

**APPENDIX D**  
**NOISE IMPACT ANALYSIS**

**NOISE IMPACT ANALYSIS**  
**SLOVER AVENUE WIDENING**  
**COUNTY OF SAN BERNARDINO, CALIFORNIA**

Prepared for:

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## Background

The proposed project includes construction of two additional traffic lanes and median islands (continuous left turn lane) along portions of Slover Avenue. In 2008, the proposed Slover Avenue improvements encompassed the approximate area from Laurel Avenue to Maple Avenue, impacting few residences. In 2009 the Slover Avenue improvements were extended to include roadway segments on both the east and west of the original area. This noise study analyzes the additional Slover Avenue frontage extending from Tamarind Avenue to Locust along the western perimeter and from Valencia Street to Cedar Avenue along the eastern perimeter. In total, the proposed improvements will start at Tamarind Avenue and proceed westerly to Cedar Avenue for a total length of approximately 1.5 miles. This extends the project from its original planned length of approximately 0.80 miles.

# Noise Setting

## *Background*

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise is generally defined as unwanted sound. Sound is characterized by various parameters that describe the physical properties of sound waves. These properties include the rate of oscillation (frequency), the distance between successive troughs or crests, the speed of propagation, and the pressure level or energy content of a given sound wave. In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level.

The unit of sound pressure ratioed to the faintest sound detectable to a person with normal hearing is called a decibel (dB). Sound or noise can vary in intensity by over one million times within the range of human hearing. A logarithmic loudness scale similar to the Richter Scale for earthquake magnitude is therefore used to keep sound intensity numbers at a convenient and manageable level. The human ear is not equally sensitive to all sound frequencies within the entire spectrum. Noise levels at maximum human sensitivity from around 500 to 2,000 cycles per second are factored more heavily into sound descriptions in a process called “A-weighting,” written as “dBA.”

Leq is a time-averaged sound level; a single-number value that expresses the time-varying sound level for the specified period as though it were a constant sound level with the same total sound energy as the time-varying level. Its unit is the decibel (dB). The most common averaging period for Leq is hourly.

Because community receptors are more sensitive to unwanted noise intrusion during more sensitive evening and nighttime hours, state law requires that an artificial dBA increment be added to quiet time noise levels. The 24-hour noise descriptor with a specified evening and nocturnal penalty is called the Community Noise Equivalent Level (CNEL). CNEL's are a weighted average of hourly Leq's.

An interior CNEL of 45 dBA is mandated by the State of California Noise Insulation Standards (CCR, Title 24, Part 6, Section T25-28) for multiple family dwellings, hotel and motel rooms. In 1988, the State Building Standards Commission expanded that standard to include all habitable rooms in residential use, including single-family dwelling units. Since typical noise attenuation within residential structures with closed windows is about 20 dB, an exterior noise exposure of 65 dBA CNEL is generally the noise land-use compatibility guideline for new residential dwellings in California. Because commercial and industrial uses are not occupied on a 24-hour basis, the exterior noise exposure standard for less sensitive land uses generally is somewhat less stringent.

Noise from temporary construction activities is exempt from noise ordinances as long as the construction activities are between the hours of 7 a.m. and 7 p.m., Monday through Saturday, with no activity on Sundays or Federal Holidays.

### ***Baseline Noise Levels***

Noise measurements were made in order to document existing baseline levels in the area. These help to serve as a basis for projecting future noise exposure, both from projects upon the surrounding community and from ambient noise activity upon the proposed project. Noise measurements were initially conducted on Tuesday to Wednesday, May 13th, 2008 and May 14, 2008 for 24- hours at two locations. The results are shown in Table 1 and locations are shown in Figure 1.

The 2008 measurement locations are along Slover Avenue within the initial proposed improvement segment. Measurements were made for 24 hours along edge of the roadway with the sound meters placed in trees and on fences. Meter 1 was located at 180 feet from the Slover Avenue centerline and at 50 feet from the Locust Avenue centerline. Meter 2 recorded only existing Slover Avenue traffic noise at 50 feet from the roadway. The data from Meter 1 was adjusted for a 50-foot set-back from Slover Avenue assuming acoustically “hard” propagation conditions. Both locations agreed with each other within 0.5 dB CNEL. The average of the CNELs at 50 feet from the roadway centerline is 70.5 dB.

Another set of measurements was made in on July 29-July 30, 2009 at 3 locations to capture the added areas of improvement. The location of these meters is shown in Figure 2 and the results are shown in Table 2. Resultant noise levels along these segments are between 71 and 72 dB CNEL at 50 feet from the centerline. Therefore, a maximum noise level of 72 dB CNEL is considered the baseline noise measurement at 50 feet from the centerline for this study.

The results of the measurements are representative of the existing noise exposure for homes along Slover Avenue. They are also almost equal to the building facade noise level of homes with only minimal, i.e., 1-2 dB downward adjustment due to increased setback distance and for some homes, are equal to the recreational side yard noise exposure. The measured existing noise levels along Slover Avenue currently exceed the County of San Bernardino residential standards of 65 dB CNEL for usable outdoor space. For existing homes without air conditioning that would allow for window closure, interior noise exposures also likely exceed the County’s indoor standard of 45 dB CNEL.

**Figure 1**

**Noise Meter Locations 2008 Readings  
Locust Avenue Adjacent**



Meter Location

Meter 1 SW corner of closest residence on Locust Avenue.

Meter 2 North Side of street, 18184 Slover.

**Table 1**  
**Slover Avenue**  
**Existing On-Site Hourly Leq's and CNEL - 2008**

<b>Time Interval</b>	<b>Meter 1</b>	<b>Meter 2</b>
14:00-15:00	61.0	68.2
15:00-16:00	58.7	68.2
16:00-17:00	57.9	68.4
17:00-18:00	61.4	68.9
18:00-19:00	65.7	67.4
19:00-20:00	57.4	65.8
20:00-21:00	54.6	64.4
21:00-22:00	61.7	64.4
22:00-23:00	55.0	61.4
23:00-24:00	52.6	59.7
0:00-1:00	54.2	57.0
1:00-2:00	53.9	57.8
2:00-3:00	53.8	56.5
3:00-4:00	55.6	59.8
4:00-5:00	56.2	63.0
5:00-6:00	59.7	66.4
6:00-7:00	62.3	68.0
7:00-8:00	64.3	68.5
8:00-9:00	59.7	68.4
9:00-10:00	58.8	70.8
10:00-11:00	59.1	66.5
11:00-12:00	57.6	66.8
12:00-13:00	58.2	67.2
13:00-14:00	61.4	68.4

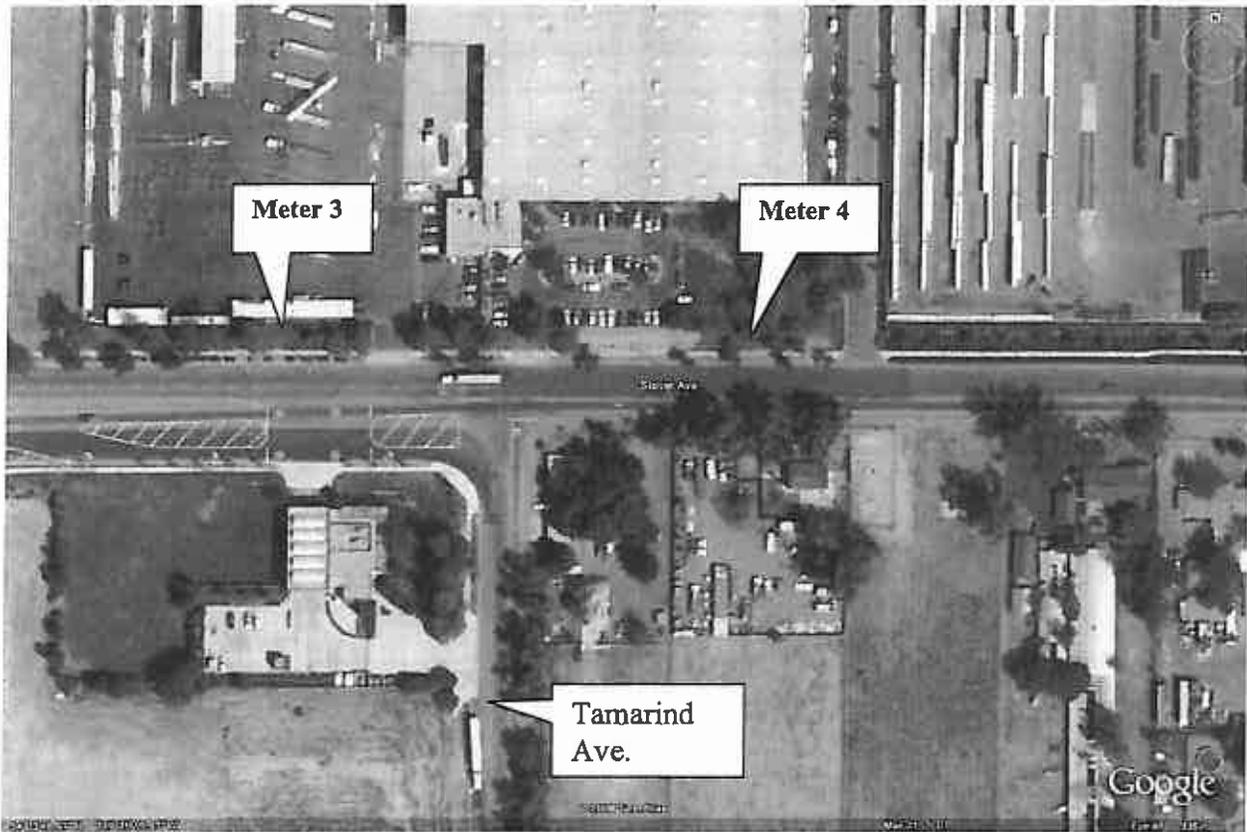
Shaded entries represent night time values (10:00 p.m. to 7:00 a.m.)

**Resultant CNEL at 50 feet from centerline**

<b>Measurement Parameter</b>	<b>Meter 1</b>	<b>Meter 2</b>
<b>24-Hour CNEL</b>	<b>70.2*</b>	<b>70.7</b>

\* adjusted from 180 feet to 50 feet from the Slover Avenue centerline.

**Figure 2**  
**Noise Meter Locations 2009 Readings**  
**Tamarind Avenue Adjacent**



Meter Location

Meter 3 N side of Slover, 45 feet to centerline, east side of Tamarind.

Meter 4 N side of Slover, 50 feet to centerline, west side of Tamarind.

**Figure 2 (continued)**  
**Noise Meter Locations 2009 Readings**  
**Cedar Avenue Adjacent**



Meter Location

Meter 5 North side of Slover Ave, 50 feet to centerline, adjacent to 7-11 store parking lot.

**Table 2**  
**Slover Avenue**  
**Existing On-Site Hourly Leq's and CNEL - 2009**

<b>Time Interval</b>	<b>Meter 3</b>	<b>Meter 4</b>	<b>Meter 5</b>
14:00-15:00	69.7	68.6	66.5
15:00-16:00	69.5	68.0	65.5
16:00-17:00	69.4	68.2	65.1
17:00-18:00	69.6	68.5	66.0
18:00-19:00	68.8	67.1	64.8
19:00-20:00	68.1	68.9	64.2
20:00-21:00	67.7	68.1	62.9
21:00-22:00	66.5	64.7	62.6
22:00-23:00	65.7	63.9	62.4
23:00-24:00	66.0	64.1	60.5
0:00-1:00	61.8	61.7	61.2
1:00-2:00	60.9	62.5	64.7
2:00-3:00	56.9	62.8	59.6
3:00-4:00	60.6	59.7	61.4
4:00-5:00	65.5	63.1	61.4
5:00-6:00	67.4	66.4	64.8
6:00-7:00	69.0	67.8	68.4
7:00-8:00	69.3	67.8	66.2
8:00-9:00	68.5	67.9	66.1
9:00-10:00	69.3	68.1	69.1
10:00-11:00	69.7	68.4	67.6
11:00-12:00	69.5	69.3	67.2
12:00-13:00	69.9	68.7	66.1
13:00-14:00	67.5	67.6	65.4

Shaded entries represent night time values (10:00 p.m. to 7:00 a.m.)

**Resultant CNEL at 50 feet from centerline**

<b>Measurement Parameter</b>	<b>Meter 3*</b>	<b>Meter 4</b>	<b>Meter 5</b>
<b>24-Hour CNEL</b>	72.0	71.9	70.7

\* adjusted to 50 feet from the Slover Avenue centerline.

# Noise Impact Analysis

## *General*

The major source of noise at the residences within the project sphere is traffic from Slover Avenue. Slover Avenue is to be widened with traffic lanes added, and as a result the road will be closer to some homes. Additionally, although not project related, the sensitive uses within the Slover Avenue widening envelope will experience additional noise due to area growth, which will put greater quantities of traffic on Slover Avenue in the coming years.

Most impacted existing Slover Avenue residences have front yards facing the roadway and take their access through driveways along the street. Setbacks from the Slover Avenue centerline for these homes range from approximately 55 feet to 110 feet. Existing noise levels near yards of homes fronting Slover Avenue currently exceed the County General Plan guidelines for noise-sensitive exterior residential recreational uses. However, most the recreational yards are in the rear of these homes and are shielded by increased distance from the roadway and by the residential structure itself. For these homes it is the interior noise level that requires evaluation. Utilizing noise walls as a mitigation measure for homes fronting Slover Avenue is typically not possible, since a wall break would be necessary for driveway access.

Per the County of San Bernardino Noise Element and General Plan, the interior residential noise standard is 45 dB CNEL. Structural attenuation with partly open single-paned windows is around -10 dB. With tightly closed single-paned windows, noise is decreased by almost 20 dB between the outside and inside. With tightly closed dual-paned windows, noise attenuation can approach 30 dB. With the existing measured noise levels shown in Table 1 and 2 of up to 72 dB CNEL at 50 feet from roadway centerline, front bedrooms of homes closest to Slover Avenue would require dual-paned window closure to achieve the County's interior noise standard.

Several homes adjacent to Slover Avenue have side yard exposures. Useable outdoor spaces (patios or yards) at these homes are not behind the structure and as a result may experience noise exposures greater than the 65 dB CNEL threshold for exterior residential recreational use. The roadway segment from Maple to Linden has already been widened to four lanes, and although these homes have side and rear yard noise traffic exposure, a noise wall has already been erected and therefore noise protection for these homes was not considered in this study.

## ***Impact Significance Criteria***

Project noise impacts are considered significant if:

1. They create violations of noise standards, or
2. They substantially worsen an already excessive noise environment, or
3. They substantially increase an existing quiet environment even if noise standards are not violated by the proposed action.

The term "substantial increase" is not defined by any responsible agency. The limits of perceptibility by ambient grade instrumentation (sound meters) or by humans in a laboratory environment is around 1.5 dB. Under ambient conditions, people generally do not perceive that noise has clearly changed until there is a 3.0 dB difference. A threshold of 3.0 dB is typically used to define "substantial increase." Traffic noise due to the project would be significant if it would increase outdoor noise levels by 3.0 dB or more.

Upon completion, homes closer to the widened roadway will be exposed to a slightly higher level of traffic noise than previously. This project will not cause an increase in the area-wide acoustical environment because no change in traffic volume is anticipated to occur solely due to the roadway widening. However, cumulative area growth will cause an incremental increase in roadway usage and increase roadway traffic noise. Additionally, noise at residential receptors may increase as a result of the increase in traffic lanes.

Area noise levels currently exceed County standards. The emphasis of this study therefore is to determine the noise that area residents will experience as a result of project implementation. This is accomplished by a comparison of noise exposures with and without the project, currently and in the future. For the purposes of this project, area build-out is considered to be in the year 2030.

## ***Methodology***

Current traffic volumes along Slover Avenue, west of Cedar Avenue were obtained from the County of San Bernardino Traffic Engineering Department. The latest traffic count volume was 13,037 vehicles per day. Engineering staff recommends a growth factor of approximately 2% per year for determining build-out volumes. Using year 2030 for area build-out, traffic volume along this segment is forecast to increase to 19,500 vehicles per day (a volume growth of 50%). Since Traffic Engineering staff did not have any specific traffic mix data, Giroux and Associates performed a basic calibration by comparing modeled predictions with on-site noise measurements for consistency. By modeling the existing traffic volume with the standard County vehicular traffic mix, the predicted noise exposure is 69 dB CNEL for a 45 mile per hour travel speed at 50 feet from roadway centerline.

However, observed CNELs are as much as 3.0 dB higher, which may be due to a larger number of trucks than assumed in the standard vehicle mix. The future traffic volume of 19,500 would normally create a CNEL of almost 71 dB at 50 feet from the centerline. However, by adding an additional 3.0 dB to account for the increased truck traffic along Slover Avenue, the future vehicular noise level is predicted to be approximately 73.7 dB CNEL at 50 feet from the centerline. This data is summarized below:

<b>Time Frame</b>	<b>Traffic Volume</b>	<b>Modeled Noise Level dB CNEL @ 50 feet from Centerline</b>	<b>Adjusted Noise Level dB CNEL @ 50 feet from Centerline</b>
<b>Current</b>	13,037	69.0	72.0
<b>Build-Out</b>	19,500	70.7	73.7

The widened roadway is expected to be 104 feet wide at project completion, or 52 feet from centerline to edge of right-of-way. Since the roadway is not being realigned, the centerline will remain intact. However, there will be an addition of a traffic lane in each direction, for a total of four lanes. In addition, there will be a median comprised of a continuous left turn lane extending from Laurel to Maple Avenue, from Tamarind Avenue to Locust Avenue and from Valencia Street to Cedar Avenue. Though traffic noise will diminish somewhat due to cars on the far side of the centerline located farther away from a sensitive receiver, this is more than countered by the addition of a closer lane.

The mean noise generation distance will remain at the centerline. One traffic lane nearer will be somewhat balanced by one lane farther away than existing conditions. Utilizing an equivalent lane distance methodology recommended by Caltrans based on FHWA-RD-108, the net effect of additional lanes was calculated for both current and future time frames. A single reference point of 52 feet from roadway centerline was used, since that will be the edge of right-of-way for the widened roadway and the residential property line boundary.

To calculate the change in the noise environment due to shifts in centerline and the addition of traffic lanes, the following methodology is used:

$$\text{Equivalent Distance (ED)} = \sqrt{D_1 D_2}$$

$D_1$  = distance of the center of the near lanes and

$D_2$  = distance to center of the far lanes

$$\text{Noise Increase} = 10 * \log((\text{ED Existing Roadway Geometry}) / (\text{ED New Roadway Geometry}))$$

The following small noise increase will result solely due to changes in roadway geometry:

**Noise Increase from Roadway Widening and Realignment**

Segment	Old Equivalent Lane Distances in feet (D <sub>1</sub> / D <sub>2</sub> )	New Equivalent Lane Distance in feet (D <sub>1</sub> / D <sub>2</sub> )	Equivalent Change in dB
Slover Avenue	45/59	31/73	+0.35 dB

The following summarizes the project impacts:

**Project versus No Project Comparison  
Single Family Home Property Line**

Roadway ROW (52 feet from C/L)	Current (2009) Noise Level*	2030 Noise Level*		Noise Increase* 2009 - 2030	
		Without Project	With Project	Without Project	With Project
Slover Ave, Residences	72.0 dB	73.7 dB	74.1 dB	1.7 dB	2.1 dB

\* At 52 feet from centerline

As a result of project implementation at area build-out, property lines of homes along Slover Avenue would experience 74.1 dB CNEL of traffic noise versus 73.7 dB without project implementation. The “project only impact” from the increase and relocation of travel lanes is +0.35 dB CNEL at the edge of right-of-way.

The cumulative impact (difference between future “with project” and existing) is expected to be +2.1 dB CNEL. Again this is less than the 3.0 dB CNEL significance threshold. Cumulative, as well as “project only” impacts, will be less than significant. In the absence of any individually or cumulatively significant traffic noise impacts, no impact mitigation is required.

The project impact of +0.35 dB CNEL is almost the same for each adjacent home regardless of setback or home orientation. These impacts are not considered significant in a CEQA definition of significance. However, existing homes are noise impacted and that impact will worsen slightly due to a change in roadway geometry and mainly due to future traffic growth. If there were state or partial federal involvement in this project (such as partial funding), a different threshold would be applied. State/federal guidelines consider a noise exposure of 66 dB during the noisiest hour to constitute a residential impact. Measurements showed existing levels to exceed this level in yards along Slover Avenue. State/federal guidelines require an evaluation of “reasonable and feasible” mitigation if there is an impact.

For traffic noise, the construction of sound walls is typically reasonable mitigation. However, most residences fronting Slover Avenue have driveway access that precludes construction of a contiguous wall. Although exterior noise cannot be reduced, the County of San Bernardino could agree to provide financial compensation to single family residential property owners affected by noise increases over time. Financial compensation, deemed “damages compensation”, could be awarded to property owners as a result of roadway proximity and

parking loss damages. The compensation could be used for structural retrofits to reduce interior noise levels, including, but not limited to, dual paned windows on the front and side of residences with a line of sight to Slover Avenue and air conditioning units.

### Homes with Side Yard Exposure to Slover Avenue

Several homes have side yard exposure to Slover Avenue. The yards for these homes would possibly be protected to achieve a 65 dB CNEL recreational space noise level. Existing exterior noise levels for the homes with side yard exposure that could be noise protected are as follows:

**Slover Ave. Homes With Side Yard Exposure  
(may be demolished as part of project)**

APN/ Location	Setback (feet)	Current/ Future Exterior Noise Exposure (dB CNEL)
SW side Laurel and Slover APN 0256-031-15	80	69/71
NE corner of Locust and Slover APN 0252-173-47	180	64/66
SE corner of Tamarind and Slover APN 0256-021-01	At ROW	72/74
SE corner of Locust and Slover	At ROW	72/74
NE corner of Linden and Slover	At ROW	72/74
SE corner of Linden and Slover	At ROW	72/74
SE corner of Orchard and Slover	At ROW	72/74

All but one residence with side yard exposure to Slover Avenue are currently in excess of the recommended noise compatibility thresholds of 65 dB CNEL. Mitigation in the form of noise walls are generally capable of achieving 1 dB CNEL of noise attenuation per vertical foot of wall height, if the wall is continuous. For example, a 6-foot wall is generally capable of providing 6 dB CNEL of noise attenuation, while an 8-foot wall could provide 8 dB of noise attenuation.

If residences with side yard exposure to Slover Avenue were be provided with a 7-8 foot perimeter noise wall along the side yard perimeter adjacent to Slover Avenue, approximately 7-8 dB of noise attenuation could be achieved bringing noise levels within the County outdoor exterior noise standards under current conditions. A noise wall may not be practical however, since it may block visibility for driveway access of homes with driveways adjacent to the noise walls. They may also leak sound around their ends. Short segments of 8-foot high walls needed to perhaps achieve 65 dB CNEL are also unaesthetic. Issues of safety, aesthetics and limited noise reduction benefit all argue against recommendation of construction of 8-foot high side yard walls.

## ***Construction Noise Impact Mitigation***

Construction activities from project development may impact surrounding residential uses. Such impacts are mitigated by required compliance with grading/construction permits. These considerations include:

- The hours of construction operation shall be limited to be between the hours of 7 a.m. and 7 p.m., Monday to Saturday. No construction activity is allowed on Sundays or federal holidays.
- Staging areas shall be located away from existing residences.
- All construction equipment shall use properly operating mufflers.
- Impulsive noise, such as jack-hammering, should be scheduled to affect the fewest number of noise-sensitive homes.

Implementation of these mitigation measures would reduce potential impacts to a level that is less than significant.