NOISE ANALYSIS

FINAL REPORT

ORANGE GROVE ROAD

CAMINO DE LA TIERRA TO
LA CHOLLA BOULEVARD

Tucson, Arizona

Sound Solutions, LLC 11010

September, 2011

PCDOT Project Code: 4OGCAM

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

The purpose of this document is to evaluate the traffic noise effects associated with expanding a 1.5 mile section of Orange Grove Road between Camino de la Tierra and La Cholla Boulevard. The traffic noise analysis for the Orange Grove Road project involved a series of steps. Each of these steps is discussed in detail in the following sections.

Background

The Pima County Department of Transportation (PCDOT) proposes to widen approximately 1.5 miles of Orange Grove Road (Figure 1) from a 3-lane arterial roadway into a 5-lane arterial roadway between Camino de la Tierra and La Cholla Boulevard. The cross section would include 4' graded shoulders, 6' paved shoulders, 11' travel lanes and a 12' wide center turn lane. The existing pavement will be removed and rebuilt. There will be some minor profile changes. The profile of the new road would match that of the existing road, thus maintaining the existing horizontal and vertical alignment. The Peglar Wash box culvert, located west of La Cholla Boulevard, will be extended. At Mona Lisa Road, there will be a westbound right turn lane on Orange Grove Road and a southbound right turn lane on Mona Lisa Road.

Project Location

The project is located approximately eight miles northwest of downtown Tucson (Figure 1). The west end of the project (at Camino de la Tierra) is approximately one mile east of I-10. Northwest Medical Center is located just east of the project (on the east side of La Cholla Boulevard).

Existing Road Conditions and Land Use

Current land use in the project area is primarily residential, with some small commercial properties and the Faith Community Church and School. An undeveloped portion on the east side of the Church property has been split and slated for a commercial residential property to be known as the Orange Grove Casitas. There are other undeveloped properties east of this proposed development

Exhibit 1 Vicinity Maps

2 Methods

For this study, the methods for determining the future noise levels and identifying possible mitigation measures to address future noise levels involved the following series of steps:

- Assess the existing and planned land uses (residential, commercial, industrial, etc.) and determination of sensitive noise receivers within the project corridor.
- Assess the existing conditions (including: traffic volumes; vehicle types; vehicle speeds; roadway layout; area topography; existing walls, and; locations of residences relative to the roadway).
- Predict the existing and future build and future no-build scenarios for a reasonable worse case hour noise condition using the Federal Highway Administration (FHWA) Traffic Noise Model version 2.5 (TNM 2.5).
- Verify the noise model by measuring the existing noise levels at representative noise sensitive receivers.
- Compare the modeled results with the noise abatement criteria established by the Pima County Department of Transportation. Based on the results of the noise monitoring and modeling, potential noise mitigation was examined. This task included noise barrier modeling for noise mitigation as warranted by the results of the noise analysis. Reasonable and feasible mitigation, based on current PCDOT Procedures, is then recommended.

Overview

An assessment of existing and planned land uses (residential, commercial, industrial, etc.) and determination of sensitive noise receivers was undertaken within the project corridor. Aerial photographs and field reconnaissance were used to determine the approximate locations and land use activities of potential sensitive receivers near the roadway. Field measurements were used to determine the existing noise levels throughout the Study Area, as described in Section 4.0, *Noise Analysis Results*. Noise levels were measured at 14 sensitive receiver locations within the project area. The noise measurement locations are representative locations selected to determine the noise impacts along the project.

The TNM 2.5 model was used to predict the noise levels that would occur with the proposed improvements to Orange Grove Road receiver locations. Roadway geometry and topography, traffic volumes, existing barriers, land features, and the representative sites were entered into TNM 2.5 to replicate the conditions under which the noise level measurements were taken. Modeled noise levels were calculated and compared with the noise levels measured at sensitive receiver locations. This process examines the accuracy of the traffic noise model in performing noise level calculations for this project. Discrepancies in the model's calculations were addressed prior to using it for predicting future noise levels. Traffic volumes and speeds used in the modeling for this project represent "worst case" peak-hour traffic conditions.

Three conditions were modeled using TNM 2.5. Traffic Volumes used in the model were provided by PCDOT Traffic Division and the DOWL HKM traffic report (DOWL HKM 2011) which used Pima Association of Governments (PAG) traffic volumes. The model estimated the peak-hour traffic noise levels for:

- Existing traffic conditions – the model included the current street configuration and 2011 traffic volumes.
- Future no-build condition – the model included the current street configuration and 2032 traffic volumes.
- Future build condition – the model included proposed road improvements and future projected 2032 traffic volumes. The project area used projected condition with a noise reduction credit of 3 dBA for the application of rubberized asphalt concrete (RAC). Noise abatement criteria including the use of RAC are described in Section 3 *Noise Abatement Criteria*.

Noise levels for the 2032 traffic and improved roadway conditions were compared with the appropriate noise abatement criterion to determine whether traffic noise mitigation should be considered. Generally, the mitigation considerations consist of noise barriers in the right-of-way (R/W). Although other mitigation considerations are possible, noise barriers are considered the most cost-effective and accepted technique when they are warranted.

TNM 2.5 Modeling

The TNM 2.5 model translated the roads in the Study Area into a series of endpoints on a three-dimensional X, Y, and Z coordinate system. This computer model was developed to comply with FHWA noise regulations and is considered the current standard for roadway noise analyses.

The TNM model requires input data regarding the geometry of roadways in the Study Area, vehicle mix, traffic volumes, and vehicle speeds. The following data were used in the models:

- Vehicle Speeds – as follows
  - Orange Grove Road – 45 mph
  - Camino de la Tierra – 35 mph
  - La Cholla Blvd – 45 mph
  - Shannon Road – 45 mph
  - Mona Lisa Road – 45 mph
  - San Joaquin – 35 mph
  - Side streets have a 25 mph posted speed limit
- Traffic Volumes were provided by DOWL HKM traffic report (DOWL HKM 2011) which used PAG traffic volumes, shown in Table 1.
- Vehicle Mix was provided by DOWL HKM traffic engineers.
  - 96% of the vehicles were automobiles, 4% heavy vehicles (tractor trailers) during AM peak traffic hour.
  - 98% of the vehicles were automobiles, 2% heavy vehicles (tractor trailers) during PM peak traffic hour.
- Elevations – topographic information was used for the roads and receivers. Topographic information was provided by DOWL HKM.
- Ground – "Hard soil"
- Receiver heights – 5 feet above the ground

The proposed roadway and the surrounding arterial streets were defined by a series of roadway segment endpoints. Existing barriers, including residential privacy walls, were included in the model. Receivers were identified as single points and assigned an elevation of 5 feet above the ground to simulate the average height of human hearing. The sound levels were modeled using the A-weighted decibel (dBA), which is the measurement of sound that most closely approximates the sensitivity of the human ear. The noise level results are discussed in Section 4.

Table 1. Peak AM and PM Hour Traffic Volumes

Road	Existing Volumes (2011)		Future Volumes (2032)	
	AM	PM	AM	PM
Orange Grove Road (west of Camino de la Tierra)	1974	2265	2535	2764
Orange Grove Road (east of Camino de la Tierra)	2330	2586	2842	3153
Orange Grove Road (east of Shannon Road)	1840	2091	2245	2551
Orange Grove Road (east of Mona Lisa Road)	1827	2109	2265	2622
Orange Grove Road (east of La Cholla Blvd)	1855	2100	2262	2563
Camino de la Tierra (north of Orange Grove Road)	659	768	924	936
Camino de la Tierra (south of Orange Grove Road)	917	859	1111	1049
Shannon Road (north of Orange Grove Road)	779	864	967	1054
Shannon Road (south of Orange Grove Road)	545	644	665	786
Mona Lisa Road (north of Orange Grove Road)	177	229	215	281
Mona Lisa Road (south of Orange Grove Road)	30	11	129	138
La Cholla Blvd (north of Orange Grove Road)	2437	2735	2973	3338
La Cholla Blvd (south of Orange Grove Road)	2441	2692	2980	3285

The vehicles were classified as automobiles (four wheels), medium trucks (2-axle long, buses, 2-axle 6 tire), and heavy trucks (3 to 6-axle vehicles). Each of these vehicle types generates noise from a different height above the roadway, called the source height.

TNM 2.5 uses the above-described information to calculate the noise contribution from each roadway segment to each receiver and then determine the cumulative effect of all roadway noise sources for each receiver. Validation studies conducted at the Volpe National Transportation Systems Center, a facility of the United States Department of Transportation Research and Innovative Technology Administration, show that the TNM 2.5 model typically predicts noise levels within an acceptable range of accuracy.

Analysis Limitations

This noise analysis is based on design and traffic information available at the time of the analysis. The following assumptions were made to reach conclusions during the analysis phase:

- The project designs as evaluated in this report will not change.
- Future traffic volumes, vehicle mix and speed will remain consistent with those predicted in the traffic study for this project.
- The nature of the land use will remain consistent with current use and planned development (i.e., industrial businesses will not be constructed where retail and professional offices are currently planned)
- The area where people are most likely to spend time outside of their homes is in their yards, near their homes.

While the TNM 2.5 model has been calibrated and tested against actual noise measurements for several years, it should be noted that it is still a noise prediction model. The results of this

analysis assume the predicting capabilities of TNM are sufficient. Assumptions have been made to simplify the calculations for TNM.

- The receiver (representing human hearing) is 5 feet above ground.
- The angle of view from the receiver to the road is 180 degrees.
- The terrain between the roadway and the receiver is flat.
- The ground type is consistent throughout the project area.

The noise levels used in the predictions are measured as peak hour A-weighted Leq (LAeq1h). As stated in Section 2, this is the A-weighted average that represents the steady level over 1 hour that would produce the same energy as the actual signal. The actual instantaneous noise levels fluctuate above and below the measured Leq during the measurement period (e.g., a police siren, a particularly noisy truck, or unusually high traffic volumes). Therefore, the use of LAeq1h for predicting noise levels and conducting the noise evaluation does not consider the noise levels as they may occur in their full range. The fluctuation of instantaneous noise levels will result in sounds that temporarily exceed (and be below) the Leq noise levels as they have been presented in the noise evaluation.

3 Noise Abatement Criteria

Potential negative impact from traffic noise is assessed on the basis of predicted noise levels approaching or exceeding Noise Abatement Criteria (NAC). Pima County NAC is described below.

The PCDOT Procedure Number 03-5, entitled “Traffic Noise Analysis and Mitigation Guidance for Major Roadway Projects,” dated December 1, 2003, was developed to provide guidance for the development of noise mitigation for Pima County’s major roadway projects. The procedure, commonly called the Pima County Noise Abatement Procedure (PC NAP), contains methods for noise analysis, criteria for traffic noise abatement, and requirements for noise reports. Effective April 7, 2008, the Pima County “Revision of Traffic Noise Analysis and Mitigation Guidance for Major Road Projects” was implemented to address changes in the cost of noise mitigation measures. This report reflects the updated mitigation costs per benefited receiver and barrier construction cost per square foot.

According to the PC NAP, noise abatement should be considered if noise levels reach 66 dBA or higher at noise-sensitive properties. Additionally, mitigation measures will be considered for noise-sensitive properties if predicted traffic noise levels substantially exceed existing levels. “Substantially exceed” is defined as a 15-dBA increase between the existing noise levels and the future noise levels. The area at noise-sensitive properties from which the noise level is used to determine abatement consideration, is at an out-of-doors location assumed to be most frequented by the residents. For example, the noise levels used in consideration for abatement at a residence would be from a location outside of the house, but near the house. Noise abatement is only considered for the first floor of multi-floor units.

Noise-sensitive properties include single family or multi-family housing units. Each first floor apartment in an apartment complex or duplex is counted as a separate housing unit. Noise-sensitive properties may also include facilities such as picnic areas, recreation areas, playgrounds, active sports areas, parks, schools, churches, libraries, hospitals, places of worship, and cemeteries.

The PC NAP contains a provision allowing a noise reduction credit of 3 dBA for the use of RAC. As part of the noise abatement procedure described in the PC NAP, this credit is applied during the mitigation determination process as described below.

The PC NAP provides criteria for use of noise walls for noise abatement mitigation. Where a sound wall is considered all of the following criteria must be met in order to recommend the barrier:

- A reduction of at least 5 dBA must be achieved at noise sensitive receivers
- The barrier must benefit two or more adjacent receivers
- The cost of the barrier will not exceed $35,000 per benefited receiver (this is not the actual cost but the cost using a factor of $25/ft^2)
- A majority of the impacted property owners must approve the mitigation
- Mitigation is for only the first floor of multi-story residences
- Barriers must be less than 10 feet tall
- No mitigation will be provided for undeveloped properties unless building permit issued prior to the final EAMR document

4 Noise Analysis Results

Existing Noise Levels

Sensitive Noise Receivers
Sensitive noise receivers in the study area consist of twenty-one single family housing units, two apartment buildings and one business (Antigua de Mexico). Single family housing is located on the north and south side of Orange Grove Road throughout the project. The apartments occur on the south side of Orange Grove Road. Antigua de Mexico occurs on the south side of Orange Grove Road. Twenty-four sensitive receivers were identified (see Table 2). Noise sensitive receiver locations are shown in Figure 2.

There are solid block barriers between most of the residences and roadways except for Antigua de Mexico, 6401 North Avenida Pina, 2830 West Via Hacienda, 2726 West Orange Grove Road, 2710 West Placita Hacienda, 6400 North Placita De Ona and 6401 North Mona Lisa Road.

Table 2. Sensitive Receiver Locations

Location Number	Location Description
1	6402 N Camino De La Tierra – 121 feet north of the centerline of Orange Grove Road. 4-foot high wall encloses back yard, 2 feet higher than Orange Grove Road
2	3235 W Orange Grove Road, Antigua de Mexico – 172 feet south of the centerline of Orange Grove Road. No barrier. 2 feet below Orange Grove Road
3	6400 N Avenida Manzana – 113 feet north of the centerline of Orange Grove Road. 6-foot high wall encloses back yard, 2 feet higher than Orange Grove Road
4	6401 N Avenida Pina – 117 feet north of the centerline of Orange Grove Road. 5-foot high wooden fence encloses back yard, 3 feet higher than Orange Grove Road
5	6401 N Lena Way – 110 feet north of the centerline of Orange Grove Road. 5-foot high wall encloses back yard
6	6400 N Lena Way – 107 feet north of the centerline of Orange Grove Road. 4-foot high wall encloses back yard
7	3030 W Orange Grove Road – 111 feet north of the centerline of Orange Grove Road. 5-foot high wall encloses back yard
8	3006 W Basil Place – 112 feet south of the centerline of Orange Grove Road. 5-foot high wall encloses back yard, 8 feet below Orange Grove Road
9	2936 W Basil Place – 94 feet south of the centerline of Orange Grove Road. 5-foot high wall encloses back yard, 10 feet below Orange Grove Road
10	6411 N Lena Place – 145 feet north of the centerline of Orange Grove Road. 5-foot high wall encloses back yard
11	6430 N Shannon Road – 150 feet north of the centerline of Orange Grove Road. 5-foot high wall encloses back yard
12	2850 W Via Hacienda – 137 feet south of the centerline of Orange Grove Road. 6-foot high wall encloses back yard, 10 feet higher than house.
13	2830 W Via Hacienda – 128 feet south of the centerline of Orange Grove Road. No barrier
14	2740 W Placita Hacienda – 151 feet south of the centerline of Orange Grove Road. 5-foot high wall encloses back yard, 10 feet higher than Orange Grove Road
15	2726 W Orange Grove Road – 104 feet north of the centerline of Orange Grove Road. No barrier
16	2710 W Placita Hacienda – 158 feet south of the centerline of Orange Grove Road. 3-foot high wooden fence on the north and west side of home. Chain link fence on east side of home.
17	6372 N Calle De Ona – 119 feet south of the centerline of Orange Grove Road. 5-foot high wall encloses back yard
18	6400 N Placita De Ona – 124 feet north of the centerline of Orange Grove Road. No barrier
19	6401 N Mona Lisa Road – 134 feet north of the centerline of Orange Grove Road. Chain linked fence
20	6401 N Via Picolina – 99 feet north of the centerline of Orange Grove Road. 5-foot high wall encloses southern and south-western portion of back yard, 4 feet higher than Orange Grove Road
21	6402 N Via Picolina – 92 feet north of the centerline of Orange Grove Road. 6-foot high wall encloses back yard, 5 feet higher than Orange Grove Road
22	6400 N Montrose Drive – 132 feet north of the centerline of Orange Grove Road. 5-foot high wall encloses back yard, 10 feet higher than Orange Grove Road
23	2255 W Orange Grove Road Palm Canyon Apartments #1101 – 137 feet south of the centerline of Orange Grove Road. 5-foot high wall north of the complex
24	2255 W Orange Grove Road Palm Canyon Apartments #23104 – 116 feet south of the centerline of Orange Grove Road. 5-foot high wall north of the complex

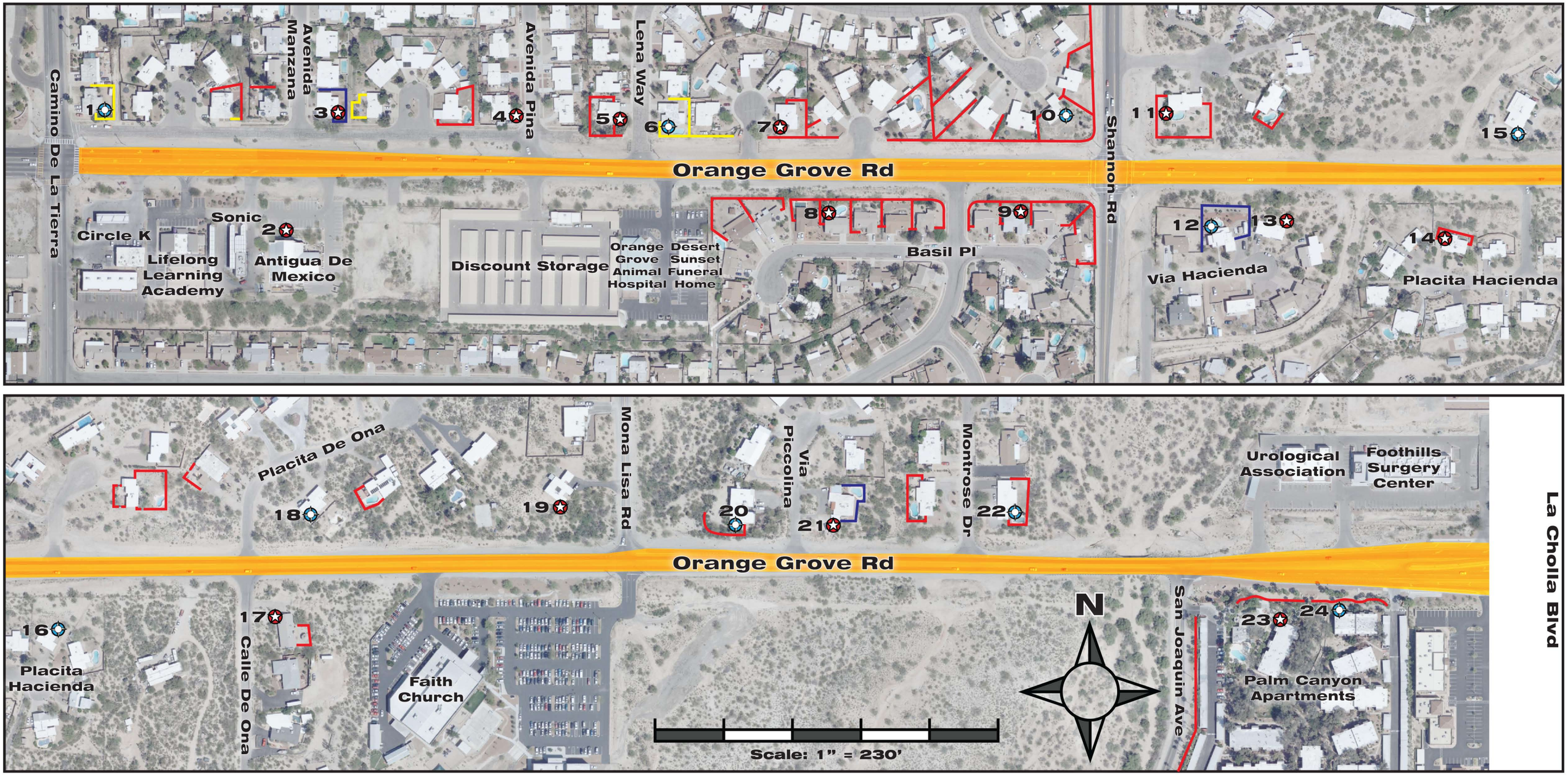

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FIGURE 2

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ORANGE GROVE - CAMINO DE LA TIERRA TO LA CHOLLA

TUCSON, ARIZONA

DESCRIPTION: Existing Road

- Prediction and Measurement Location
- Prediction Location
- 4’ Barrier
- 5’ Barrier
- 6’ Barrier
- Existing Road

Traffic Noise Monitoring

An assessment of existing traffic noise conditions was made. The monitoring program focused on residential and other sensitive land uses within the project area. A series of noise measurements were performed at fourteen monitoring locations in the study area to document existing conditions. Monitoring was conducted according to PCDOT procedures. Noise levels were measured using one Larson Davis 820 sound level meter, which meets the American National Standard Institute (ANSI) requirements for Type 1 sound level meter. The detector of the meter was set for "slow" response (1 second samples). The microphones were located approximately five feet above the ground. The sound level meter was calibrated prior to and immediately after each noise measurement. Noise levels were measured for three 5 minute periods at each of the fourteen measurement locations.

Noise was measured during peak PM traffic hours on Wednesday, July 13, 2011, Thursday, July 14, 2011, Tuesday, July 19, 2011 and Thursday, July 21, 2011. Peak PM traffic hours were from 5 to 7 PM. These times were selected to represent peak traffic hours. Actual traffic counts were used in the verification model.

The primary noise source at all of the sensitive receivers was traffic on Orange Grove Road. At sensitive receivers 9-13, traffic on Shannon Road was significant as well. Other noise sources included: aircraft, trains on the Union Pacific railroad, emergency sirens and birds. Measurements were made to minimize the impact of extraneous noise sources.

The atmospheric conditions during the measurement periods were in compliance with PCDOT and ADOT noise measurement guidelines. Since atmospheric conditions affect sound propagation, the conditions are entered into the noise model.

- Wednesday, July 13, 2011 5:00 PM – During the measurement period the temperature was about 101°F, the relative humidity was 54%, it was clear with a slight breeze from the west (4-5 mph).

- Thursday, July 14, 2011 5:00 PM – During the measurement period the temperature was about 101°F, the relative humidity was 70%, it was clear with a slight breeze from the west and northwest (3-5 mph).

- Tuesday, July 19, 2011 5:00 PM – During the measurement period the temperature was about 101°F, the relative humidity was 70%, it was partly cloudy with a slight breeze from the south (0-2 mph).

- Thursday, July 21, 2011 5:00 PM – During the measurement period the temperature was about 104°F, the relative humidity was 70%, it was mostly sunny with a slight breeze from the west (2-4 mph).

Noise Model Verification

The monitoring site conditions were modeled in TNM 2.5 to evaluate the accuracy of TNM 2.5. Reported noise levels are the average of the three noise level readings taken at each monitoring site during the evening peak traffic hours. These levels were compared with predicted sound levels from the modeled conditions. This comparison was used to make any necessary adjustments to the model input to most accurately reflect site conditions. The noise model verification results are summarized in Table 3.

Table 3. Field Verification Model Results

Measurement Location	Measurement Period	Average Measured Noise Level (dBA)	Modeled Noise Level (dBA)
2 - Antigua de Mexico	7/21/11 5:56-6:15 PM	62	65
3 - 6400 N Avenida Manzana	7/21/11 5:27-5:45 PM	59	59
4 - 6401 N Avenida Pina	7/21/11 5:03-5:20 PM	63	66
5 - 6401 N Lena Way	7/19/11 4:59-5:15 PM	58	61
7 - 3030 W Orange Grove Road	7/14/11 6:29-6:46 PM	60	63
8 - 3006 W Basil Place	7/21/11 6:27-6:45 PM	58	58
9 - 2936 W Basil Place	7/14/11 5:59-6:15 PM	58	60
11 - 6430 N Shannon Road	7/14/11 5:34-5:50 PM	59	59
13 - 2830 W Via Hacienda	7/14/11 5:05-5:21 PM	58	59
14 - 2740 W Placita Hacienda	7/13/11 6:27-6:45 PM	59	60
17 - 6372 N Calle de Ona	7/13/11 6:03-6:19 PM	60	63
19 - 6401 N Mona Lisa Road	7/13/11 5:41-5:57 PM	65	66
21 - 6402 N Via Picolina	7/13/11 5:20-5:36 PM	66	67
23 - 2255 W Orange Grove Road #1101	7/13/11 5:00-5:16 PM	59	61
Source: Calculations and measurements performed by Sound Solutions using TNM 2.5			

As shown in Table 3, the modeled noise levels are equal to or higher than the measured noise levels, showing that the predictions are conservative. These results reflect good agreement between measured and modeled values (within 3 dBA). Variations between measured and modeled are due to many factors including: slight wind (not accounted for in the model), specific vehicles that may be louder or quieter then the modeled level, and other noise sources (aircraft, trains, and birds) not included in the noise model.

Future Noise Levels

Noise levels were modeled for 24 sensitive receiver locations. Modeled sensitive receiver locations are shown in Figure 3. Potential traffic noise impacts were evaluated relative to the PCDOT noise limit of 66 dBA for noise sensitive land use (residential). The future build scenario was computed using projected future traffic data provided by PAG, ADOT and DOWL HKM traffic report (DOWL HKM 2011).

Results

As shown in Table 4, the predicted Future Build noise levels are up to 2 dBA lower than the existing noise levels. The future noise level is 1-2 dBA lower than existing at 22 of the 24 prediction locations because of the noise reduction provided by the RAC on Orange Grove. The future levels are the same as the existing noise levels at locations 1 and 11 because they receive significant noise from Camino de la Tierra and Shannon Road, respectively. The Future Build noise levels are 1-3 dBA lower than the Future No-Build noise levels because of the noise reduction from the RAC on Orange Grove.

The predicted Future Build noise levels are below the PCDOT noise limits at all of the 24 prediction locations along the project.

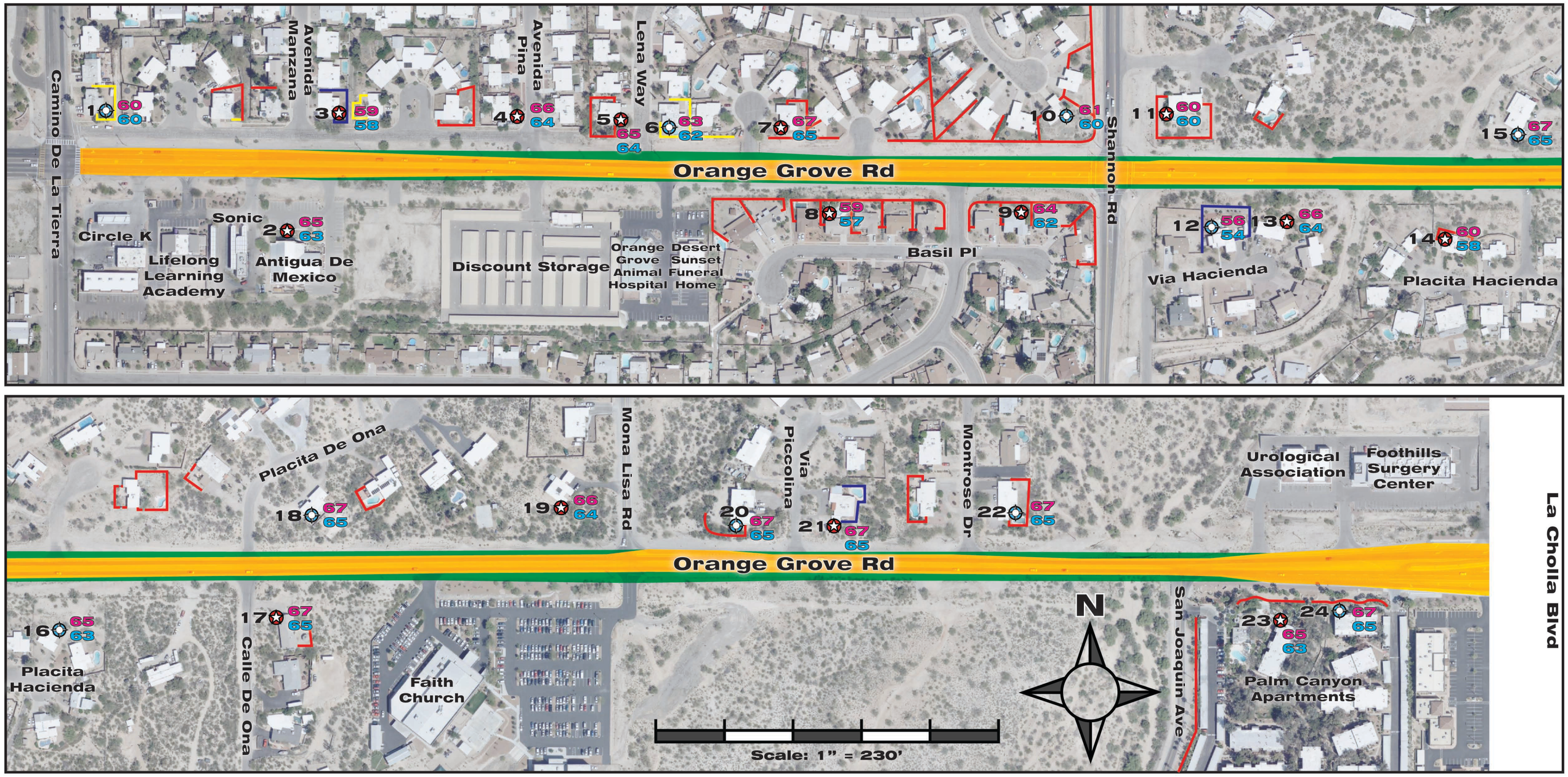

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FIGURE 3

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ORANGE GROVE - CAMINO DE LA TIERRA TO LA CHOLLA

TUCSON, ARIZONA

DESCRIPTION: Future Road

- Prediction and Measurement Location
- Prediction Location
- 4' Barrier
- 5' Barrier
- 6' Barrier
- Existing Road
- Future Road Build
- Existing Sound Level
- Future Sound Level

Table 4 Noise Prediction Results

Sensitive Receiver Location	Existing Noise Level (dBA)	Future No-Build Noise Level (dBA)	Future Build Noise Level (dBA) [1]	Noise Criteria (dBA)
1 - 6402 N Camino De La Tierra	60	61	60	66
2 - Antigua de Mexico	65	**66**	63	NA
3 - 6400 N Avenida Manzana	59	60	58	66
4 - 6401 N Avenida Pina	**66**	**67**	64	66
5 - 6401 N Lena Way	61	62	60	66
6 - 6400 N Lena Way	63	64	62	66
7 - 3030 W Orange Grove Road	63	64	61	66
8 - 3006 W Basil Place	59	60	57	66
9 - 2936 W Basil Place	61	62	59	66
10 - 6411 N Lena Place	61	62	60	66
11 - 6430 N Shannon Road	60	61	60	66
12 - 2850 W Via Hacienda	56	57	54	66
13 - 2830 W Via Hacienda	**66**	**67**	64	66
14 - 2740 W Placita Hacienda	60	61	58	66
15 - 2726 W Orange Grove Road	**67**	**68**	65	66
16 - 2710 W Placita Hacienda	65	**66**	63	66
17 - 6372 N Calle De Ona	63	64	61	66
18 - 6400 N Placita De Ona	**67**	**68**	65	66
19 - 6401 N Mona Lisa Road	**66**	**67**	64	66
20 - 6401 N Via Picolina	63	64	62	66
21 - 6402 N Via Picolina	**67**	**68**	65	66
22 - 6400 N Montrose Drive	63	64	61	66
23 -2255 W Orange Grove Road #1101	62	63	60	66
24 -2255 W Orange Grove Road #23104	65	**66**	63	66

Source: Calculations performed by Sound Solutions using TNM 2.5
Numbers in **bold** exceed noise limits
1 Includes 3 dBA noise reduction for RAC on Orange Grove Road

5 Mitigation Measures

Noise mitigation measures are not required for this project because the predicted Future Build noise levels are below the PCDOT noise limits at all prediction locations along the project.

6 Construction Noise

Properties in the vicinity of the project area would be exposed to noise from construction activities.

The Pima County Noise Code (Chapter 9.30.070) limits construction activities to between 5 AM and 7 PM, April 15 to October 15 and between 6 AM and 7 PM, October 16 to April 14. A noise variance will be required if nighttime construction is necessary.

Construction noise differs from traffic noise in several ways:

- Construction noise lasts only for the duration of the construction contract, with most construction activities in noise-sensitive areas being conducted during hours that are least disturbing to adjacent and nearby residents.
- Construction activities generally are of a short-term nature, and depend on the nature of construction operations.
- Construction noise also is intermittent and depends on the type of operation, location, and function of the equipment, and the equipment usage cycle. Traffic noise, on the other hand, is present in a more continuous fashion after construction activities are completed.

Adjacent properties in the project area would be exposed to noise from construction activity.

Table 5 shows the noise levels produced by various types of construction equipment. The types of construction equipment used for this project will typically generate noise levels of 80 to 90 dBA at a distance of 15 meters (50 feet) while the equipment is operating. Construction equipment operations can vary from intermittent to fairly continuous, with multiple pieces of equipment operating concurrently.

Table 5 Typical Construction Equipment Noise Levels

Type of Equipment	Noise Level in dBA at 50 Feet
Bulldozer	80
Front Loader	72 - 84
Jack Hammer or Rock Drill	81 - 98
Crane with Headache Ball	75 - 87
Backhoe	72 - 93
Scraper and Grader	80 - 93
Electrical Generator	71 - 82
Concrete Pump	81 - 83
Concrete Vibrator	76
Concrete and Dump Trucks	83 - 90
Air Compressor	74 - 87
Pile Drivers (Peaks)	95 - 106
Pneumatic Tools	81 - 98
Roller (Compactor)	73 - 75
Saws	73 - 82
Source: U.S. EPA Noise from Construction Equipment and Operations	

Locations within about 500 meters (1,650 feet) of a construction site are expected to experience occasional episodes of noise levels greater than 60 dBA. Areas within about 150 meters (500 feet) of a construction site will experience episodes with noise levels greater than 70 dBA. Such episodes of high noise levels will not be continuous throughout the day and will generally be restricted to daytime hours.

The following noise mitigation measures are recommended to reduce impacts from construction noise; however, not all measures may be feasible for the Orange Grove Road project:

- Re-route truck traffic away from residential streets, if possible. Select streets with fewest homes, if no alternatives are available.
- Locate equipment on the construction lot as far away from noise sensitive receivers as possible.
- Combine noisy operations to occur in the same time period. The total noise will not increase significantly and the duration of the noise impact will be less.
- Avoid nighttime activities. Sensitivity to noise increases during the nighttime hours at residential receivers.
- Use specially quieted equipment when possible, such as quieted and enclosed air compressors, residential or critical grade mufflers on all engines.
- Stationary equipment will be located as far away from sensitive receptors as possible. Loud, disrupting construction activities in noise sensitive areas will be conducted during hours that are least disturbing to adjacent and nearby residents.

7 Conclusion

Noise mitigation for the Orange Grove Road, Camino de la Tierra to La Cholla Blvd, project has been evaluated in this report. Future noise levels were predicted using TNM 2.5 with the application of RAC as the only noise mitigation measure. The predicted Future Build noise levels are below the PCDOT noise limits at all prediction locations along the project.

Noise abatement for construction-related activities will involve limiting construction activities to between the identified hours as described by the Pima County Noise Code (Chapter 9.30.070).

APPENDIX A

References

Traffic Engineering Study for Orange Grove Road, Camino de la Tierra to La Cholla Boulevard – DOWL HKM 2011

PCDOT Traffic Noise Analysis and Mitigation Guidance for Major Roadway Projects 12/1/2003

PCDOT Revision of Traffic Noise Analysis and Mitigation Guidance for Major Road Projects, Amendment to Statement of Purpose, and Cost Effective Criteria 4/8/2008

Federal Highway Administration, DOT 23 CFR, Chapter 1, Subsection 772 4/1/1998

Traffic Noise Model Version 2.5 User's Guide (Addendum) 4/2004

Handbook of Acoustical Measurements and Noise Control, Third Edition, Cyril Harris 1998

Transit Noise and Vibration Impact Assessment, Federal Transit Administration 4/1995

Environmental Protections Authority – Noise Policy 1/2000

Federal Highway Administration, Measurement of Highway-Related Noise 1995

Federal Highway Administration, Highway Traffic Noise Analysis and Abatement Policy and Guideline 1995

APPENDIX B

Acoustic Terminology

Sound Pressure Level

Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 μPa, which is approximately the lowest sound pressure that can be detected by the human ear.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, background noise, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[2] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the human auditory system does. Thus the A-weighted sound

1 D.W. Robinson and R.S. Dadson, "A Re-Determination of the Equal-Loudness Relations for Pure Tones," *British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226).

level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown below.

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise.

Common Sound Levels in dBA

Common Outdoor Sounds	Sound Pressure Level (dBA)	Common Indoor Sounds	Subjective Evaluation
Auto horn at 10’ Jackhammer at 50’	**100**	Printing plant	Deafening
Gas lawn mower at 4’ Pneumatic drill at 50’	**90**	Auditorium during applause Food blender at 3’	Very Loud
Concrete mixer at 50’ Jet flyover at 5000’	**80**	Telephone ringing at 8’ Vacuum cleaner at 5’	
Large dog barking at 50’ Large transformer at 50’	**70**	Electric shaver at 1’	Loud
Automobile at 55 mph at 150’ Urban residential	**60**	Normal conversation at 3’	
 Small town residence	**50**	Office noise Dishwasher in adjacent room	 Moderate
	40	Soft stereo music in residence Library	
 Rustling leaves	**30**	Average bedroom at night Soft whisper at 3’	Faint
Quiet rural nighttime	**20**	Broadcast and recording studio	
	10	Human breathing	Very Faint
	0	Threshold of hearing (audibility)	
Source: Sound Solution measurements and reference library			

APPENDIX C

Model Input/Output Files
FHWA Traffic Noise Model
Existing AM

Sound Solutions, LLC
Argentina
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Existing AM
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

19 September 2011
TNM 2.5
Calculated with TNM 2.5

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	59.5	66	59.5	10	----	59.5	0.0	8	-8.0
Receiver2	2	1	0.0	65.0	66	65.0	10	----	65.0	0.0	8	-8.0
Receiver3	3	1	0.0	59.4	66	59.4	10	----	59.4	0.0	8	-8.0
Receiver4	4	1	0.0	66.2	66	66.2	10	Snd Lvl	66.2	0.0	8	-8.0
Receiver5	5	1	0.0	61.1	66	61.1	10	----	61.1	0.0	8	-8.0
Receiver6	6	1	0.0	63.3	66	63.3	10	----	63.3	0.0	8	-8.0
Receiver7	7	1	0.0	63.4	66	63.4	10	----	63.4	0.0	8	-8.0
Receiver8	8	1	0.0	58.6	66	58.6	10	----	58.6	0.0	8	-8.0
Receiver9	9	1	0.0	60.9	66	60.9	10	----	60.9	0.0	8	-8.0
Receiver10	10	1	0.0	60.7	66	60.7	10	----	60.7	0.0	8	-8.0
Receiver11	11	1	0.0	60.2	66	60.2	10	----	60.2	0.0	8	-8.0
Receiver12	12	1	0.0	55.7	66	55.7	10	----	55.7	0.0	8	-8.0
Receiver13	13	1	0.0	66.3	66	66.3	10	Snd Lvl	66.3	0.0	8	-8.0
Receiver14	14	1	0.0	60.4	66	60.4	10	----	60.4	0.0	8	-8.0
Receiver15	15	1	0.0	67.0	66	67.0	10	Snd Lvl	67.0	0.0	8	-8.0
Receiver16	16	1	0.0	65.4	66	65.4	10	----	65.4	0.0	8	-8.0
Receiver17	17	1	0.0	63.0	66	63.0	10	----	63.0	0.0	8	-8.0
Receiver18	18	1	0.0	66.9	66	66.9	10	Snd Lvl	66.9	0.0	8	-8.0
Receiver19	19	1	0.0	66.3	66	66.3	10	Snd Lvl	66.3	0.0	8	-8.0
Receiver20	20	1	0.0	62.9	66	62.9	10	----	62.9	0.0	8	-8.0
Receiver21	21	1	0.0	67.1	66	67.1	10	Snd Lvl	67.1	0.0	8	-8.0
Receiver22	22	1	0.0	63.2	66	63.2	10	----	63.2	0.0	8	-8.0
Receiver23	23	1	0.0	61.9	66	61.9	10	----	61.9	0.0	8	-8.0
Receiver24	24	1	0.0	65.2	66	65.2	10	----	65.2	0.0	8	-8.0

Faith Church	26	1	0.0	60.8	66	60.8	10	----	60.8	0.0	8	-8.0

Dwelling Units		**# DUs**	**Noise Reduction**		
			Min	**Avg**	**Max**
			dB	**dB**	**dB**
All Selected		25	0.0	0.0	0.0
All Impacted		6	0.0	0.0	0.0
All that meet NR Goal		0	0.0	0.0	0.0

Sound Solutions, LLC
Argentina

19 September 2011
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Existing AM

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria: Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Receiver1	1	1	4,910.3	10,213.9	2,243.00	4.92	0.00	66	10.0	8.0	Y
Receiver2	2	1	5,364.3	9,914.4	2,246.00	4.92	0.00	66	10.0	8.0	Y
Receiver3	3	1	5,489.4	10,201.0	2,247.00	4.92	0.00	66	10.0	8.0	Y
Receiver4	4	1	5,927.8	10,202.9	2,255.00	4.92	0.00	66	10.0	8.0	Y
Receiver5	5	1	6,149.2	10,176.3	2,265.00	4.92	0.00	66	10.0	8.0	Y
Receiver6	6	1	6,299.3	10,172.4	2,268.00	4.92	0.00	66	10.0	8.0	Y
Receiver7	7	1	6,619.1	10,176.6	2,278.31	4.92	0.00	66	10.0	8.0	Y
Receiver8	8	1	6,688.8	9,974.5	2,260.00	4.92	0.00	66	10.0	8.0	Y
Receiver9	9	1	7,174.1	9,985.0	2,267.20	4.92	0.00	66	10.0	8.0	Y
Receiver10	10	1	7,281.0	10,192.5	2,283.90	4.92	0.00	66	10.0	8.0	Y
Receiver11	11	1	7,528.5	10,219.5	2,289.30	4.92	0.00	66	10.0	8.0	Y
Receiver12	12	1	7,634.3	9,934.2	2,273.20	4.92	0.00	66	10.0	8.0	Y
Receiver13	13	1	7,792.2	9,946.4	2,276.00	4.92	0.00	66	10.0	8.0	Y
Receiver14	14	1	8,244.5	9,911.0	2,295.00	4.92	0.00	66	10.0	8.0	Y
Receiver15	15	1	8,400.4	10,167.5	2,291.50	4.92	0.00	66	10.0	8.0	Y
Receiver16	16	1	8,586.2	9,906.4	2,300.00	4.92	0.00	66	10.0	8.0	Y
Receiver17	17	1	9,144.8	9,926.1	2,316.00	4.92	0.00	66	10.0	8.0	Y
Receiver18	18	1	9,214.0	10,188.5	2,323.50	4.92	0.00	66	10.0	8.0	Y
Receiver19	19	1	9,841.0	10,219.1	2,324.00	4.92	0.00	66	10.0	8.0	Y
Receiver20	20	1	10,267.3	10,168.8	2,338.10	4.92	0.00	66	10.0	8.0	Y
Receiver21	21	1	10,527.3	10,193.4	2,340.00	4.92	0.00	66	10.0	8.0	Y
Receiver22	22	1	10,968.4	10,185.4	2,340.30	4.92	0.00	66	10.0	8.0	Y

Receiver23	23	1	11,613.4	9,921.3	2,330.60	4.92	0.00	66	10.0	8.0	Y
Receiver24	24	1	11,767.4	9,948.7	2,335.00	4.92	0.00	66	10.0	8.0	Y
Faith Church	26	1	9,588.0	9,858.0	2,314.00	4.92	0.00	66	10.0	8.0	Y

Sound Solutions, LLC 29 August 2011
Argentina TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Existing AM

Barrier									Points										
Name	Type	Height		If Wall	If Berm			Add'tnl	Name	No.	Coordinates (bottom)			Height	Segment				
		Min	Max	$ per	$ per	Top	Run:Rise	$ per			X	Y	Z	at	Seg Ht Perturbs			On	Important
				Unit	Unit	Width		Unit						Point	Incre-	#Up	#Dn	Struct?	Reflec-
				Area	Vol.			Length							ment				tions?
		ft	ft	$/sq ft	$/cu yd	ft	ft:ft	$/ft			ft	ft	ft	ft	ft				
Barrier 1	W	0.00	99.99	0.00				0.00	point1	1	4,884.1	10,278.5	2,247.90	4.00	0.00	0	0		
									point3	3	4,929.2	10,278.5	2,247.90	4.00	0.00	0	0		
									point4	4	4,929.2	10,201.3	2,247.90	4.00	0.00	0	0		
									point5	5	4,894.2	10,201.3	2,247.90	4.00	0.00	0	0		
									point2	2	4,894.2	10,212.7	2,247.90	4.00					
Barrier2	W	0.00	99.99	0.00				0.00	point6	6	5,172.5	10,262.8	2,248.50	5.00	0.00	0	0		
									point7	7	5,172.5	10,269.9	2,248.50	5.00	0.00	0	0		
									point8	8	5,244.9	10,283.0	2,248.50	5.00	0.00	0	0		
									point9	9	5,244.9	10,195.9	2,248.50	5.00	0.00	0	0		
									point10	10	5,218.5	10,195.9	2,248.50	4.00					
Barrier3	W	0.00	99.99	0.00				0.00	point11	11	5,293.9	10,274.9	2,250.00	5.00	0.00	0	0		
									point12	12	5,330.9	10,274.9	2,250.00	5.00					
Barrier5	W	0.00	99.99	0.00				0.00	point13	13	5,438.9	10,269.4	2,248.40	6.00	0.00	0	0		
									point14	14	5,508.1	10,269.4	2,248.40	6.00	0.00	0	0		
									point15	15	5,508.1	10,194.4	2,248.40	6.00	0.00	0	0		
									point16	16	5,483.7	10,194.4	2,248.40	6.00	0.00	0	0		
									point17	17	5,483.7	10,199.3	2,248.40	6.00					
Barrier6	W	0.00	99.99	0.00				0.00	point18	18	5,555.4	10,269.8	2,248.60	4.00	0.00	0	0		
									point19	19	5,539.9	10,269.8	2,248.60	4.00	0.00	0	0		
									point20	20	5,539.9	10,255.2	2,248.60	4.00	0.00	0	0		
									point21	21	5,530.9	10,255.2	2,248.60	4.00	0.00	0	0		
									point22	22	5,530.9	10,199.8	2,248.60	4.00	0.00	0	0		
									point23	23	5,558.8	10,199.8	2,248.60	4.00					
Barrier7	W	0.00	99.99	0.00				0.00	point24	24	5,781.5	10,258.7	2,253.90	5.00	0.00	0	0		
									point25	25	5,781.5	10,269.9	2,253.90	5.00	0.00	0	0		
									point26	26	5,819.8	10,278.0	2,253.90	5.00	0.00	0	0		
									point27	27	5,819.8	10,183.2	2,253.90	5.00	0.00	0	0		
									point28	28	5,734.8	10,183.2	2,253.90	5.00	0.00	0	0		
									point29	29	5,734.8	10,198.6	2,253.90	5.00					
Barrier8	W	0.00	99.99	0.00				0.00	point30	30	6,160.8	10,249.1	2,265.00	5.00	0.00	0	0		
									point31	31	6,159.6	10,244.3	2,265.00	5.00	0.00	0	0		
									point32	32	6,103.5	10,245.5	2,265.00	5.00	0.00	0	0		
									point33	33	6,104.7	10,158.5	2,265.00	5.00	0.00	0	0		
									point34	34	6,165.8	10,158.5	2,265.00	5.00	0.00	0	0		
									point35	35	6,165.8	10,183.5	2,265.00	5.00					

Barrier9	W	0.00	99.99	0.00				0.00	point36	36	6,259.7	10,247.1	2,268.50	4.00	0.00	0	0		
									point37	37	6,353.6	10,247.1	2,268.50	4.00	0.00	0	0		
									point38	38	6,354.2	10,147.6	2,268.50	4.00	0.00	0	0		
									point39	39	6,279.0	10,150.6	2,268.50	4.00	0.00	0	0		
									point40	40	6,279.0	10,180.7	2,268.50	4.00	0.00	0	0		
									point41	41	6,342.8	10,183.5	2,268.50	4.00	0.00	0	0		
									point42	42	6,348.0	10,193.1	2,268.50	4.00					
Barrier10	W	0.00	99.99	0.00				0.00	point43	43	6,594.1	10,249.1	2,270.00	5.00	0.00	0	0		
									point44	44	6,642.4	10,249.1	2,270.00	5.00	0.00	0	0		
									point45	45	6,641.9	10,152.9	2,270.00	5.00					
Barrier11	W	0.00	99.99	0.00				0.00	point46	46	6,576.7	10,148.8	2,270.00	5.00	0.00	0	0		
									point47	47	6,708.2	10,148.8	2,270.00	5.00					
Barrier12	W	0.00	99.99	0.00				0.00	point48	48	6,845.6	10,147.4	2,285.00	5.00	0.00	0	0		
									point49	49	7,350.1	10,147.4	2,285.00	5.00	0.00	0	0		
									point50	50	7,350.1	10,382.3	2,285.00	5.00					
Barrier13	W	0.00	99.99	0.00				0.00	point51	51	6,453.4	9,893.0	2,255.00	5.00	0.00	0	0		
									point52	52	6,408.8	9,923.6	2,255.00	5.00	0.00	0	0		
									point53	53	6,408.8	9,989.6	2,255.00	5.00	0.00	0	0		
									point54	54	6,591.1	9,989.6	2,255.00	5.00	0.00	0	0		
									point55	55	6,591.1	9,964.5	2,255.00	5.00					
Barrier14	W	0.00	99.99	0.00				0.00	point56	56	6,611.2	9,947.4	2,265.00	5.00	0.00	0	0		
									point57	57	6,604.5	9,991.4	2,265.00	5.00	0.00	0	0		
									point58	58	6,979.9	9,991.4	2,265.00	5.00	0.00	0	0		
									point59	59	6,979.9	9,922.0	2,265.00	5.00					
Barrier15	W	0.00	99.99	0.00				0.00	point60	60	7,040.1	9,920.3	2,270.00	5.00	0.00	0	0		
									point61	61	7,040.1	9,998.1	2,270.00	5.00	0.00	0	0		
									point62	62	7,350.6	9,998.1	2,270.00	5.00	0.00	0	0		
									point63	63	7,350.6	9,834.2	2,270.00	5.00					
Barrier16	W	0.00	99.99	0.00				0.00	point64	64	7,527.2	10,254.2	2,289.00	5.00	0.00	0	0		
									point65	65	7,499.9	10,254.2	2,289.00	5.00	0.00	0	0		
									point66	66	7,499.9	10,161.7	2,289.00	5.00	0.00	0	0		
									point67	67	7,637.5	10,161.7	2,289.00	5.00	0.00	0	0		
									point68	68	7,637.5	10,236.6	2,289.00	5.00	0.00	0	0		
									point69	69	7,617.0	10,236.6	2,289.00	5.00					
Barrier18	W	0.00	99.99	0.00				0.00	point73	73	7,705.3	9,891.0	2,280.00	6.00	0.00	0	0		
									point74	74	7,733.4	9,909.0	2,280.00	6.00	0.00	0	0		
									point75	75	7,733.4	9,975.3	2,280.00	6.00	0.00	0	0		
									point76	76	7,616.5	9,975.3	2,280.00	6.00	0.00	0	0		
									point77	77	7,616.5	9,853.6	2,280.00	6.00					
Barrier19	W	0.00	99.99	0.00				0.00	point78	78	7,757.8	10,217.0	2,300.00	5.00	0.00	0	0		
									point79	79	7,745.0	10,198.3	2,300.00	5.00	0.00	0	0		
									point80	80	7,783.8	10,173.0	2,300.00	5.00	0.00	0	0		
									point81	81	7,813.6	10,217.2	2,300.00	5.00					
Barrier20	W	0.00	99.99	0.00				0.00	point82	82	8,210.1	9,901.4	2,295.00	5.00	0.00	0	0		
									point83	83	8,192.6	9,905.2	2,295.00	5.00	0.00	0	0		
									point84	84	8,196.9	9,926.8	2,295.00	5.00	0.00	0	0		
									point85	85	8,281.1	9,908.2	2,295.00	5.00	0.00	0	0		
									point86	86	8,277.9	9,891.4	2,295.00	5.00	0.00	0	0		
									point87	87	8,269.5	9,893.0	2,295.00	5.00					

Barrier21	W	0.00	99.99	0.00				0.00	point88	88	8,753.1	10,263.7	2,301.00	5.00	0.00	0	0		
									point89	89	8,737.6	10,263.7	2,301.00	5.00	0.00	0	0		
									point90	90	8,737.6	10,214.6	2,301.00	5.00	0.00	0	0		
									point91	91	8,764.2	10,214.6	2,301.00	5.00					
Barrier22	W	0.00	99.99	0.00				0.00	point92	92	8,792.6	10,282.7	2,301.00	5.00	0.00	0	0		
									point93	93	8,792.6	10,293.3	2,301.00	5.00	0.00	0	0		
									point94	94	8,834.4	10,293.3	2,301.00	5.00	0.00	0	0		
									point95	95	8,834.4	10,208.9	2,301.00	5.00	0.00	0	0		
									point96	96	8,794.9	10,208.9	2,301.00	5.00					
Barrier23	W	0.00	99.99	0.00				0.00	point97	97	8,937.6	10,317.1	2,306.00	5.00	0.00	0	0		
									point98	98	8,909.9	10,281.9	2,306.00	5.00	0.00	0	0		
									point99	99	8,951.5	10,252.9	2,306.00	5.00					
Barrier24	W	0.00	99.99	0.00				0.00	point100	100	9,353.5	10,264.6	2,320.00	5.00	0.00	0	0		
									point101	101	9,330.1	10,252.1	2,320.00	5.00	0.00	0	0		
									point102	102	9,355.5	10,207.3	2,320.00	5.00	0.00	0	0		
									point103	103	9,401.2	10,232.5	2,320.00	5.00					
Barrier25	W	0.00	99.99	0.00				0.00	point104	104	9,182.5	9,914.7	2,317.00	5.00	0.00	0	0		
									point105	105	9,212.5	9,918.3	2,317.00	5.00	0.00	0	0		
									point106	106	9,219.3	9,874.8	2,317.00	5.00	0.00	0	0		
									point107	107	9,185.3	9,870.0	2,317.00	5.00					
Barrier26	W	0.00	99.99	0.00				0.00	point108	108	10,192.2	10,200.6	2,335.00	5.00	0.00	0	0		
									point109	109	10,189.6	10,189.6	2,335.00	5.00	0.00	0	0		
									point110	110	10,196.8	10,164.9	2,335.00	5.00	0.00	0	0		
									point111	111	10,215.4	10,149.4	2,335.00	5.00	0.00	0	0		
									point112	112	10,281.8	10,149.3	2,335.00	5.00	0.00	0	0		
									point113	113	10,281.8	10,172.7	2,335.00	5.00					
Barrier27	W	0.00	99.99	0.00				0.00	point114	114	10,526.5	10,178.1	2,335.00	6.00	0.00	0	0		
									point115	115	10,569.7	10,175.9	2,335.00	6.00	0.00	0	0		
									point116	116	10,574.1	10,229.3	2,335.00	6.00	0.00	0	0		
									point117	117	10,586.0	10,228.2	2,335.00	6.00	0.00	0	0		
									point118	118	10,589.1	10,263.6	2,335.00	6.00	0.00	0	0		
									point119	119	10,531.6	10,266.9	2,335.00	6.00					
Barrier28	W	0.00	99.99	0.00				0.00	point120	120	10,729.5	10,275.9	2,335.00	5.00	0.00	0	0		
									point121	121	10,729.5	10,287.3	2,335.00	5.00	0.00	0	0		
									point122	122	10,694.7	10,287.3	2,335.00	5.00	0.00	0	0		
									point123	123	10,694.7	10,177.8	2,335.00	5.00	0.00	0	0		
									point124	124	10,737.8	10,177.8	2,335.00	5.00	0.00	0	0		
									point125	125	10,737.8	10,192.0	2,335.00	5.00					
Barrier29	W	0.00	99.99	0.00				0.00	point126	126	10,941.0	10,168.1	2,339.00	5.00	0.00	0	0		
									point127	127	10,988.8	10,168.1	2,339.00	5.00	0.00	0	0		
									point128	128	10,988.8	10,284.4	2,339.00	5.00	0.00	0	0		
									point129	129	10,946.6	10,284.4	2,339.00	5.00					
Barrier30	W	0.00	99.99	0.00				0.00	point130	130	11,407.7	9,938.1	2,325.00	5.00	0.00	0	0		
									point131	131	11,407.7	9,669.1	2,325.00	5.00	0.00	0	0		
									point132	132	11,358.1	9,537.3	2,325.00	5.00					
Barrier31	W	0.00	99.99	0.00				0.00	point133	133	11,550.9	9,988.4	2,335.00	5.00	0.00	0	0		
									point134	134	11,648.5	9,974.9	2,335.00	5.00	0.00	0	0		
									point135	135	11,695.9	9,975.4	2,335.00	5.00	0.00	0	0		
									point136	136	11,751.0	9,977.3	2,335.00	5.00	0.00	0	0		

									point137	137	11,803.2	9,979.7	2,335.00	5.00	0.00	0	0		
									point138	138	11,860.2	9,982.6	2,335.00	5.00					

Sound Solutions, LLC **29 August 2011**
Argentina **TNM 2.5**

INPUT: ROADWAYS
PROJECT/CONTRACT: **DOWL HKM**
RUN: **Orange Grove Existing AM**

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points					Flow Control			Segment	
Name	Width	Name	No.	Coordinates (pavement) X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Orange Grove	12.0	East	1	1,725.4	10,121.0	2,216.00				Average	
		Camino de	2	4,791.8	10,092.4	2,239.95				Average	
		point3	3	5,365.4	10,083.7	2,247.40				Average	
		Ave. Piña	4	5,984.8	10,074.0	2,256.26				Average	
		point5	5	6,476.3	10,065.2	2,264.45				Average	
		point6	6	6,873.3	10,073.0	2,270.65				Average	
		Shannon F	7	7,400.6	10,059.8	2,280.30				Average	
		point8	8	8,396.3	10,056.0	2,284.12				Average	
		point9	9	9,084.1	10,066.7	2,320.24				Average	
		Mona Lisa	18	9,991.5	10,081.2	2,324.10				Average	
		Via Piccoli	19	10,877.2	10,069.5	2,328.21				Average	
		point12	20	11,590.0	10,061.5	2,343.21				Average	
		point13	21	12,094.1	10,062.6	2,355.96				Average	
		La Cholla	36	12,572.6	10,076.4	2,360.40				Average	
		West	10	15,246.2	10,053.7	2,366.86					
Camino de la Tierra North	12.0	South	11	4,797.7	10,134.5	2,240.40				Average	
		North	12	4,761.9	11,048.6	2,250.00					
Camino de la Tierra South	12.0	North	13	4,789.7	10,065.0	2,239.00				Average	
		South	14	4,793.6	9,178.7	2,230.00					
Ave. Pina	12.0	South	15	5,961.2	10,107.7	2,255.00				Average	
		North	17	5,964.8	10,410.5	2,260.00					
Lena Way	12.0	South	22	6,231.0	10,104.5	2,264.60				Average	
		North	23	6,232.1	10,399.4	2,270.00					
Shannon Rd. North	12.0	South	24	7,396.9	10,097.3	2,281.20				Average	
		North	25	7,382.8	11,155.0	2,289.70					

Shannon Rd. South	12.0	North	26	7,403.0	10,039.9	2,280.00				Average	
		South	27	7,392.0	9,227.4	2,255.50					
Montrose Dr.	12.0	South	28	10,839.6	10,092.4	2,332.80				Average	
		North	29	10,826.6	10,679.1	2,345.00					
Mona Lisa Rd.	12.0	South	30	10,000.6	10,100.2	2,322.90				Average	
		North	31	9,991.7	10,699.5	2,322.90					
La Cholla Blvd. South	12.0	North	32	12,568.2	9,974.0	2,355.00				Average	
		South	33	12,565.4	9,043.1	2,330.30					
La Cholla Blvd. North	12.0	South	34	12,537.9	10,149.4	2,361.80				Average	
		North	35	12,537.6	10,953.5	2,361.80					

APPENDIX D

Model Input/Output Files
FHWA Traffic Noise Model
Existing PM

Sound Solutions
Argentina
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove PM Existing
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

19 September 2011
TNM 2.5
Calculated with TNM 2.5

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	59.2	66	59.2	10	----	59.2	0.0	8	-8.0
Receiver2	2	1	0.0	64.9	66	64.9	10	----	64.9	0.0	8	-8.0
Receiver3	3	1	0.0	59.1	66	59.1	10	----	59.1	0.0	8	-8.0
Receiver4	4	1	0.0	66.1	66	66.1	10	Snd Lvl	66.1	0.0	8	-8.0
Receiver5	5	1	0.0	60.4	66	60.4	10	----	60.4	0.0	8	-8.0
Receiver6	6	1	0.0	62.6	66	62.6	10	----	62.6	0.0	8	-8.0
Receiver7	7	1	0.0	63.3	66	63.3	10	----	63.3	0.0	8	-8.0
Receiver8	8	1	0.0	58.2	66	58.2	10	----	58.2	0.0	8	-8.0
Receiver9	9	1	0.0	60.4	66	60.4	10	----	60.4	0.0	8	-8.0
Receiver10	10	1	0.0	59.9	66	59.9	10	----	59.9	0.0	8	-8.0
Receiver11	11	1	0.0	59.4	66	59.4	10	----	59.4	0.0	8	-8.0
Receiver12	12	1	0.0	55.3	66	55.3	10	----	55.3	0.0	8	-8.0
Receiver13	13	1	0.0	66.2	66	66.2	10	Snd Lvl	66.2	0.0	8	-8.0
Receiver14	14	1	0.0	60.0	66	60.0	10	----	60.0	0.0	8	-8.0
Receiver15	15	1	0.0	66.7	66	66.7	10	Snd Lvl	66.7	0.0	8	-8.0
Receiver16	16	1	0.0	65.1	66	65.1	10	----	65.1	0.0	8	-8.0
Receiver17	17	1	0.0	62.7	66	62.7	10	----	62.7	0.0	8	-8.0
Receiver18	18	1	0.0	66.5	66	66.5	10	Snd Lvl	66.5	0.0	8	-8.0
Receiver19	19	1	0.0	65.8	66	65.8	10	----	65.8	0.0	8	-8.0
Receiver20	20	1	0.0	62.4	66	62.4	10	----	62.4	0.0	8	-8.0
Receiver21	21	1	0.0	66.7	66	66.7	10	Snd Lvl	66.7	0.0	8	-8.0
Receiver22	22	1	0.0	62.5	66	62.5	10	----	62.5	0.0	8	-8.0
Receiver23	23	1	0.0	61.4	66	61.4	10	----	61.4	0.0	8	-8.0
Receiver24	24	1	0.0	64.6	66	64.6	10	----	64.6	0.0	8	-8.0

Faith Church	26	1	0.0	60.4	66	60.4	10	----	60.4	0.0	8	-8.0

Dwelling Units		**# DUs**	**Noise Reduction**		
			Min	**Avg**	**Max**
			dB	**dB**	**dB**
All Selected		25	0.0	0.0	0.0
All Impacted		5	0.0	0.0	0.0
All that meet NR Goal		0	0.0	0.0	0.0

Sound Solutions 29 August 2011
Argentina TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove PM Existing

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points					Flow Control			Segment	
Name	Width	Name	No.	Coordinates (pavement) X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Orange Grove	12.0	East	1	1,725.4	10,121.0	2,216.00				Average	
		Camino de	2	4,791.8	10,092.4	2,239.95				Average	
		point3	3	5,365.4	10,083.7	2,247.40				Average	
		Ave. Piña	4	5,984.8	10,074.0	2,256.26				Average	
		point5	5	6,476.3	10,065.2	2,264.45				Average	
		point6	6	6,873.3	10,073.0	2,270.65				Average	
		Shannon F	7	7,400.6	10,059.8	2,280.30				Average	
		point8	8	8,396.3	10,056.0	2,284.12				Average	
		point9	9	9,084.1	10,066.7	2,320.24				Average	
		Mona Lisa	18	9,991.5	10,081.2	2,324.10				Average	
		Via Piccoli	19	10,877.2	10,069.5	2,328.21				Average	
		point12	20	11,590.0	10,061.5	2,343.21				Average	
		point13	21	12,094.1	10,062.6	2,355.96				Average	
		La Cholla	36	12,572.6	10,076.4	2,360.40				Average	
		West	10	15,246.2	10,053.7	2,366.86					
Camino de la Tierra Norte	12.0	South	11	4,797.7	10,134.5	2,240.40				Average	
		North	12	4,761.9	11,048.6	2,250.00					
Camino de la Tierra Sur	12.0	North	13	4,789.7	10,065.0	2,239.00				Average	
		South	14	4,793.6	9,178.7	2,230.00					
Ave. Pina	12.0	South	15	5,961.2	10,107.7	2,255.00				Average	
		North	17	5,964.8	10,410.5	2,260.00					
Lena Way	12.0	South	22	6,231.0	10,104.5	2,264.60				Average	
		North	23	6,232.1	10,399.4	2,270.00					
Shannon Rd. North	12.0	South	24	7,396.9	10,097.3	2,281.20				Average	
		North	25	7,382.8	11,155.0	2,289.70					

Shannon Rd. South	12.0	North	26	7,403.0	10,039.9	2,280.00				Average	
		South	27	7,392.0	9,227.4	2,255.50					
Montrose Dr.	12.0	South	28	10,839.6	10,092.4	2,332.80				Average	
		North	29	10,826.6	10,679.1	2,345.00					
Mona Lisa Rd.	12.0	South	30	10,000.6	10,100.2	2,322.90				Average	
		North	31	9,991.7	10,699.5	2,322.90					
La Cholla Blvd. South	12.0	North	32	12,568.2	9,974.0	2,355.00				Average	
		South	33	12,565.4	9,043.1	2,330.30					
La Cholla Blvd. North	12.0	South	34	12,537.9	10,149.4	2,361.80				Average	
		North	35	12,537.6	10,953.5	2,361.80					

APPENDIX E

Model Input/Output Files
FHWA Traffic Noise Model
Future No-Build AM

Sound Solutions
Argentina
19 September 2011
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grover Future AM No Build
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	60.8	66	60.8	10	----	60.8	0.0	8	-8.0
Receiver2	2	1	0.0	66.1	66	66.1	10	Snd Lvl	66.1	0.0	8	-8.0
Receiver3	3	1	0.0	60.4	66	60.4	10	----	60.4	0.0	8	-8.0
Receiver4	4	1	0.0	67.3	66	67.3	10	Snd Lvl	67.3	0.0	8	-8.0
Receiver5	5	1	0.0	62.2	66	62.2	10	----	62.2	0.0	8	-8.0
Receiver6	6	1	0.0	64.4	66	64.4	10	----	64.4	0.0	8	-8.0
Receiver7	7	1	0.0	64.4	66	64.4	10	----	64.4	0.0	8	-8.0
Receiver8	8	1	0.0	59.6	66	59.6	10	----	59.6	0.0	8	-8.0
Receiver9	9	1	0.0	61.8	66	61.8	10	----	61.8	0.0	8	-8.0
Receiver10	10	1	0.0	61.7	66	61.7	10	----	61.7	0.0	8	-8.0
Receiver11	11	1	0.0	61.1	66	61.1	10	----	61.1	0.0	8	-8.0
Receiver12	12	1	0.0	56.6	66	56.6	10	----	56.6	0.0	8	-8.0
Receiver13	13	1	0.0	67.2	66	67.2	10	Snd Lvl	67.2	0.0	8	-8.0
Receiver14	14	1	0.0	61.3	66	61.3	10	----	61.3	0.0	8	-8.0
Receiver15	15	1	0.0	67.8	66	67.8	10	Snd Lvl	67.8	0.0	8	-8.0
Receiver16	16	1	0.0	66.3	66	66.3	10	Snd Lvl	66.3	0.0	8	-8.0
Receiver17	17	1	0.0	63.9	66	63.9	10	----	63.9	0.0	8	-8.0
Receiver18	18	1	0.0	67.8	66	67.8	10	Snd Lvl	67.8	0.0	8	-8.0
Receiver19	19	1	0.0	67.1	66	67.1	10	Snd Lvl	67.1	0.0	8	-8.0
Receiver20	20	1	0.0	63.8	66	63.8	10	----	63.8	0.0	8	-8.0
Receiver21	21	1	0.0	68.0	66	68.0	10	Snd Lvl	68.0	0.0	8	-8.0
Receiver22	22	1	0.0	64.2	66	64.2	10	----	64.2	0.0	8	-8.0
Receiver23	23	1	0.0	62.9	66	62.9	10	----	62.9	0.0	8	-8.0
Receiver24	24	1	0.0	66.1	66	66.1	10	Snd Lvl	66.1	0.0	8	-8.0

Faith Church	27	1	0.0	61.7	66	61.7	10	----	61.7	0.0	8	-8.0

Dwelling Units		**# DUs**	**Noise Reduction**		
			Min	**Avg**	**Max**
			dB	**dB**	**dB**
All Selected		25	0.0	0.0	0.0
All Impacted		9	0.0	0.0	0.0
All that meet NR Goal		0	0.0	0.0	0.0

Sound Solutions
Argentina

19 September 2011
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grover Future AM No Build

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria: Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Receiver1	1	1	4,910.3	10,213.9	2,243.00	4.92	0.00	66	10.0	8.0	Y
Receiver2	2	1	5,364.3	9,914.4	2,246.00	4.92	0.00	66	10.0	8.0	Y
Receiver3	3	1	5,489.4	10,201.0	2,247.00	4.92	0.00	66	10.0	8.0	Y
Receiver4	4	1	5,927.8	10,202.9	2,255.00	4.92	0.00	66	10.0	8.0	Y
Receiver5	5	1	6,149.2	10,176.3	2,265.00	4.92	0.00	66	10.0	8.0	Y
Receiver6	6	1	6,299.3	10,172.4	2,268.00	4.92	0.00	66	10.0	8.0	Y
Receiver7	7	1	6,619.1	10,176.6	2,278.31	4.92	0.00	66	10.0	8.0	Y
Receiver8	8	1	6,688.8	9,974.5	2,260.00	4.92	0.00	66	10.0	8.0	Y
Receiver9	9	1	7,174.1	9,985.0	2,267.20	4.92	0.00	66	10.0	8.0	Y
Receiver10	10	1	7,281.0	10,192.5	2,283.90	4.92	0.00	66	10.0	8.0	Y
Receiver11	11	1	7,528.5	10,219.5	2,289.30	4.92	0.00	66	10.0	8.0	Y
Receiver12	12	1	7,634.3	9,934.2	2,273.20	4.92	0.00	66	10.0	8.0	Y
Receiver13	13	1	7,792.2	9,946.4	2,276.00	4.92	0.00	66	10.0	8.0	Y
Receiver14	14	1	8,244.5	9,911.0	2,295.00	4.92	0.00	66	10.0	8.0	Y
Receiver15	15	1	8,400.4	10,167.5	2,291.50	4.92	0.00	66	10.0	8.0	Y
Receiver16	16	1	8,586.2	9,906.4	2,300.00	4.92	0.00	66	10.0	8.0	Y
Receiver17	17	1	9,144.8	9,926.1	2,316.00	4.92	0.00	66	10.0	8.0	Y
Receiver18	18	1	9,214.0	10,188.5	2,323.50	4.92	0.00	66	10.0	8.0	Y
Receiver19	19	1	9,841.0	10,219.1	2,324.00	4.92	0.00	66	10.0	8.0	Y
Receiver20	20	1	10,267.3	10,168.8	2,338.10	4.92	0.00	66	10.0	8.0	Y
Receiver21	21	1	10,527.3	10,193.4	2,340.00	4.92	0.00	66	10.0	8.0	Y
Receiver22	22	1	10,968.4	10,185.4	2,340.30	4.92	0.00	66	10.0	8.0	Y

Receiver23	23	1	11,613.4	9,921.3	2,330.60	4.92	0.00	66	10.0	8.0	Y
Receiver24	24	1	11,767.5	9,948.7	2,335.00	4.92	0.00	66	10.0	8.0	Y
Faith Church	27	1	9,588.0	9,858.0	2,314.00	4.92	0.00	66	10.0	8.0	Y

Sound Solutions 19 September 2011
Argentina TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grover Future AM No Build

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points									
Name	Width	Name	No.	Coordinates (pavement)			Flow Control			Segment	
				X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Orange Grove	12.0	East	1	1,725.4	10,121.0	2,216.00				Average	
		Camino de	2	4,791.8	10,092.4	2,239.95				Average	
		point3	3	5,365.4	10,083.7	2,247.40				Average	
		Ave. Piña	4	5,984.8	10,074.0	2,256.26				Average	
		point5	5	6,476.3	10,065.2	2,264.45				Average	
		point6	6	6,873.3	10,073.0	2,270.65				Average	
		Shannon F	7	7,400.6	10,059.8	2,280.30				Average	
		point8	8	8,396.3	10,056.0	2,284.12				Average	
		point9	9	9,084.1	10,066.7	2,320.24				Average	
		Mona Lisa	18	9,991.5	10,081.2	2,324.10				Average	
		Via Piccoli	19	10,877.2	10,069.5	2,328.21				Average	
		point12	20	11,590.0	10,061.5	2,343.21				Average	
		point13	21	12,094.1	10,062.6	2,355.96				Average	
		La Cholla	36	12,572.6	10,076.4	2,360.40				Average	
		West	10	15,246.2	10,053.7	2,366.86					
Camino de la Tierra North	12.0	South	11	4,797.7	10,134.5	2,240.40				Average	
		North	12	4,761.9	11,048.6	2,250.00					
Camino de la Tierra South	12.0	North	13	4,789.7	10,065.0	2,239.00				Average	
		South	14	4,793.6	9,178.7	2,230.00					
Ave. Pina	12.0	South	15	5,961.2	10,107.7	2,255.00				Average	
		North	17	5,964.8	10,410.5	2,260.00					
Lena Way	12.0	South	22	6,231.0	10,104.5	2,264.60				Average	
		North	23	6,232.1	10,399.4	2,270.00					
Shannon Rd. North	12.0	South	24	7,396.9	10,097.3	2,281.20				Average	
		North	25	7,382.8	11,155.0	2,289.70					

Shannon Rd. South	12.0	North	26	7,403.0	10,039.9	2,280.00				Average	
		South	27	7,392.0	9,227.4	2,255.50					
Montrose Dr.	12.0	South	28	10,839.6	10,092.4	2,332.80				Average	
		North	29	10,826.6	10,679.1	2,345.00					
Mona Lisa Rd.	12.0	South	30	10,000.6	10,100.2	2,322.90				Average	
		North	31	9,991.7	10,699.5	2,322.90					
La Cholla Blvd. South	12.0	North	32	12,568.2	9,974.0	2,355.00				Average	
		South	33	12,565.4	9,043.1	2,330.30					
La Cholla Blvd. North	12.0	South	34	12,537.9	10,149.4	2,361.80				Average	
		North	35	12,537.6	10,953.5	2,361.80					

APPENDIX F

Model Input/Output Files
FHWA Traffic Noise Model
Future No-Build PM

Sound Solutions
Argentina
RESULTS: SOUND LEVELS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Future PM No Build
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

19 September 2011
TNM 2.5
Calculated with TNM 2.5

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	58.3	66	58.3	10	----	58.3	0.0	8	-8.0
Receiver2	2	1	0.0	65.7	66	65.7	10	----	65.7	0.0	8	-8.0
Receiver3	3	1	0.0	59.9	66	59.9	10	----	59.9	0.0	8	-8.0
Receiver4	4	1	0.0	66.9	66	66.9	10	Snd Lvl	66.9	0.0	8	-8.0
Receiver5	5	1	0.0	61.3	66	61.3	10	----	61.3	0.0	8	-8.0
Receiver6	6	1	0.0	63.4	66	63.4	10	----	63.4	0.0	8	-8.0
Receiver7	7	1	0.0	64.1	66	64.1	10	----	64.1	0.0	8	-8.0
Receiver8	8	1	0.0	59.1	66	59.1	10	----	59.1	0.0	8	-8.0
Receiver9	9	1	0.0	61.3	66	61.3	10	----	61.3	0.0	8	-8.0
Receiver10	10	1	0.0	60.8	66	60.8	10	----	60.8	0.0	8	-8.0
Receiver11	11	1	0.0	60.3	66	60.3	10	----	60.3	0.0	8	-8.0
Receiver12	12	1	0.0	56.1	66	56.1	10	----	56.1	0.0	8	-8.0
Receiver13	13	1	0.0	67.0	66	67.0	10	Snd Lvl	67.0	0.0	8	-8.0
Receiver14	14	1	0.0	60.9	66	60.9	10	----	60.9	0.0	8	-8.0
Receiver15	15	1	0.0	67.5	66	67.5	10	Snd Lvl	67.5	0.0	8	-8.0
Receiver16	16	1	0.0	65.9	66	65.9	10	----	65.9	0.0	8	-8.0
Receiver17	17	1	0.0	63.5	66	63.5	10	----	63.5	0.0	8	-8.0
Receiver18	18	1	0.0	67.4	66	67.4	10	Snd Lvl	67.4	0.0	8	-8.0
Receiver19	19	1	0.0	66.8	66	66.8	10	Snd Lvl	66.8	0.0	8	-8.0
Receiver20	20	1	0.0	63.3	66	63.3	10	----	63.3	0.0	8	-8.0
Receiver21	21	1	0.0	67.7	66	67.7	10	Snd Lvl	67.7	0.0	8	-8.0
Receiver22	22	1	0.0	63.5	66	63.5	10	----	63.5	0.0	8	-8.0
Receiver23	23	1	0.0	62.4	66	62.4	10	----	62.4	0.0	8	-8.0
Receiver24	24	1	0.0	65.6	66	65.6	10	----	65.6	0.0	8	-8.0

Faith Church	26	1	0.0	61.3	66	61.3	10	----	61.3	0.0	8	-8.0

Dwelling Units		**# DUs**	**Noise Reduction**		
			Min	**Avg**	**Max**
			dB	**dB**	**dB**
All Selected		25	0.0	0.0	0.0
All Impacted		6	0.0	0.0	0.0
All that meet NR Goal		0	0.0	0.0	0.0

Sound Solutions 19 September 2011
Argentina TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Future PM No Build

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points					Flow Control			Segment	
Name	Width	Name	No.	Coordinates (pavement) X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Orange Grove	12.0	East	1	1,725.4	10,121.0	2,216.00				Average	
		Camino de	2	4,791.8	10,092.4	2,239.95				Average	
		point3	3	5,365.4	10,083.7	2,247.40				Average	
		Ave. Piña	4	5,984.8	10,074.0	2,256.26				Average	
		point5	5	6,476.3	10,065.2	2,264.45				Average	
		point6	6	6,873.3	10,073.0	2,270.65				Average	
		Shannon F	7	7,400.6	10,059.8	2,280.30				Average	
		point8	8	8,396.3	10,056.0	2,284.12				Average	
		point9	9	9,084.1	10,066.7	2,320.24				Average	
		Mona Lisa	18	9,991.5	10,081.2	2,324.10				Average	
		Via Piccoli	19	10,877.2	10,069.5	2,328.21				Average	
		point12	20	11,590.0	10,061.5	2,343.21				Average	
		point13	21	12,094.1	10,062.6	2,355.96				Average	
		La Cholla	36	12,572.6	10,076.4	2,360.40				Average	
		West	10	15,246.2	10,053.7	2,366.86					
Camino de la Tierra North	12.0	South	11	4,797.7	10,134.5	2,240.40				Average	
		North	12	4,761.9	11,048.6	2,250.00					
Camino de la Tierra South	12.0	North	13	4,789.7	10,065.0	2,239.00				Average	
		South	14	4,793.6	9,178.7	2,230.00					
Ave. Pina	12.0	South	15	5,961.2	10,107.7	2,255.00				Average	
		North	17	5,964.8	10,410.5	2,260.00					
Lena Way	12.0	South	22	6,231.0	10,104.5	2,264.60				Average	
		North	23	6,232.1	10,399.4	2,270.00					
Shannon Rd. North	12.0	South	24	7,396.9	10,097.3	2,281.20				Average	
		North	25	7,382.8	11,155.0	2,289.70					

Shannon Rd. South	12.0	North	26	7,403.0	10,039.9	2,280.00				Average	
		South	27	7,392.0	9,227.4	2,255.50					
Montrose Dr.	12.0	South	28	10,839.6	10,092.4	2,332.80				Average	
		North	29	10,826.6	10,679.1	2,345.00					
Mona Lisa Rd.	12.0	South	30	10,000.6	10,100.2	2,322.90				Average	
		North	31	9,991.7	10,699.5	2,322.90					
La Cholla Blvd. South	12.0	North	32	12,568.2	9,974.0	2,355.00				Average	
		South	33	12,565.4	9,043.1	2,330.30					
La Cholla Blvd. North	12.0	South	34	12,537.9	10,149.4	2,361.80				Average	
		North	35	12,537.6	10,953.5	2,361.80					

Sound Solutions
Argentina

19 September 2011
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Future PM No Build

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria: Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Receiver1	1	1	4,910.3	10,213.9	2,243.00	4.92	0.00	66	10.0	8.0	Y
Receiver2	2	1	5,364.3	9,914.4	2,246.00	4.92	0.00	66	10.0	8.0	Y
Receiver3	3	1	5,489.4	10,201.0	2,247.00	4.92	0.00	66	10.0	8.0	Y
Receiver4	4	1	5,927.8	10,202.9	2,255.00	4.92	0.00	66	10.0	8.0	Y
Receiver5	5	1	6,149.2	10,176.3	2,265.00	4.92	0.00	66	10.0	8.0	Y
Receiver6	6	1	6,299.3	10,172.4	2,268.00	4.92	0.00	66	10.0	8.0	Y
Receiver7	7	1	6,619.1	10,176.6	2,278.31	4.92	0.00	66	10.0	8.0	Y
Receiver8	8	1	6,688.8	9,974.5	2,260.00	4.92	0.00	66	10.0	8.0	Y
Receiver9	9	1	7,174.1	9,985.0	2,267.20	4.92	0.00	66	10.0	8.0	Y
Receiver10	10	1	7,281.0	10,192.5	2,283.90	4.92	0.00	66	10.0	8.0	Y
Receiver11	11	1	7,528.5	10,219.5	2,289.30	4.92	0.00	66	10.0	8.0	Y
Receiver12	12	1	7,634.3	9,934.2	2,273.20	4.92	0.00	66	10.0	8.0	Y
Receiver13	13	1	7,792.2	9,946.4	2,276.00	4.92	0.00	66	10.0	8.0	Y
Receiver14	14	1	8,244.5	9,911.0	2,295.00	4.92	0.00	66	10.0	8.0	Y
Receiver15	15	1	8,400.4	10,167.5	2,291.50	4.92	0.00	66	10.0	8.0	Y
Receiver16	16	1	8,586.2	9,906.4	2,300.00	4.92	0.00	66	10.0	8.0	Y
Receiver17	17	1	9,144.8	9,926.1	2,316.00	4.92	0.00	66	10.0	8.0	Y
Receiver18	18	1	9,214.0	10,188.5	2,323.50	4.92	0.00	66	10.0	8.0	Y
Receiver19	19	1	9,841.0	10,219.1	2,324.00	4.92	0.00	66	10.0	8.0	Y
Receiver20	20	1	10,267.3	10,168.8	2,338.10	4.92	0.00	66	10.0	8.0	Y
Receiver21	21	1	10,527.3	10,193.4	2,340.00	4.92	0.00	66	10.0	8.0	Y
Receiver22	22	1	10,968.4	10,185.4	2,340.30	4.92	0.00	66	10.0	8.0	Y

Receiver23	23	1	11,613.4	9,921.3	2,330.60	4.92	0.00	66	10.0	8.0	Y
Receiver24	24	1	11,767.5	9,948.7	2,335.00	4.92	0.00	66	10.0	8.0	Y
Faith Church	26	1	9,588.0	9,858.0	2,314.00	4.92	0.00	66	10.0	8.0	Y

APPENDIX G

Model Input/Output Files
FHWA Traffic Noise Model
Future Build AM

Sound Solutions
Argentina
19 September 2011
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grover Future AM
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	59.6	66	59.6	10	----	59.6	0.0	8	-8.0
Receiver2	2	1	0.0	63.2	66	63.2	10	----	63.2	0.0	8	-8.0
Receiver3	3	1	0.0	57.6	66	57.6	10	----	57.6	0.0	8	-8.0
Receiver4	4	1	0.0	64.3	66	64.3	10	----	64.3	0.0	8	-8.0
Receiver5	5	1	0.0	59.3	66	59.3	10	----	59.3	0.0	8	-8.0
Receiver6	6	1	0.0	61.5	66	61.5	10	----	61.5	0.0	8	-8.0
Receiver7	7	1	0.0	61.6	66	61.6	10	----	61.6	0.0	8	-8.0
Receiver8	8	1	0.0	56.9	66	56.9	10	----	56.9	0.0	8	-8.0
Receiver9	9	1	0.0	59.7	66	59.7	10	----	59.7	0.0	8	-8.0
Receiver10	10	1	0.0	60.2	66	60.2	10	----	60.2	0.0	8	-8.0
Receiver11	11	1	0.0	59.7	66	59.7	10	----	59.7	0.0	8	-8.0
Receiver12	12	1	0.0	53.9	66	53.9	10	----	53.9	0.0	8	-8.0
Receiver13	13	1	0.0	64.3	66	64.3	10	----	64.3	0.0	8	-8.0
Receiver14	14	1	0.0	58.4	66	58.4	10	----	58.4	0.0	8	-8.0
Receiver15	15	1	0.0	64.9	66	64.9	10	----	64.9	0.0	8	-8.0
Receiver16	16	1	0.0	63.3	66	63.3	10	----	63.3	0.0	8	-8.0
Receiver17	17	1	0.0	61.0	66	61.0	10	----	61.0	0.0	8	-8.0
Receiver18	18	1	0.0	64.8	66	64.8	10	----	64.8	0.0	8	-8.0
Receiver19	19	1	0.0	64.4	66	64.4	10	----	64.4	0.0	8	-8.0
Receiver20	20	1	0.0	61.0	66	61.0	10	----	61.0	0.0	8	-8.0
Receiver21	21	1	0.0	65.1	66	65.1	10	----	65.1	0.0	8	-8.0
Receiver22	22	1	0.0	61.3	66	61.3	10	----	61.3	0.0	8	-8.0
Receiver23	23	1	0.0	60.3	66	60.3	10	----	60.3	0.0	8	-8.0
Receiver24	24	1	0.0	63.4	66	63.4	10	----	63.4	0.0	8	-8.0

Faith Church	27	1	0.0	58.8	66	58.8	10	----	58.8	0.0	8	-8.0

Dwelling Units		**# DUs**	**Noise Reduction**		
			Min	**Avg**	**Max**
			dB	**dB**	**dB**
All Selected		25	0.0	0.0	0.0
All Impacted		0	0.0	0.0	0.0
All that meet NR Goal		0	0.0	0.0	0.0

Sound Solutions 19 September 2011
Argentina TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grover Future AM

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points									
Name	Width	Name	No.	Coordinates (pavement)			Flow Control			Segment	
				X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Orange Grove	12.0	East	1	1,725.4	10,121.0	2,216.00				Average	
		Camino de	2	4,791.8	10,092.4	2,239.95				Average	
		point3	3	5,365.4	10,083.7	2,247.40				Average	
		Ave. Piña	4	5,984.8	10,074.0	2,256.26				Average	
		point5	5	6,476.3	10,065.2	2,264.45				Average	
		point6	6	6,873.3	10,073.0	2,270.65				Average	
		Shannon F	7	7,400.6	10,059.8	2,280.30				Average	
		point8	8	8,396.3	10,056.0	2,284.12				Average	
		point9	9	9,084.1	10,066.7	2,320.24				Average	
		Mona Lisa	18	9,991.5	10,081.2	2,324.10				Average	
		Via Piccoli	19	10,877.2	10,069.5	2,328.21				Average	
		point12	20	11,590.0	10,061.5	2,343.21				Average	
		point13	21	12,094.1	10,062.6	2,355.96				Average	
		La Cholla	36	12,572.6	10,076.4	2,360.40				Average	
		West	10	15,246.2	10,053.7	2,366.86					
Camino de la Tierra North	12.0	South	11	4,797.7	10,134.5	2,240.40				Average	
		North	12	4,761.9	11,048.6	2,250.00					
Camino de la Tierra South	12.0	North	13	4,789.7	10,065.0	2,239.00				Average	
		South	14	4,793.6	9,178.7	2,230.00					
Ave. Pina	12.0	South	15	5,961.2	10,107.7	2,255.00				Average	
		North	17	5,964.8	10,410.5	2,260.00					
Lena Way	12.0	South	22	6,231.0	10,104.5	2,264.60				Average	
		North	23	6,232.1	10,399.4	2,270.00					
Shannon Rd. North	12.0	South	24	7,396.9	10,097.3	2,281.20				Average	
		North	25	7,382.8	11,155.0	2,289.70					

Shannon Rd. South	12.0	North	26	7,403.0	10,039.9	2,280.00				Average	
		South	27	7,392.0	9,227.4	2,255.50					
Montrose Dr.	12.0	South	28	10,839.6	10,092.4	2,332.80				Average	
		North	29	10,826.6	10,679.1	2,345.00					
Mona Lisa Rd.	12.0	South	30	10,000.6	10,100.2	2,322.90				Average	
		North	31	9,991.7	10,699.5	2,322.90					
La Cholla Blvd. South	12.0	North	32	12,568.2	9,974.0	2,355.00				Average	
		South	33	12,565.4	9,043.1	2,330.30					
La Cholla Blvd. North	12.0	South	34	12,537.9	10,149.4	2,361.80				Average	
		North	35	12,537.6	10,953.5	2,361.80					

Sound Solutions
Argentina

19 September 2011
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grover Future AM

Receiver Name	No.	#DUs	Coordinates (ground) X	Y	Z	Height above Ground	Input Sound Levels and Criteria: Existing LAeq1h	Impact Criteria LAeq1h	Impact Criteria Sub'l	NR Goal	Active in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Receiver1	1	1	4,910.3	10,213.9	2,243.00	4.92	0.00	66	10.0	8.0	Y
Receiver2	2	1	5,364.3	9,914.4	2,246.00	4.92	0.00	66	10.0	8.0	Y
Receiver3	3	1	5,489.4	10,201.0	2,247.00	4.92	0.00	66	10.0	8.0	Y
Receiver4	4	1	5,927.8	10,202.9	2,255.00	4.92	0.00	66	10.0	8.0	Y
Receiver5	5	1	6,149.2	10,176.3	2,265.00	4.92	0.00	66	10.0	8.0	Y
Receiver6	6	1	6,299.3	10,172.4	2,268.00	4.92	0.00	66	10.0	8.0	Y
Receiver7	7	1	6,619.1	10,176.6	2,278.31	4.92	0.00	66	10.0	8.0	Y
Receiver8	8	1	6,688.8	9,974.5	2,260.00	4.92	0.00	66	10.0	8.0	Y
Receiver9	9	1	7,174.1	9,985.0	2,267.20	4.92	0.00	66	10.0	8.0	Y
Receiver10	10	1	7,281.0	10,192.5	2,283.90	4.92	0.00	66	10.0	8.0	Y
Receiver11	11	1	7,528.5	10,219.5	2,289.30	4.92	0.00	66	10.0	8.0	Y
Receiver12	12	1	7,634.3	9,934.2	2,273.20	4.92	0.00	66	10.0	8.0	Y
Receiver13	13	1	7,792.2	9,946.4	2,276.00	4.92	0.00	66	10.0	8.0	Y
Receiver14	14	1	8,244.5	9,911.0	2,295.00	4.92	0.00	66	10.0	8.0	Y
Receiver15	15	1	8,400.4	10,167.5	2,291.50	4.92	0.00	66	10.0	8.0	Y
Receiver16	16	1	8,586.2	9,906.4	2,300.00	4.92	0.00	66	10.0	8.0	Y
Receiver17	17	1	9,144.8	9,926.1	2,316.00	4.92	0.00	66	10.0	8.0	Y
Receiver18	18	1	9,214.0	10,188.5	2,323.50	4.92	0.00	66	10.0	8.0	Y
Receiver19	19	1	9,841.0	10,219.1	2,324.00	4.92	0.00	66	10.0	8.0	Y
Receiver20	20	1	10,267.3	10,168.8	2,338.10	4.92	0.00	66	10.0	8.0	Y
Receiver21	21	1	10,527.3	10,193.4	2,340.00	4.92	0.00	66	10.0	8.0	Y
Receiver22	22	1	10,968.4	10,185.4	2,340.30	4.92	0.00	66	10.0	8.0	Y

Receiver23	23	1	11,613.4	9,921.3	2,330.60	4.92	0.00	66	10.0	8.0	Y
Receiver24	24	1	11,767.5	9,948.7	2,335.00	4.92	0.00	66	10.0	8.0	Y
Faith Church	27	1	9,588.0	9,858.0	2,314.00	4.92	0.00	66	10.0	8.0	Y

APPENDIX H

Model Input/Output Files
FHWA Traffic Noise Model
Future Build PM

Sound Solutions
Argentina
19 September 2011
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Future PM
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Receiver1	1	1	0.0	56.2	66	56.2	10	----	56.2	0.0	8	-8.0
Receiver2	2	1	0.0	62.8	66	62.8	10	----	62.8	0.0	8	-8.0
Receiver3	3	1	0.0	57.0	66	57.0	10	----	57.0	0.0	8	-8.0
Receiver4	4	1	0.0	64.0	66	64.0	10	----	64.0	0.0	8	-8.0
Receiver5	5	1	0.0	58.4	66	58.4	10	----	58.4	0.0	8	-8.0
Receiver6	6	1	0.0	60.6	66	60.6	10	----	60.6	0.0	8	-8.0
Receiver7	7	1	0.0	61.3	66	61.3	10	----	61.3	0.0	8	-8.0
Receiver8	8	1	0.0	56.4	66	56.4	10	----	56.4	0.0	8	-8.0
Receiver9	9	1	0.0	59.3	66	59.3	10	----	59.3	0.0	8	-8.0
Receiver10	10	1	0.0	59.3	66	59.3	10	----	59.3	0.0	8	-8.0
Receiver11	11	1	0.0	58.8	66	58.8	10	----	58.8	0.0	8	-8.0
Receiver12	12	1	0.0	53.5	66	53.5	10	----	53.5	0.0	8	-8.0
Receiver13	13	1	0.0	64.1	66	64.1	10	----	64.1	0.0	8	-8.0
Receiver14	14	1	0.0	58.0	66	58.0	10	----	58.0	0.0	8	-8.0
Receiver15	15	1	0.0	64.6	66	64.6	10	----	64.6	0.0	8	-8.0
Receiver16	16	1	0.0	63.0	66	63.0	10	----	63.0	0.0	8	-8.0
Receiver17	17	1	0.0	60.6	66	60.6	10	----	60.6	0.0	8	-8.0
Receiver18	18	1	0.0	64.4	66	64.4	10	----	64.4	0.0	8	-8.0
Receiver19	19	1	0.0	64.1	66	64.1	10	----	64.1	0.0	8	-8.0
Receiver20	20	1	0.0	60.5	66	60.5	10	----	60.5	0.0	8	-8.0
Receiver21	21	1	0.0	64.7	66	64.7	10	----	64.7	0.0	8	-8.0
Receiver22	22	1	0.0	60.7	66	60.7	10	----	60.7	0.0	8	-8.0
Receiver23	23	1	0.0	59.8	66	59.8	10	----	59.8	0.0	8	-8.0
Receiver24	24	1	0.0	62.9	66	62.9	10	----	62.9	0.0	8	-8.0

Faith Church	26	1	0.0	58.4	66	58.4	10	----	58.4	0.0	8	-8.0

Dwelling Units		**# DUs**	**Noise Reduction**		
			Min	**Avg**	**Max**
			dB	**dB**	**dB**
All Selected		25	0.0	0.0	0.0
All Impacted		0	0.0	0.0	0.0
All that meet NR Goal		0	0.0	0.0	0.0

Sound Solutions 29 August 2011
Argentina TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: DOWL HKM
RUN: Orange Grove Future PM

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points					Flow Control			Segment	
Name	Width	Name	No.	Coordinates (pavement) X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
Orange Grove	12.0	East	1	1,725.4	10,121.0	2,216.00				Average	
		Camino de	2	4,791.8	10,092.4	2,239.95				Average	
		point3	3	5,365.4	10,083.7	2,247.40				Average	
		Ave. Piña	4	5,984.8	10,074.0	2,256.26				Average	
		point5	5	6,476.3	10,065.2	2,264.45				Average	
		point6	6	6,873.3	10,073.0	2,270.65				Average	
		Shannon F	7	7,400.6	10,059.8	2,280.30				Average	
		point8	8	8,396.3	10,056.0	2,284.12				Average	
		point9	9	9,084.1	10,066.7	2,320.24				Average	
		Mona Lisa	18	9,991.5	10,081.2	2,324.10				Average	
		Via Piccoli	19	10,877.2	10,069.5	2,328.21				Average	
		point12	20	11,590.0	10,061.5	2,343.21				Average	
		point13	21	12,094.1	10,062.6	2,355.96				Average	
		La Cholla	36	12,572.6	10,076.4	2,360.40				Average	
		West	10	15,246.2	10,053.7	2,366.86					
Camino de la Tierra North	12.0	South	11	4,797.7	10,134.5	2,240.40				Average	
		North	12	4,761.9	11,048.6	2,250.00					
Camino de la Tierra South	12.0	North	13	4,789.7	10,065.0	2,239.00				Average	
		South	14	4,793.6	9,178.7	2,230.00					
Ave. Pina	12.0	South	15	5,961.2	10,107.7	2,255.00				Average	
		North	17	5,964.8	10,410.5	2,260.00					
Lena Way	12.0	South	22	6,231.0	10,104.5	2,264.60				Average	
		North	23	6,232.1	10,399.4	2,270.00					
Shannon Rd. North	12.0	South	24	7,396.9	10,097.3	2,281.20				Average	
		North	25	7,382.8	11,155.0	2,289.70					

Shannon Rd. South	12.0	North	26	7,403.0	10,039.9	2,280.00				Average	
		South	27	7,392.0	9,227.4	2,255.50					
Montrose Dr.	12.0	South	28	10,839.6	10,092.4	2,332.80				Average	
		North	29	10,826.6	10,679.1	2,345.00					
Mona Lisa Rd.	12.0	South	30	10,000.6	10,100.2	2,322.90				Average	
		North	31	9,991.7	10,699.5	2,322.90					
La Cholla Blvd. South	12.0	North	32	12,568.2	9,974.0	2,355.00				Average	
		South	33	12,565.4	9,043.1	2,330.30					
La Cholla Blvd. North	12.0	South	34	12,537.9	10,149.4	2,361.80				Average	
		North	35	12,537.6	10,953.5	2,361.80					