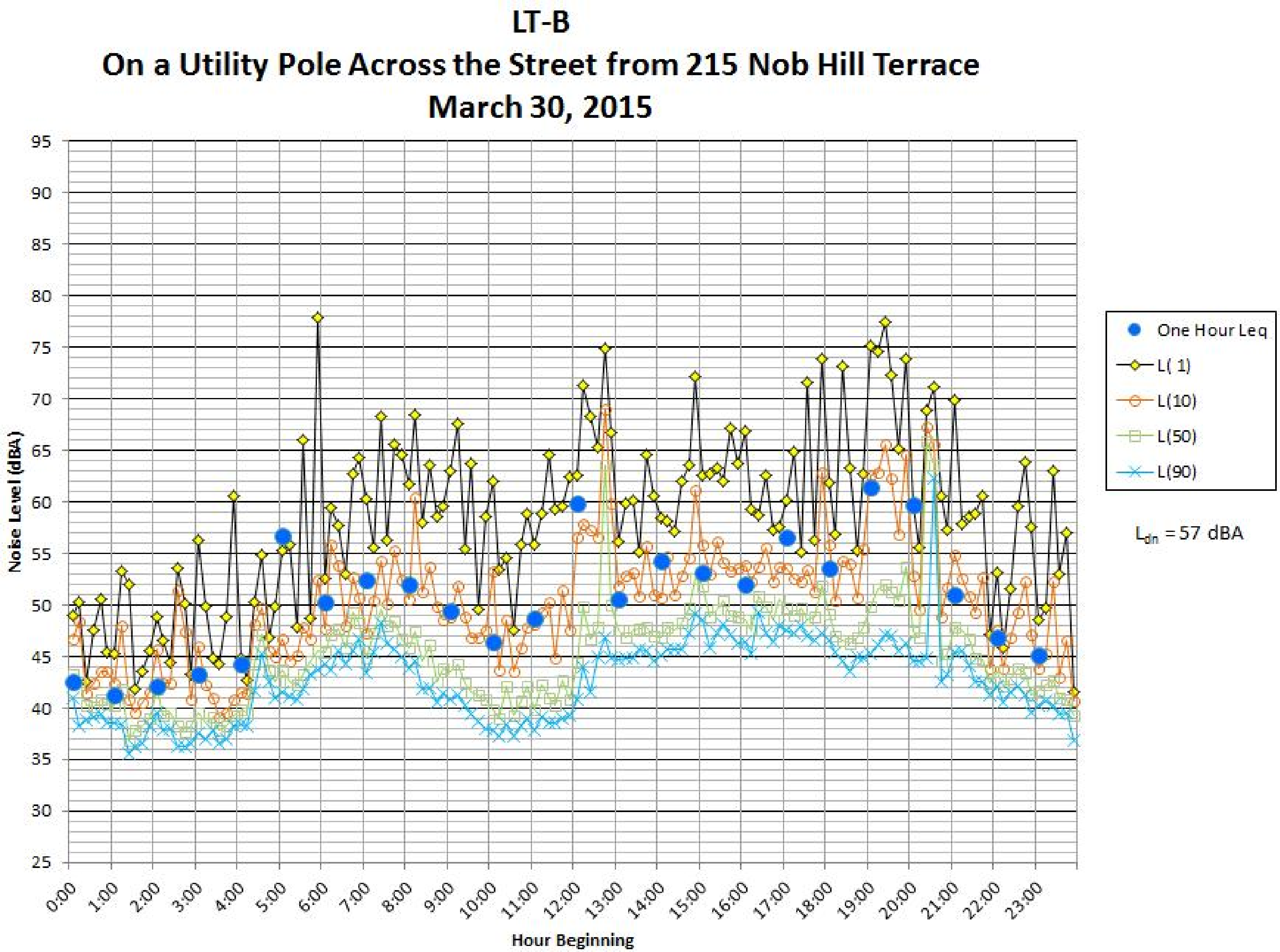


Figure 5: Daily Trend in Noise Levels at LT-B



NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Appendix G of the CEQA Guidelines states that a project would normally be considered to result in a significant impact if noise levels conflict with adopted environmental standards or plans, if the project would expose persons to or generate excessive groundborne vibration levels, or if noise levels generated by the project would substantially increase existing noise levels on a permanent or temporary basis. For the purposes of this analysis, the following criteria were used to quantitatively evaluate noise and vibration impacts resulting from the project:

- **Groundborne Vibration:** The proposed project would result in a significant impact if project construction activity or project-related vehicle traffic would result in vibration levels of 0.3 in/sec PPV or greater.

- **Traffic Noise Increases:** A significant permanent noise impact would occur if the project resulted in an increase of 3 dBA L_{dn} or greater at noise-sensitive land uses where existing or projected noise levels would exceed 60 dBA L_{dn} or an increase of 5 dBA L_{dn} or greater at noise-sensitive land uses where noise levels would continue to be below 60 dBA L_{dn}.

- **Construction Noise:** Due to the temporary nature of construction activities, construction noise levels are treated differently than operational noise levels. When construction activities are predicted to cause prolonged interference with normal activities at noise-sensitive receiver locations and exceed 60 dBA L_{eq} and ambient noise levels by 5 dBA L_{eq} or more, the impact would be considered significant. Prolonged interference is defined as a noise level increase that occurs for more than one year.

Impact 1: **Conflict with Established Standards.** The project would not conflict with local noise standards contained in the General Plan or Municipal Code. **This is a less-than-significant impact.**

Applicable standards, goals, and policies contained in the City of Morgan Hill's 2035 General Plan and Municipal Code are summarized in the Setting section of this report. Noise and land use compatibility standards presented in the General Plan are used in the siting of new noise-sensitive land uses. In areas where the existing noise levels (as described in Impact 3) currently exceed the "normally acceptable" residential limit of 60 dBA L_{dn}, future noise levels with or without the proposed project will continue to exceed the 60 dBA L_{dn} limit. These exceedances of the General Plan noise level goal occur in areas near existing roadways (e.g. Dewitt, West Dunne, and West Main Avenues) where mitigation is not possible due to the need to maintain driveway access to the residential properties. With the proposed noise barriers, the noise impacts from the project will be mitigated; however, the existing exceedances of the General Plan noise level goal cannot be mitigated. The Municipal Code allows construction noise occurring between the hours of 7:00 AM and 8:00 PM on weekdays, and 9:00 AM and 6:00 PM on Saturdays, with no construction occurring on Sundays or holidays. Construction of the project would be limited to within the allowable hours as specified in the Municipal Code. As such, the project would not conflict with the standards presented in the Municipal Code and the impact is less-than-significant.

Mitigation Measure 1: None Required.

Impact 2: Groundborne Vibration. The proposed project will not result in excessive groundborne vibration at residences in the vicinity. **This is a less-than-significant impact.**

Project-related vehicle traffic is not anticipated to generate perceptible levels of groundborne vibration at nearby structures (vibration levels are anticipated to be below 0.01 in/sec PPV). The anticipated construction equipment to be used on the project includes backhoes, scrapers, motor graders, steel-wheel rollers, pneumatic tire rollers, manually operated compactors, asphalt pavers, milling machines, concrete trucks, cranes, drill rigs, truck mounted traffic paint stripers, and pick-up trucks. Pile driving is not anticipated as part of the construction of the project. Construction activities with the greatest potential of generating perceptible vibration levels would include the removal of pavement and soil, the movement of heavy tracked equipment, and vibratory compacting of roadway base materials by use of a roller. Table 5 summarizes typical vibration levels associated with varying pieces of construction equipment at a distance of 25 feet.

Table 5: Vibration Source Levels for Construction Equipment

Equipment		**PPV at 25 ft. (in/sec)**
Pile Driver (Impact)	upper range	1.158
	typical	0.644
Pile Driver (Sonic)	upper range	0.734
	typical	0.170
Clam shovel drop		0.202
Hydromill (slurry wall)	in soil	0.008
	in rock	0.017
Vibratory Roller		0.210
Hoe Ram		0.089
Large bulldozer		0.089
Caisson drilling		0.089
Loaded trucks		0.076
Jackhammer		0.035
Small bulldozer		0.003

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

A review of the anticipated construction equipment and the vibration level data provided in Table 5 indicates that vibration levels generated by proposed activities and equipment would be below the 0.3 in/sec PPV criteria when construction occurs at distances of 25 feet or greater from sensitive structures. There are no known sensitive historic structures located within 25 feet of construction activities. Vibration levels generated by construction activities would be perceptible indoors and may be considered annoying at times, causing irritating secondary vibration, such as a slight rattling of windows or doors. However, architectural damage to normal residential structures would not be anticipated and vibration levels would be well below those anticipated to cause structural damage. In addition, the duration of vibration generating construction activities at individual locations along the project alignment would be limited because construction would move from place to place as progress occurs. Furthermore, proposed construction hours are during the daytime only thus reducing the potential for residential annoyance during typical periods of rest or sleep.

Mitigation Measure 2: None Required.

Impact 3: **Permanent Traffic Noise Increases.** Project generated traffic and changes to the roadway alignment would not substantially increase traffic noise levels in the area because the project includes the construction of sound walls. **This is a less-than-significant impact.**

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

The project would add a new two lane roadway, an extension of Hale Avenue which is part of the Santa Teresa Corridor. Based on traffic volumes supplied by *Hexagon Transportation Consultants*,[2] noise modeling was completed.

Traffic noise modeling was conducted using Federal Highway Administration's Traffic Noise Model (TNM v. 2.5). Traffic volumes and roadway/site geometries were entered into the model based on digital project plans, GIS coordinates and observations documented in the field, and a review of available mapping software such as Google Earth, etc.

AM and PM peak-hour traffic noise levels were calculated under the Existing plus Project and Year 2035 Build traffic scenarios. Based on a review of the long-term measurement data, the L_{dn} at each measurement site was calculated to be equal to the highest peak-hour traffic noise level (AM or PM) at that location (see Figures 2 and 3).

The results of the modeling are summarized in Table 6. The cells highlighted in gray show where the noise levels exceed the Acceptable Noise Levels as specified by the Morgan Hill General Plan in the Year 2035 Build condition. For the Year 2035 Build condition, multiple barrier heights

[2] Traffic Study for the Proposed Hale Avenue Extension, excel worksheet from Pattapon Khodmanee, Hexagon Transportation Consultants, March 11, 2016

were modeled, as summarized in Table 7. The locations shown are representative of receptors along the project alignment, but the receipt of traffic noise would not be limited to these specific locations. Gray highlighting in Table 7 indicates receivers that would be within the Acceptable Noise Levels for the Morgan Hill General Plan. As stated in Impact 1 there are areas where the existing and future noise levels will exceed 60 dBA L_{dn} with or without the project. The receptors that will remain above 60 dBA L_{dn} are 1-R, 28-R, B, C, D, 1-N and 2-N as shown on Figure 1, the Noise Measurement, Sound Wall, and Modeled Receiver Locations map.

Sound Wall #1 would begin along the southeast side of the proposed alignment near Spring Avenue along the right-of-way. The wall would continue along the easterly side of the alignment and terminate adjacent to the existing sound wall for the West Dunne Avenue Benchmark Residential Area.

Sound Wall #2 is proposed on the southwest side of the proposed alignment near Dewitt Avenue along the right-of-way. The sound wall would continue for approximately 400 feet. The approximate stationing would be referenced off the “H” line based on the 90% plans prepared by Mark Thomas & Company, Inc. The sound wall would begin left of Station 7+99 and end left of Station 30+50.

Sound Wall #3 is located on the west side of the proposed alignment near the north end of the project. Again the approximate stationing would be referenced off the “H” line based on the 90% plans prepared by Mark Thomas & Company, Inc. The sound wall would begin right of Station 44+85 and end right of Station 52+00.

All heights are relative to the pavement elevation adjacent to the sound wall and not the elevation where the wall is located.

Existing roads outside the project area where traffic levels were increased due to the project were also analyzed. There were no roads where the noise levels were projected to increase by 3 dBA L_{dn}; therefore the increases would not exceed the guidelines outlined in the City of Morgan Hill General Plan and would be less than significant.

Table 6: Modeled Traffic Noise Levels for Hale Avenue Extension

Receiver ID	Existing	2035 Build No Barriers	Increase Above Existing	Receiver ID	Existing	2035 Build No Barriers	Increase Above Existing
1-R	58	61	3	23-R	54	67	13
2-R	57	61	4	24-R	54	67	13
3-R	56	61	5	25-R	54	--[A]	--[A]
4-R	54	62	8	26-R	54	--[A]	--[A]
5-R	54	60	6	27-R	54	--[A]	--[A]
6-R	54	61	7	28-R	60	67	7
7-R	54	62	8	A	54	66	12
8-R	54	63	9	B	62	64	2
9-R	54	60	6	C	62	65	3
10-R	54	64	10	D	62	68	6
11-R	54	64	10	E	54	59	5
12-R	54	63	9	F	54	57	3
13-R	54	61	7	1-N	61	65	4
14-R	54	60	6	2-N	57	62	5
15-R	54	61	7	3-N	57	63	6
16-R	54	62	8	4-N	57	60	3
17-R	54	63	9	5-N	57	60	3
18-R	54	64	10	6-N (LT-B)	57	60	3
19-R	54	63	9	7-N	57	61	4
20-R	54	64	10	8-N	53	54	1
21-R	54	66	12	9-N	53	54	1
22-R	54	67	13	10-N (LT-1)	53	55	2

[A.] Receptors 25-R, 26-R, and 27-R have an existing 12-foot sound wall that was previously constructed.

Table 7: Modeled Traffic Noise Levels for Hale Avenue Extension

Barrier	Receiver	Modeled Existing L_{dn}, dBA	Modeled Year 2035 Build L_{dn}, dBA[A]			
			No Barrier	8 ft. High	9 ft. High	10 ft. High
SB Wall 1	1-R[B]	58	61	60	60	60
	2-R[B]	57	61	59	59	58
	3-R	56	61	58	58	58
	4-R	54	62	58	57	57
	5-R	54	60	57	57	56
	6-R	54	61	57	57	57
	7-R	54	62	57	57	57
	8-R	54	63	58	57	57
	9-R	54	60	57	57	56
	10-R	54	64	58	58	57
	11-R	54	64	57	58	57
	12-R	54	63	58	58	57
	13-R	54	61	57	57	56
	14-R	54	60	57	57	56
	15-R	54	61	57	57	56
	16-R	54	62	57	57	57
	17-R	54	63	58	57	57
	18-R	54	64	58	58	57
	19-R	54	63	58	58	57
	20-R	54	64	59	58	57
	21-R	54	66	57	57	57
	22-R	54	67	58	57	57
	23-R	54	67	58	57	57
	24-R	54	67	58	57	57
	25-R[C]	54	--[C]	--[C]	--[C]	--[C]
	26-R[C]	54	--[C]	--[C]	--[C]	--[C]
	27-R[C]	54	--[C]	--[C]	--[C]	--[C]
	28-R[B]	60	67	63	62	61
SB Wall 2	A	54	65	59	58	58
	B[B]	62	63	63	63	63
	C[B]	62	65	63	63	63
	D[B]	62	67	63	63	63
	E	54	59	57	57	56
SB Wall 3	1-N[B]	61	65	62	62	62
	2-N	57	62	59	60	58
	3-N	57	63	58	58	58
	4-N	57	62	58	58	58
	5-N	57	60	58	58	58
	7-N	57	61	59	59	59

A. Barrier height is relative to ground elevation at proposed barrier location, which is considered to be located at top of grade between the roadway and right-of-way, typically near the right of way. In all cases, barriers are elevated above the roadway based on existing terrain.
B. Primary noise source at these receivers is either Dewitt Avenue, West Dunne Avenue or West Main Street
C. Receptors 25-R, 26-R, and 27-R have an existing 12-foot sound wall that was previously constructed.

As shown in Table 6, traffic noise levels exceed the City of Morgan Hill's established noise and land use compatibility standard of 60 dBA L_{dn} for residential uses in many locations under Existing conditions. Near existing roadways, Dewitt Avenue, West Dunne Avenue, and West Main Avenue traffic noise levels are anticipated to increase by about 1 to 2 dB. Along the remainder of the alignment noise level due to traffic will increase by 3 to 15 dBA.

Based on the results of the sound wall design calculations, as shown in Table 7, barriers would reduce Future Build traffic noise levels at most receivers to a level that would meet the City's' General Plan requirements. Sound walls would range from 8 to 9 feet for the first row receivers to be within acceptable limits at all residences. .

The proposed construction of sound walls would sufficiently protect existing residential land uses from increased traffic noise levels resulting in a less-than-significant impact. The following recommendations are made to ensure appropriate design of the replacement sound walls:

- Based on detailed traffic noise modeling, 8-foot-high sound walls in most cases would not be sufficient to reduce noise levels to below Future No Project conditions or be within 2 dB of existing levels. Sound Wall #1 and Sound Wall #2, which are shown at 8-feet, are part of the project features and are shown on the plans. The exact heights of portions of the sound walls would need to be adjusted and an additional sound wall would need to be constructed to adequately reduce the noise levels to meet the City's noise level standards.

    1. Sound Wall #1 would need to be a minimum of 8 feet, with a portion at 9 foot in height, for most of the length. The length of the sound wall as designed would need to be lengthened to tie into the existing sound wall at the north end of the segment near West Dunne. This would reduce traffic noise levels to within the City of Morgan Hill standard for noise (see significance threshold described above) at all residential land uses.

    2. Sound Wall #2 would need to be a minimum of 8 feet tall, with a portion at 9 foot in height, to achieve City of Morgan Hill standard for noise (see significance threshold described above) at all residential land uses. The sound wall would not be effective as normal due to the traffic impacts from Dewitt Avenue.

    3. Sound Wall #3 south of West Main Avenue would need to be a minimum of 8 feet tall to achieve City of Morgan Hill standard for noise (see significance threshold described above) at all residential land uses. The sound wall would not be effective as normal due to the traffic impacts from West Main Avenue.

- Sound wall heights are specified relative to the existing ground elevation at existing barrier locations, which is considered to be located at the top of grade between the roadway and right-of-way, typically at the edge of roadway shoulder. In all cases, barriers are elevated above the roadway based on existing terrain.

- To be effective, sound walls must be constructed with a solid material with no gaps in the face of the wall or at the base. Openings or gaps between sound wall materials or the ground substantially decrease the effectiveness of the sound wall. Suitable materials for sound wall construction should have a minimum surface weight of 3 pounds per square foot (such as 1-inch-thick wood, masonry block, concrete, or metal).

Impact 4: **Construction Noise.** The project would not expose noise-sensitive land uses to a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project. **This is a less-than-significant impact.**

Construction of the roadway segments of the Hale Avenue Extension, construction of sound walls along the project alignment, and implementing proposed intersection improvements will require the temporary use of heavy equipment that could generate high noise levels in the immediate project area. Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. The anticipated construction equipment to be used on the project includes backhoes, scrapers, motor graders, steel-wheel rollers, pneumatic tire rollers, manually operated compactors, asphalt pavers, milling machines, concrete trucks, cranes, drill rigs, truck mounted traffic paint stripers, and pick-up trucks. Noise generated during construction activities would result in a temporary increase in ambient noise levels. Typical noise levels from equipment that may be used during construction are shown in Table 8.

Table 8: Typical Construction Noise Levels

Equipment	Typical Noise Level (dBA) 50 feet from Source
Grader	85
Bulldozers	85
Truck	88
Loader	85
Roller	74
Air Compressor	81
Backhoe	80
Pneumatic Tool	85
Paver	89
Concrete Pump	82

Source: Federal Transportation Administration, 2006.

Based on the types of construction activities and equipment required for the proposed project, unshielded noise levels at 50 feet from the center of construction activities would generally range from 80 to 85 dBA L_{eq} during peak periods, with the highest maximum instantaneous noise levels typically ranging from 80 to 89 dBA L_{max}.. However, because not all of the equipment would be operating at the same time or for the entire day, the hourly average L_{eq} from project construction would be lower. Some construction would occur closer than 50 feet to receptors, and noise could exceed those levels. Noise produced by construction equipment typically attenuates over distance at a rate of about 6 dB per doubling of distance; construction noise levels would be highest at receptors closest to the roadway under construction.

Hourly average construction noise levels could reach more than 20 dBA above ambient noise levels at some locations where sound wall construction would be unshielded and occur very close to residences. Noise levels would be as high as 60 dBA L_{eq} inside unshielded homes (assuming the windows are shut), with maximum interior noise levels of up to 68 dBA inside the closest unshielded residences. The noise levels could be high enough to interfere with conversation in backyards and possibly inside homes but, this period of time would be relatively short as construction activities move along the right-of-way as the project proceeds and the reconstruction of the sound walls would provide shielding for future roadway construction.

Construction is anticipated to occur over a total period of 10 months with noise generating activities occurring over the entire construction period. However, the duration of noise generating activities at individual locations along the project alignment would be limited to less than a ten-month period because construction activities would move from place to place as progress occurs. As discussed in Impact 1, construction would occur within the daytime hours allowable by the Morgan Hill Municipal Code with no construction occurring on Sundays or holidays.

The following standard noise suppression devices and techniques are assumed to be included in the project:

- Equip all internal combustion engine-driven equipment with mufflers, air-inlet silencers, and any other shrouds, shields, or other noise-reducing features that are in good operating condition and appropriate for the equipment;
- Use “quiet” models of air compressors and other stationary noise sources where such technology exists;
- Use electrically powered equipment instead of pneumatic or internal combustion powered equipment, where feasible;
- Limit noise-producing signals, including horns, whistles, alarms, and bells, to safety warning purposes only;

- Locate stationary noise-generating equipment, construction parking, and maintenance areas as far as reasonable from sensitive receptors when sensitive receptors adjoin or are near the construction project area;

- Avoid unnecessary idling of internal combustion engines (i.e., in excess of 5 minutes);

- Place temporary sound walls or enclosure around stationary noise-generating equipment when located near noise sensitive areas;

- Ensure that project-related public address or music systems are not audible at any adjacent receptor; and

- Notify adjacent residents in advance of construction work.

The City of Morgan Hill Municipal Code establishes limits on the hours during the day that construction activity is permitted to occur, and proposed construction activities would occur during daytime hours only. This ensures that construction noise impacts would not occur during the sensitive nighttime period when it would result in potential sleep disturbance. Construction of the proposed improvements would result in temporary noise level increases at sensitive receptors along the project alignment. Construction noise levels would exceed the 60 dBA L_{eq} noise threshold and exceed the ambient noise environment by at least 5 dBA L_{eq}. However, construction activities would generally move along the right-of-way as construction proceeds, and the overall construction duration would be limited to less than one year. This is a less-than-significant impact.

Mitigation Measure 4: None Required.