V.C. NOISE

The following discussion of noise and noise impacts associated with the proposed project is based on the technical report *Noise Impact Analysis: Willow Road Extension/US 101 Interchange Project* prepared by LSA Associates, Inc (July 2005) included in Volume II, Appendix C of this document. This analysis is included in its entirety in Appendix C.

1. Existing Conditions

Fundamentals of Traffic Noise. The following is a brief discussion of fundamental traffic noise concepts. This discussion is pertinent to understanding the existing noise conditions in the project area and the projected short- and long-term noise impacts of the proposed project.

Sound, Noise, and Acoustics. Sound is a disturbance created by a moving or vibrating source in a gaseous or liquid medium or the elastic stage of a solid, and is capable of being detected by the human ear. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired.

Frequency and Hertz. A continuous sound can be described by its frequency (pitch) and its amplitude (loudness). Frequency relates to the number of pressure oscillations per second. Low-frequency sounds are low in pitch, like the low notes on a piano, whereas high-frequency sounds are high in pitch, like the high notes on a piano. Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as Hertz (Hz).

Sound Pressure Levels and Decibels. The amplitude of a sound determines its loudness. Loudness of sound increases and decreases with increasing and decreasing amplitude. Sound pressure level (SPL) is used to describe in logarithmic units the ratio of actual sound pressures to a reference pressure squared. These units are called bels, named after Alexander Graham Bell. To provide a finer resolution, a bel is subdivided into 10 decibels, abbreviated dB.

Adding Decibels. Because decibels are logarithmic units, sound pressure level cannot be added or subtracted by ordinary arithmetic means. For example, if one automobile produces 70 A-weighted decibels (dBA) as it passes an observer, two cars passing simultaneously would not produce 140 dBA; they would, in fact, combine to produce 73 dBA. When two sounds of equal loudness are combined, they will produce a noise level 3 dBA greater than the original individual noise level. In other words, sound energy must be doubled to produce a 3 dBA increase.

A-Weighted Decibels. Sound pressure level alone is not a reliable indicator of loudness. The frequency, or pitch, of a sound also has a substantial effect on how humans will respond. To approximate the frequency response of the human ear, a series of adjustments is usually applied to the sound measured by a sound level meter. The adjustments (referred to as a weighting network) are frequency dependent.

The A-scale weighting network approximates the frequency response of the average young ear when listening to most ordinary sounds. Other weighting networks have been devised to address high noise levels or other special problems (e.g., B-scale, C-scale, D-scale), but these scales are rarely, if ever, used in conjunction with highway traffic noise. Noise levels for traffic noise reports are typically reported in terms of A-weighted dBAs. In environmental noise studies, A-weighted SPLs are commonly referred to as noise levels. Table V.C-1 shows typical A-weighted noise levels.

Table V.C-1: Typical Noise Levels

Common Outdoor Activities	Noise Level dBA	Common Indoor Activities
	—110—	Rock Band
Jet Flyover at 300 m (1000 ft)	—100—	
Gas Lawn Mower at 1 m (3.3 ft)	—90—	
Diesel Truck at 15 m (50 ft), at 80 km/hr (50 mph)	—80—	Food Blender at 1 m (3.3 ft) Garbage Disposal at 1 m (3.3 ft)
Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft)	—70—	Vacuum Cleaner at 3 m (10 ft)
Heavy Traffic at 90 m (300 ft)	—60—	Normal Speech at 1 m (3.3 ft)
Quiet Urban, Daytime	—50—	Large Business Office Dishwasher Next Room
Quiet Urban, Nighttime	—40—	Theater, Large Conference
Quiet Suburban, Nighttime	—30—	Room (Background) Library
Quiet Rural Nighttime	—20—	Bedroom at Night, Concert Hall (Background)
	—10—	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

Source: Caltrans, Technical Noise Supplement, October 1998.

Human Response to Changes in Noise Levels. Under controlled conditions in an acoustics laboratory, the trained, healthy human ear is able to discern changes in sound levels of 1 dBA. Outside such controlled conditions, the trained ear can detect changes of 2 dBA in normal environmental noise. It is widely accepted that the average healthy ear, however, can barely perceive noise level changes of 3 dBA. As discussed above, a doubling of sound energy results in a 3 dBA increase in sound, which means that a doubling of sound energy (e.g., doubling the volume of traffic on a highway) would result in a barely perceptible change in sound level.

Noise Descriptors. Noise in the daily environment fluctuates over time. Various noise descriptors have been developed to describe time-varying noise levels. The following is a list of the noise descriptors most commonly used in traffic noise analysis:

- Equivalent Sound Level (L_{eq}): L_{eq} represents an average of the sound energy occurring over a specified period. L_{eq} is, in effect, the steady-state sound level that, in a stated period, would contain the same acoustical energy as the time-varying sound that actually occurs during the same period. The one-hour A-weighted equivalent sound level, $L_{eq}(h)$, is the energy average of the A-weighted sound levels occurring during a one-hour period and is the basis for the Noise Abatement Criteria (NAC) used by Caltrans and the Federal Highway Administration (FHWA).

- Maximum Sound Level (L_{max}): L_{max} is the highest instantaneous sound level measured during a specified period.
- Day-Night Sound Level (L_{dn}): The U.S. Department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA) have adopted the L_{dn} as their standard unit of measurement for noise levels. This measure increases the average noise level (L_{eq}) for late evening and early morning hours (10:00 p.m. to 7:00 a.m.) by 10 dBA. The daytime noise levels (7:01 a.m. to 9:59 p.m.) are then combined with these weighted levels and are averaged to obtain a 24-hour averaged noise level.

Sound Propagation. When sound propagates over a distance, it changes in both level and frequency content. The manner in which noise reduces with distance depends on the following factors.

Geometric Spreading. Sound from a small, localized source (i.e., a point source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates (or drops off) at a rate of 6 dBA for each doubling of distance. Highway noise is not a single, stationary point source of sound. The movement of the vehicles on a highway makes the source of the sound appear to emanate from a line (i.e., a line source) rather than a point. This line source results in cylindrical spreading rather than the spherical spreading that results from a point source. The change in sound level from a line source is 3 dBA per doubling of distance.

Ground Absorption. Most often, the noise path between the highway and the observer is very close to the ground. Noise attenuation from ground absorption adds to the attenuation associated with geometric spreading. For acoustically hard sites (i.e., those sites with a reflective surface, such as a parking lot or a smooth body of water, between the source and the receiver), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees, between the source and the receiver), an excess ground attenuation value of 1.5 dBA per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dBA per doubling of distance for a line source such as a highway.

Atmospheric Effects. Research by Caltrans and others has shown that atmospheric conditions can have a significant effect on noise levels within 60 meters (200 feet) of a highway. Wind has been shown to be the most important meteorological factor within approximately 150 meters (500 feet) of the source, whereas vertical air temperature gradients are more important for greater distances. Other factors such as air temperature, humidity, and turbulence also have significant effects. Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lower noise levels. Increased sound levels can also occur as a result of temperature inversion conditions (i.e., increasing temperature with elevation).

Shielding by Natural and Human-Made Features. A large object or barrier in the path between a noise source and a receiver can substantially attenuate noise levels at the receiver. The amount of attenuation provided by this shielding depends on the size of the object and the frequency content of the noise source. Natural terrain features (e.g., hills and dense woods) and human-made features (e.g., buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receiver specifically to reduce noise. A barrier that breaks the line of sight between a source and a receiver will typically result in at least 5 dBA of noise reduction.

State and County Noise Regulations. The San Luis Obispo County General Plan (County General Plan) provides a policy framework for addressing potential noise impacts at the county level. The purpose of the County General Plan is to identify and minimize future noise conflicts. Among the most significant policies of the Noise Element of the County General Plan are numerical noise standards that limit noise exposure within sensitive land uses. Sensitive land uses include schools, parks, playgrounds, childcare centers, hospitals, retirement homes, clinics, and residential areas. The Noise Element includes an *exterior* noise standard of 60 dBA L_{dn} and an *interior* noise standard of 45 dBA L_{dn} the County Code also limits the hours of construction adjacent to residential or sensitive land uses between the hours of 7:00 a.m. to 9:00 p.m. on Monday through Friday and 8:00 a.m. to 5:00 p.m. on Saturdays and Sundays.

Existing Noise Conditions. Developed and undeveloped land uses in the project area were identified through land use maps, aerial photography, and site inspection. Within each land-use category, sensitive receptors (e.g., schools, churches, playgrounds, and residences) were then identified. The land use data and location of particular sensitive receptors were the basis for the selection of the noise monitoring and analysis sites for evaluating the proposed project.

Because no major roads currently exist adjacent to the modeled receptors, existing conditions were not modeled. Rather, the existing and future no project noise levels were obtained by monitoring ambient noise levels at five representative locations within the proposed project site. All of the selected monitoring locations were located at existing residences.

The primary source of noise that would affect sensitive noise receptors in the project area is traffic on Willow Road, Pomeroy Road, Hetrick Avenue, and Thompson Avenue. Ambient noise measurements were conducted to document existing noise levels at the five representative sensitive receptor locations along the project alignment. Table V.C-2 contains the results of these measurements. Table V.C-3 describes the physical location of each sensitive receptor location.

These noise measurements were used to establish the existing and future no project noise levels at all 22 modeled receptors in the project area. Table V.C-4 summarizes the existing traffic noise levels at the receptor locations. Of the 22 modeled receptor locations, no receptors currently exceed the 60 dBA L_{dn} noise standard.

Table V.C-2: Summary of Field -Measured Data (See Figure V.C-1)

Monitoring Location	Date	Start Time	Duration (minutes)	Measured Sound Level (L_{eq}, dBA L_{dn})
M-1	10/9/03	9:10 a.m.	20	58
M-2	10/9/03	9:45 a.m.	20	50
M-3	10/9/03	10:53 a.m.	20	42
M-4	10/9/03	1:13 p.m.	20	55
M-5	10/9/03	1:53 p.m.	20	42

Source: LSA Associates, Inc, 2003.

Table V.C-3: Physical Location of Noise Level Measurements

Monitoring Location	Address	Location on Property
M-1	695 Misty Glen Place.	In front of the house.
M-2	1108 Pomeroy Road.	In front of the house.
M-3	775 Willow Road	In front of the house.
M-4	702 Thompson Avenue	In front of the house.
M-5	Along Willow Road between Hetrick Avenue and US 101	On the side of the street.

Source: LSA Associates, Inc. 2003.

Table V.C-4: Existing Traffic Noise Levels (L_{eq})[1]

Rec #	Location	Type of Development	# of Units Represented	Existing Noise Level
R-1	Misty Glen Place	Residential	1	58
R-2	Pomeroy Road	Residential	1	50
R-3	Pomeroy Road	Residential	1	50
R-4	Pomeroy Road	Residential	1	50
R-5	Pomeroy Road	Residential	1	50
R-6	Pomeroy Road	Residential	1	50
R-7	Pomeroy Road	Residential	1	50
R-8	Willow Road	Residential	1	42
R-9	Willow Road	Residential	1	42
R-10	Cherokee Place	Residential	1	42
R-11	Cherokee Place	Residential	1	42
R-12	Cherokee Place	Residential	1	42
R-13	Cherokee Place	Residential	1	42
R-14	Cherokee Place	Residential	1	42
R-15	Cherokee Place	Residential	1	42
R-16	Cherokee Place	Residential	1	42
R-17	Cherokee Place	Residential	1	42
R-18	Cherokee Place	Residential	1	42
R-19	Thompson Avenue	Residential	1	55
R-20	Willow Road	Residential	1	42
R-21	Willow Road	Residential	1	42
R-22	Cherokee Place	Residential	1	42

Source: LSA Associates, Inc. 2003.

[1] The County of San Luis Obispo's noise standards are expressed in terms of L_{dn}. However, the traffic noise model generates its results as L_{eq} for peak hours. In urban/suburban areas when the dominant noise source is from traffic, it has been observed that the L_{dn} level equals the peak hour L_{eq} level.

2. Thresholds of Significance

The significance of project-related noise impacts associated with the construction and operation of the proposed project is based on County standards. For the purposes of this EIR, a project-related noise impact is considered significant if noise levels in areas representing sensitive land uses, such as single-family homes, experience one or more of the following conditions:

- The proposed project generates noise levels at any of the 22 receptor locations exceeding the County 60 dBA L_{dn} standard for exterior noise and 45 dBA L_{dn} for interior noise;

- A project related increase of 3 dBA or more over the existing level causing the noise environment to exceed existing noise level standards.

- The project exposes people to severe noise or vibration.

3. Project Impacts

To predict the noise impacts from the proposed project on the surrounding land uses, future noise levels were modeled at 22 receptor locations using projected peak hour traffic operations. Peak hour traffic volumes on US 101 and local collector roads were obtained from the traffic study provided by Fehr & Peers Transportation Consultants (July, 2004)[1]. The 22 receptor locations were modeled to represent residential land uses in the project vicinity. Traffic noise from US 101 was not audible at any of the modeled receptor locations and therefore was not included in the model estimating future noise levels with the proposed road project. The ambient noise monitoring locations and the modeled receptor locations are shown in Figure V.C-1.

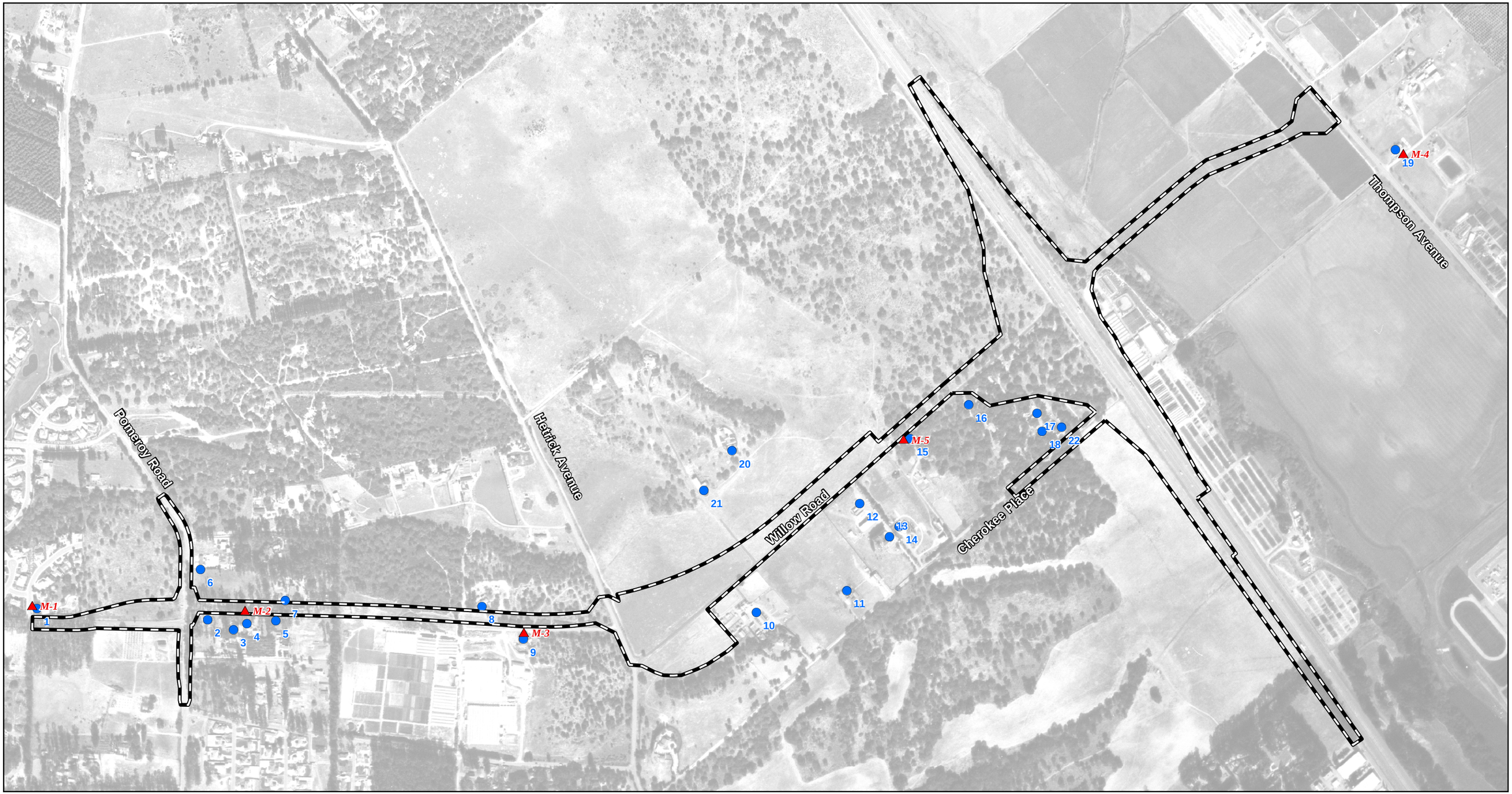
Construction Noise (Short-Term Impacts). Two types of short-term noise impacts would occur during construction of the proposed project—the transport of equipment and workers to the job site and construction of the project itself. Construction crew commutes and the transport of construction equipment and materials to the project site would incrementally raise noise levels on access roads leading to the site, but only for short periods of time. The pieces of heavy equipment for grading and construction activities will be moved on site, will remain for the duration of each construction phase, and therefore will not add to the daily traffic volume in the project vicinity. Nearby residences could experience a relatively high single-event noise of potentially 87 dBA L_{max} because of trucks passing at 15 meters (m) (50 feet [ft]). However, the projected construction traffic will be small and of short duration when compared to the existing traffic volumes on Willow Road, Pomeroy Road, Hetrick Avenue, Thompson Avenue, and other affected streets. Therefore, short-term construction related worker commutes and equipment transport noise impacts would be less than significant.

The second type of short-term noise impact is related to noise generated during excavation, grading, and roadway construction. Construction is performed in discrete steps, each of which has its own mix of equipment, and, consequently, its own noise characteristics. Therefore, noise levels along the proposed road alignment will change as road construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction related noise ranges to be categorized by work phase. Table V.C-5 lists typical construction equipment noise levels (L_{max}) recommended for noise impact assessments, based on a distance of 15 m (50 ft) between the equipment and a noise receptor.

Typical noise levels at 15 m (50 ft) from an active construction area can reach up to 91 dBA L_{max} during the noisiest construction phases. The site preparation phase, which includes grading and paving, tends to generate the highest noise levels because the noisiest construction equipment is earthmoving equipment. Earthmoving equipment includes excavating machinery such as backfillers, bulldozers, and front loaders and all associated operational noises (e.g., back-up beepers). Typical operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three to four minutes at lower power settings.

The grading phase of the proposed project is expected to require the use of earthmovers, bulldozers, water trucks, and pickup trucks. Noise associated with the use of this type of construction equipment is estimated to range between 79 and 89 dBA L_{max} at a distance of 15 m (50 ft) from the active construction area during the grading phase. As seen in Table V.C-5, the maximum noise level

[1] This traffic report has since been updated as of December 2004 with minor revisions. However, the revisions do not change the results of this analysis.



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Legend

- CEQA Study Limits
- Monitor Location
- Receptor Location

FIGURE V.C-1

Willow Road Extension/U.S. 101 Interchange Project

CEQA Noise Impact Analysis
Monitoring and Modeled Receptor Locations

SOURCE: County of San Luis Obispo (Aerial), Rajappan & Meyer Consulting Engineers, Inc. (CAD).

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generated by each earthmover is assumed to be 88 dBA L_{max} at 15 m (50 ft). Each bulldozer would also generate 88 dBA L_{max} at 15 m (50 ft). The maximum noise level generated by water and pickup trucks is approximately 86 dBA L_{max} at 15 m (50 ft). As mentioned in Section C.1., when sounds of equal strength emanating from a point source occur at the same time, the noise level does not double, rather the noise level increases by 3 dBA. When constructing the proposed project, each piece of construction equipment operates as an individual point source. Because the loudest piece of equipment during the grading phase of construction is 88 dBA $L_{max,}$ the worst-case composite noise level at the nearest residence during this phase of construction would be 91 dBA L_{max} (at a distance of 15 m [50 ft] from an active construction area).

Equipment used during the tree clearing, such as chainsaws and wood chippers, would generate noise levels of 75 to 85 dBA L_{max} at 15 m (50 ft). These noise levels are lower than the levels that would be generated by the grading equipment. Therefore, the equipment used during the tree clearing would not result in additional significant noise impacts.

The closest existing residences in the vicinity of the project area are located 15 m (50 ft) from the project construction area. These residences may be subject to construction-related noise reaching 91 dBA L_{max}. Proposed mitigation measures will help to reduce the duration and severity of the noise. However, because construction operations are short-term/ temporary, the impact associated with construction-related noise is considered to be less than significant.

Table V.C-5: Typical Construction Equipment Noise Levels

Type of Equipment	Range of Maximum Sound Levels Measured (dBA at 50 feet)	Suggested Maximum Sound Levels for Analysis (dBA at 50 feet)[1]
Pile Drivers, 12,000 to 18,000 ft-lb/blow	81–96	93
Rock Drills	83–99	96
Jackhammers	75–85	82
Pneumatic Tools	78–88	85
Pumps	68–80	77
Dozers	85–90	88
Tractors	77–82	80
Front-End Loaders	86–90	88
Hydraulic Backhoe	81–90	86
Hydraulic Excavators	81–90	86
Graders	79–89	86
Air Compressors	76–86	86
Trucks	81–87	86

Source: Noise Control for Buildings and Manufacturing Plants, Bolt, Beranek & Newman 1987.

[1] The Suggested Maximum Sound Levels is for average construction equipment that would likely be used on the proposed project. Larger than average construction equipment may generate higher noise levels such as those listed in the column titled "Range of Maximum Sound Levels Measured" in Table V.C-5.

Traffic Noise (Long-Term Impacts). Potential long-term noise impacts associated with the proposed project originate from traffic noise created by vehicles that use and will use the system of roadways in the project area. Long-term project noise impacts caused by the proposed project were determined by comparing existing roadway traffic noise to roadway traffic noise estimated for the year 2030. Roadway traffic noise in the year 2030 is considered to be a worst-case build-out scenario for the project area.

The ambient noise monitoring was used to establish the existing and future No Project noise levels (Table V.C-2). Sound levels for the year 2030 in the project area were determined by measuring peak hour traffic volumes at the 22 receptor locations. The existing traffic noise levels as compared to the future year 2030 with project conditions are shown in Table V.C-6. As described in thresholds of significance, if the peak hour traffic noise level at a sensitive receptor location is predicted to increase noise levels by 3dBA or more causing the exterior noise standard of 60 dBA L_{dn} to be exceeded, it is considered a potentially significant noise impact for which noise abatement measures must be considered.

At almost half the modeled receptor locations (10 out of 22) the Willow Road project will experience an increase of 3dBA or more, reaching levels up to 69 dBA L_{dn} and exceeding the County's exterior noise standard of 60 dBA L_{dn}. This is considered to be a significant impact for which mitigation measures must be considered.

Table V.C-6: Projected Traffic Noise Levels at Receptor Locations (L_{eq})[1]

Rec #	Location	Existing[2] Noise Level	Future With Project	Change from Existing Level
R-1	Misty Glen Place	58	**64**[3]	6
R-2	Pomeroy Road	50	**65**	15
R-3	Pomeroy Road	50	**61**	11
R-4	Pomeroy Road	50	**63**	13
R-5	Pomeroy Road	50	**64**	14
R-6	Pomeroy Road	50	**61**	11
R-7	Pomeroy Road	50	**69**	19
R-8	Willow Road	42	**66**	24
R-9	Willow Road	42	**62**	20
R-10	Cherokee Place	42	56	14
R-11	Cherokee Place	42	52	10
R-12	Cherokee Place	42	60	18
R-13	Cherokee Place	42	53	11
R-14	Cherokee Place	42	53	11
R-15	Cherokee Place	42	**61**	19
R-16	Cherokee Place	42	59	17
R-17	Cherokee Place	42	57	15
R-18	Cherokee Place	42	54	12
R-19	Thompson Avenue	55	57	2
R-20	Willow Road	42	52	10
R-21	Willow Road	42	53	11
R-22	Cherokee Place	42	56	14

Source: LSA Associates, Inc. 2003.

1 The County of San Luis Obispo's noise standards are expressed in terms of L_{dn}. However, the traffic noise model generates its results as L_{eq} for peak hours. In urban/suburban areas when the dominant noise source is from traffic, it has been observed that the L_{dn} level equals the peak hour L_{eq} level.

2 It is assumed that no additional transportation infrastructure would be added in the "Future Without Project" condition. Therefore, the Existing Traffic Noise Levels also apply to the "Future Without Project" condition.

3 Numbers in bold represent noise levels exceeding the County's exterior noise standard of 60 dBA.

Bold numbers in Table V.C-7 show impacted receptor locations with projected noise levels that exceed the County of San Luis Obispo exterior noise standards of 60 dBA L_{dn}. Following Table V.C-7 is a description of each of these receptor locations. These locations will experience significant noise impacts prior to mitigation. This table identifies sound wall heights necessary to mitigate future project noise levels. Sound walls are not feasible at many receptor locations due to the need to maintain driveway access.

Table V.C-7: Sound Barrier Modeling, (Leq)[1] (See Figure V.C-2)

Rec #	Future With Project (L_{eq}, dBA L_{dn})	Sound Wall (SW #)	With Wall H = 6' (1.8 m)		With Wall H = 8' (2.4 m)		With Wall H = 10' (3.05 m)		With Wall H = 12' (3.7 m)		With Wall H = 14' (4.3 m)		With Wall H = 16' (4.9 m)	
			L_{eq}	I.L.[2]	L_{eq}	I.L.	L_{eq}	I.L.	L_{eq}	I.L.	L_{eq}	I.L.	L_{eq}	I.L.
R-1	**64**[3]	SW #1	**62**	2	**61**	3	*59*[4]	*5*	*59*	5	*58*	*6*	*58*	*6*
R-2	**65**	None[5]	**65**	0	**65**	0	**65**	0	**65**	0	**65**	0	**65**	0
R-3	**61**	None[5]	**61**	0	**61**	0	**61**	0	**61**	0	**61**	0	**61**	0
R-4	**63**	None[5]	**63**	0	**63**	0	**63**	0	**63**	0	**63**	0	**63**	0
R-5	**64**	None[5]	**64**	0	**64**	0	**64**	0	**64**	0	**64**	0	**64**	0
R-6	**61**	None[5]	**61**	0	**61**	0	**61**	0	**61**	0	**61**	0	**61**	0
R-7	**69**	None[5]	**69**	0	**69**	0	**69**	0	**69**	0	**69**	0	**69**	0
R-8	**66**	SW #2	**62**	4	*60*	*6*	*59*	*7*	*58*	8	*57*	*9*	*57*	*9*
R-9	**62**	None[5]	**62**	0	**62**	0	**62**	0	**62**	0	**62**	0	**62**	0
R-10	56	None	56	0	56	0	56	0	56	0	56	0	56	0
R-11	52	None	52	0	52	0	52	0	52	0	52	0	52	0
R-12	60	None	60	0	60	0	60	0	60	0	60	0	60	0
R-13	53	None	53	0	53	0	53	0	53	0	53	0	53	0
R-14	53	None	53	0	53	0	53	0	53	0	53	0	53	0
R-15	**61**	SW #3	*59*	*2*	*57*	*4*	*56*	*5*	*55*	6	*54*	*7*	*53*	*8*
R-16	59	None	59	0	59	0	59	0	59	0	59	0	59	0
R-17	57	None	57	0	57	0	57	0	57	0	57	0	57	0
R-18	54	None	54	0	54	0	54	0	54	0	54	0	54	0
R-19	57	None	57	0	57	0	57	0	57	0	57	0	57	0
R-20	52	None	52	0	52	0	52	0	52	0	52	0	52	0
R-21	53	None	53	0	53	0	53	0	53	0	53	0	53	0
R-22	56	None	56	0	56	0	56	0	55	1	55	1	55	1

Source: LSA Associates, Inc. 2003

1 The County of San Luis Obispo's noise standards are expressed in terms of L_{dn}. However, the traffic noise model generates its results as L_{eq} for peak hours. In urban/suburban areas when the dominant noise source is from traffic, it has been observed that the L_{dn} level equals the peak hour L_{eq} level.

2 Insertion Loss. Insertion loss is the noise attenuation achieved by a noise-reducing feature (in this case a wall).

3 Numbers in bold represent noise levels exceeding the County's exterior noise standard of 60 dBA L_{dn}.

4 Italicized numbers indicate where a sound barrier would attenuate noise levels to below the County's exterior noise standard of 60 dBA L_{dn}.

5 Sound walls are not feasible at receptors where it is necessary to maintain driveway access.

R-1. This receptor represents an existing residence on Misty Glen Place north of Willow Road between Guadalupe Road and Pomeroy Road. Sound barriers were modeled to protect this residence. The results of the barrier analysis (see Table V.C-7) show that a ten-foot high sound wall would attenuate noise levels at this site below 60 dBA L_{dn} and therefore would reduce noise at the site to a less than significant level.

R-2, R-3, R-4, R-5, and R-7. These receptors represent existing residences accessed by Pomeroy Road. The proposed Willow Road extension will serve as the new accesses once it is constructed. Reducing traffic noise at an existing residence requires that a large continuous object or barrier be put in the path between the noise source, in this case Willow Road, and the existing residence. Because these residential properties will be using Willow Road as their access point, it is not feasible to erect a continuous sound barrier at these locations because a continuous barrier would block access to Willow Road. A discontinuous sound barrier, such as a wall that leaves a gap for a driveway, provides only a 2 to 3 dBA reduction in noise. R-2, R-5, and R-7, require noise reductions between 4 and 9 dBA. Therefore, a discontinuous sound wall will not provide sufficient noise abatement at these particular receptors. R-3 and R-4 necessitate a noise reduction of only 1-3 dBA. While this is technically feasible with a discontinuous sound barrier it is not practical or cost effective. Changes in noise of 3 dBA or less are barely perceptible to the human ear in an outdoor environment. Therefore, there would be a high cost associated with providing a sound wall with no perceptible noise reduction.

R-6. This receptor represents an existing residence along Pomeroy Road. As discussed above, because the resident's access will be onto Pomeroy Road, it is not feasible to abate traffic noise with a sound barrier.

R-8. This receptor location represents an existing residence along Willow Road west of Hetrick Avenue. Sound barriers were modeled to protect this resident. The results of the barrier analysis (see Table V.C-7) show that an eight-foot high sound wall would attenuate noise levels at this site below 60 dBA $L_{dn.}$ Therefore, provision of a noise wall would reduce noise at the site to a less than significant level.

R-9. This receptor location represents an existing residence along Willow Road west of Hetrick Avenue. As property access is via a driveway onto Willow Road, as discussed above, it is not feasible to abate traffic noise with a sound barrier.

R-15. This receptor location represents an existing residence along Cherokee Place between Hetrick Avenue and US 101. A sound barrier was modeled to protect this residence. The results of the barrier analysis (see Table V.C-7) show that provision of a six-foot high sound wall would attenuate noise levels at this site below 60 dBA L_{dn} and therefore would reduce noise at the site to a less than significant level.

Sound walls to attenuate long-term noise impacts were analyzed for each of these sensitive receptor locations. At each location, six sound barrier heights were analyzed: 1.8, 2.4, 3.05, 3.7, 4.3, and 4.9 m (6, 8, 10, 12, 14, and 16 ft). The locations of the modeled sound barriers are shown in Figure V.C-2.

Of the 10 receptor locations that would exceed the exterior noise threshold, construction of sound barriers at 7 receptor locations is determined infeasible due to the need to maintain property access

onto Willow Road, as discussed above. Results of the sound wall modeling are shown in Table V.C-7. The sound walls that would be effective in reducing the impacts of noise exposure in the project area are described below:

Sound Wall No. 1. A 39 m (129 ft) barrier in length, was analyzed within the proposed County right-of-way along the north side of Willow Road between Guadalupe and Pomeroy Road to protect receptor location #1 (R-1). The results of the noise modeling are shown in Table V.C-7. The location of Receptor R-1 and the modeled sound wall are shown in Figure V.C-2.

Sound Wall No. 2. A 97 m (318 ft) barrier in length, was analyzed within the proposed County right-of-way along Willow Road West of Hetrick Avenue to protect receptor location #8 (R-8). The results of the noise modeling are shown in Table V.C-7. The location of Receptor R-8 and the modeled sound wall are shown in Figure V.C-2.

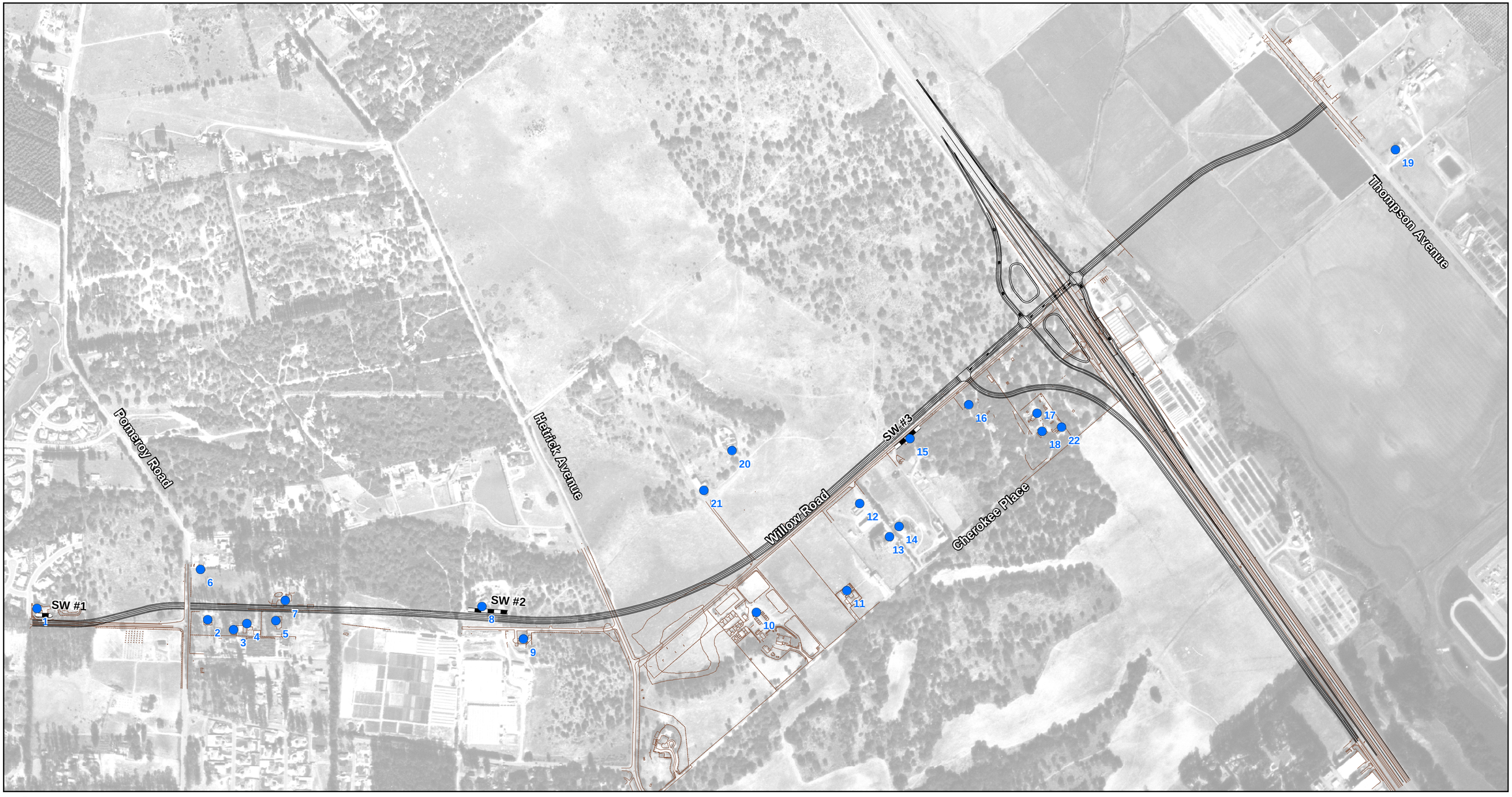
Sound Wall No. 3. A 79 m (259 ft) barrier in length, was analyzed within the proposed County right-of-way along Cherokee Place east of Hetrick Avenue to protect receptor location #15 (R-15). The results of the noise modeling are shown in Table V.C-7. The location of Receptor R-15 and the modeled sound wall are shown in Figure V.C-2.

Table V.C-8 lists the barrier heights that would attenuate noise levels at three receptor locations below 60 dBA L_{dn}. These walls are shown in Figure V.C-2.

Table V.C-8: Required Sound Barriers

SW #	Benefited Receptors	Wall Height m (ft)
SW #1	R-1	3.05 (10)
SW #2	R-8	2.4 (8)
SW #3	R-15	1.8 (6)

Source: LSA Associates, Inc. 2004



LSA

FIGURE V.C-2

N

0 500 1,000

FEET

Legend

Sound Barrier

Receptor Location

Willow Road Extension/U.S. 101 Interchange Project

CEQA Noise Impact Analysis

Modeled Soundwall and Receptor Locations

SOURCE: County of San Luis Obispo (Aerial), Rajappan & Meyer Consulting Engineers, Inc. (CAD).

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Future (2030) Traffic Noise Levels

The proposed Willow Road Extension/U.S. Highway 101 Interchange and frontage road will generate automobile traffic and a long-term source of traffic noise which will alter future noise levels in the immediate area. Although the proposed project is not obligated to mitigate for impacts to development that is not currently on the ground, the 1999 Willow Road/Highway 101 Interchange FEIR included a mitigation measure that areas that could be impacted by the proposed project would be identified via modeled noise contours at the 60, 65 and 70 dBA thresholds. These contours could then be used to amend the County's Noise Element for the major arterials and collector roads to address future area buildout. The following information addresses the mitigation measure outlined in the 1999 Willow Road/Highway 101 Interchange FEIR.

The FHWA highway traffic noise prediction model (FHWA RD-77-108) was used to evaluate highway traffic-related noise conditions in the project vicinity. This model requires various parameters, including traffic volumes, vehicle mix, vehicle speed, and roadway geometry to compute typical equivalent noise levels during daytime, evening, and nighttime hours. The future (2030) average daily traffic (ADT) volumes in the area were taken from the *Traffic Impact Analysis* prepared for the project by Fehr & Peers Transportation Consultants (July 2004). The resultant noise levels are weighted and summed over 24-hour periods to determine the Ldn values. As shown in Table A, traffic noise along these roadway segments varies from relatively low along Hetrick Avenue and Pomeroy Road and high along Willow Road and US101. The locations of the future traffic noise contours are shown in Figure 1.

Table V.C-9: Future (2030) Traffic Noise Levels

Roadway Segment	ADT	Center-line to 70 Ldn (feet)	Center-line to 65 Ldn (feet)	Center-line to 60 Ldn (feet)	Ldn (dBA) 50 Feet from Outermost Lane
Willow Road from Thompson Road to US101 NB Ramps	3,800	< 50[2]	73	152	65.5
Willow Road from US101 SB Ramps to Frontage Road	11,600	71	149	319	70.3
Willow Road from Frontage Road to Hetrick Avenue	9,100	61	127	271	69.2
Willow Road from Hetrick Avenue to Pomeroy Road	7,100	< 50	108	230	68.2
Willow Road west of Pomeroy Road	8,000	56	117	249	68.7
Frontage Road	3,900	< 50	54	116	64.8
Hetrick Avenue north of Willow Road	2,800	< 50	< 50	93	63.3
Hetrick Avenue south of Willow Road	3,800	< 50	53	114	64.7
Pomeroy Road north of Willow Road	11,500	52	111	238	69.5
Pomeroy Road south of Willow Road	3,500	< 50	50	108	64.3
US101	70,600	325	699	1505	80.0

Source: LSA Associates, Inc., June 2005.

[2] Traffic noise within 50 feet of a roadway centerline requires site-specific analysis.

Sensitive receptors locations, such as residences, constructed outside of the 60 dBA Ldn noise contours would not require mitigation measures to meet the County's 60 dBA Ldn exterior noise standard. New residential construction would provide a minimum of 15 dBA of exterior to interior noise attenuation with windows open and 24 dBA with windows closed. Therefore, no mitigation measures would be required to meet the County's 45 dBA Ldn interior noise standard (i.e., 60 dBA - 15 dBA = 45 dBA).

Sensitive land uses located between the 60 and 65 dBA Ldn traffic noise contours would require mitigation measures to meet the County's 60 dBA Ldn exterior noise standard. These measures could include the construction of a six-foot barrier, such as a concrete block wall or earth berm, along the property line. With windows or doors open, interior noise levels would exceed the 45 dBA Ldn standard (i.e., 65 dBA - 15 dBA = 50 dBA). With windows closed, interior noise levels in would not exceed the standard (i.e., 65 dBA - 24 dBA = 41 dBA). Therefore, air-conditioning systems, a form of mechanical ventilation, would be required to ensure that windows can remain closed for a prolonged period of time.

Sensitive land uses located between the 65 and 70 dBA Ldn traffic noise contours would require mitigation measures to meet the County's 60 dBA Ldn exterior noise standard. These measures could include the construction of an eight-foot barrier, such as a concrete block wall or earth berm, along the property line. With windows or doors open, interior noise levels would exceed the 45 dBA Ldn standard (i.e., 69 dBA - 15 dBA = 54 dBA). With windows closed, interior noise levels in would not exceed the standard (i.e., 69 dBA - 24 dBA = 45 dBA). Therefore, air-conditioning systems, a form of mechanical ventilation, would be required to ensure that windows can remain closed for a prolonged period of time.

Sensitive land uses located within the 70 dBA Ldn traffic noise contour would require mitigation measures to meet the County's 60 dBA Ldn exterior noise standard. These measures could include the construction of a ten-foot barrier, such as a concrete block wall or earth berm, along the property line. With windows or doors open, interior noise levels would exceed the 45 dBA Ldn standard (i.e., 70 dBA - 15 dBA = 55 dBA). With windows closed, interior noise levels in these units would also exceed 45 dBA Ldn standard (70 dBA - 24 dBA = 46 dBA). Therefore, building facade upgrades would be required for all bedrooms exposed to traffic noise. Air-conditioning systems, a form of mechanical ventilation, would be required for bedrooms with exposure to the traffic to ensure that windows can remain closed for a prolonged period of time.

A site specific noise impact analysis would be required for any proposed noise sensitive land uses that would be potentially exposed to traffic noise exceeding 60 dBA Ldn.

Pomeroy Road

Willow Road

Hetrick Avenue

60 LDN

65 LDN

70 LDN

Legend

- 70 dBA LDN Contour
- 65 dBA LDN Contour
- 60 dBA LDN Contour

0 200 400

Feet

Figure V.C-3

Willow Road Extension/U.S. 101 Interchange Project

Future Traffic Noise Contours - Part 1

SOURCE: COUNTY OF SAN LUIS OBISPO (AERIAL), RAJAPPAN & MEYER CONSULTING ENGINEERS, INC. (CAD).

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60 LDN
65 LDN
70 LDN
Willow Road
Frontage Road
US 101
Cherokee Place

Figure V.C-4

Legend

- 70 dBA LDN Contour
- 65 dBA LDN Contour
- 60 dBA LDN Contour

N

0 200 400
Feet

Willow Road Extension/U.S. 101 Interchange Project
Future Traffic Noise Contours - Part 2

SOURCE: COUNTY OF SAN LUIS OBISPO (AERIAL), RAJAPPAN & MEYER CONSULTING ENGINEERS, INC. (CAD).

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4. Cumulative Impacts

The noise impacts of the Willow Road extension, US 101 interchange and frontage road must be considered collectively with the noise impacts that would accrue from other projects proposed in the area. For a list of the proposed projects see Section IV.B Cumulative Projects.

Completion of the proposed project and buildout of the South County Circulation Study planned roadways will result in the increase and redistribution of automobile traffic on regional roadways. The list of cumulative projects as outlined in Section IV.B have been accounted for in the future traffic modeling (year 2030) for the project. Because the noise analysis was based on these future traffic volumes, the noise analysis has considered the cumulative noise impacts of reasonably foreseeable future actions. Future changes in traffic volumes will incrementally change noise levels in areas adjacent to the proposed project facilities, as well as in areas adjacent to other roadways in the vicinity. Long-term noise level increases associated with the proposed project are considered to be significant along Willow Road. Mitigation Measures C-7 through C-9 partially address the significant long-term noise level increases associated with the proposed project.

Short-term noise impacts associated with the development of the cumulative projects list could result in localized noise impacts if construction of one or more of the projects on the cumulative projects list is occurring in the same space and at the same time as the proposed project. Restrictions on the hours that construction activities can take place per the County Noise Ordinance and Mitigation Measure C-1 below would generally reduce the impact of construction-related noise impacts on existing residences and other sensitive land-uses. Short-term noise impacts from other construction activities occurring in the project study area simultaneously would be restricted to areas immediately adjacent to the particular project construction site. Therefore, short-term, construction-related noise impacts associated with the proposed project, even when added to noise impacts from other known construction projects are not considered to be significant over the long-term.

5. Mitigation Measures

In addition to the County's regulations, the following standard mitigation measures shall be implemented to reduce construction-related noise impacts to the extent feasible:

C-1, Construction Hours. The County shall restrict construction activities to the hours between 7:00 a.m. and 9:00 p.m. on Monday through Friday and 9:00 a.m. to 5:00 p.m. on Saturdays and Sundays. This condition shall be included in the construction plan specifications.

C-2, Caltrans Sound Control Requirements. To minimize the construction related noise impacts for existing residences adjacent to the project site, the County shall ensure that the project follows Caltrans Standard Specifications, Section 7-10/I, "Sound Control Requirements." This condition shall be included in the construction plan specifications.

C-3, Construction Noise Restrictions.

> a. The County shall ensure that the contractor shall provide training for all crew members regarding all requirements to minimize construction related noise impacts. This condition shall be included in the construction plan specifications.

b. The County shall require the construction of temporary barriers where construction activities will be conducted near residential receptors, and where complaints have been received. This condition shall be included in the construction plan specifications.

C-4, Portable Equipment. The County shall ensure that portable equipment is located as far as possible from the noise sensitive locations as is feasible. This condition shall be included in the construction plan specifications.

C-5, Staging Areas. The County shall ensure that the construction vehicle staging areas and equipment maintenance areas are located as far as possible from sensitive receptor locations. This condition shall be included in the construction plan specifications.

C-6, Internal Combustion Engine Mufflers. The County shall ensure that each internal combustion engine used for any purpose on the job or related to the job shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without the muffler. This condition shall be included in the construction plan specifications.

The following mitigation measures shall be implemented by the County to reduce certain long-term noise impacts associated with the proposed project:

C-7, Sound Barrier No. 1. The County shall build a sound barrier ten feet high and approximately 129 feet long within the proposed County right-of-way along the north side of Willow Road between Guadalupe and Pomeroy Road to protect receptor location #1 (R-1).

C-8, Sound Barrier No. 2. The County shall build a sound barrier 8 feet high and approximately 318 feet long within the proposed County right-of-way along Willow Road west of Hetrick Avenue to protect receptor location #8 (R-8).

C-9, Sound Barrier No. 3. The County shall build a sound barrier six feet high and approximately 259 feet long within the proposed County right-of-way along Cherokee Place east of Hetrick Avenue to protect receptor location #15 (R-15).

6. Residual Impacts

The proposed project will have significant noise impacts in the project area over the long-term. Of the 22 receptor locations representing existing residences modeled in the project area, 10 receptor locations could experience ambient noise levels exceeding the County's exterior noise standard of 60 dBA $L_{dn.}$ For reasons explained above under long-term project impacts, it is only feasible to provide sound barriers at three of the 10 receptor locations. Therefore, seven receptor locations or residences will experience significant noise impacts for which noise abatement measures are not logistically feasible. Therefore, long-term traffic noise impacts at these seven residences will remain as significant, unavoidable, adverse impacts. However, since the proposed project will result in a redistribution of vehicle traffic on the study area roadway system such that levels of service at area intersections are improved, the proposed project will not directly alter the regional or cumulative noise conditions.