Final Noise Analysis Technical Report

Pima Road, Pinnacle Peak Road to Happy Valley Road

Prepared for:
City of Scottsdale
3939 N. Drinkwater Blvd.
Scottsdale, AZ 85251

Prepared by:
Newton Environmental Consulting, LLC
9859 East Winchcomb Drive
Scottsdale, AZ 85260

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EXECUTIVE SUMMARY

The City of Scottsdale (COS) is proposing a roadway widening project. The Pima Road - Pinnacle Peak Road to Happy Valley Road project will reconstruct the existing roadway from two through lanes in each direction with a center two-way left turn lane to three through lanes in each direction with a raised median and curb and gutter. The project is located in Maricopa County within the City of Scottsdale. Pima Road in this location is designated as environmentally sensitive land (ESL) and Natural Area Open Space (NAOS).

The purpose of the project is to reconstruct Pima Road from a five-lane roadway with a center two-way left-turn lane to a six-lane rural major arterial section with curb and gutter and raised median in order to improve capacity and operational efficiency. The roadway reconstruction will tie into the existing six-lane roadway north of Pinnacle Peak (at the south end of the project, approximately 500 feet north of Pinnacle Peak Road) and will taper down to a five-lane cross-section approximately one-quarter mile (¼ mile) north of Happy Valley Road.

The COS considers mitigation for noise sensitive areas predicted to be impacted by roadway traffic noise levels from the City's transportation improvement projects. The noise level impact determination used in this analysis is based on the COS Roadway Noise Abatement Policy (RNAP), dated April 2011. Table 1 below shows the summary of the noise analysis.

Table 1. Noise Analysis Summary

Parameters	2040 No-Build Condition	2040 Build Condition
No. of Modeled Receivers	38	38
No. of Representative Receptors	38	38
Range of Noise Levels, dBA	56-68	58-70
No. of Barriers Needed for Mitigation	N/A	1
Cost of Mitigation[1]	N/A	$1,975,120
1. Mitigation cost is based on $35/ft^2 for new construction		

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1.0 PROJECT INTRODUCTION

The City of Scottsdale (COS) is proposing a roadway widening project. The Pima Road - Pinnacle Peak Road to Happy Valley Road project will reconstruct the existing roadway from two through lanes in each direction with a center two-way left turn lane to three through lanes in each direction with a raised median and curb and gutter. The project is located in Maricopa County within the City of Scottsdale. Pima Road in this location is designated as environmentally sensitive land (ESL) and Natural Area Open Space (NAOS). The project begins at Pinnacle Peak Road and extends north to Happy Valley Road, a distance of 1 mile. However, the project limits are from 500 feet north of Pinnacle Peak Road to ¼ mile north of Happy Valley Road, an approximate distance of 1.15 miles

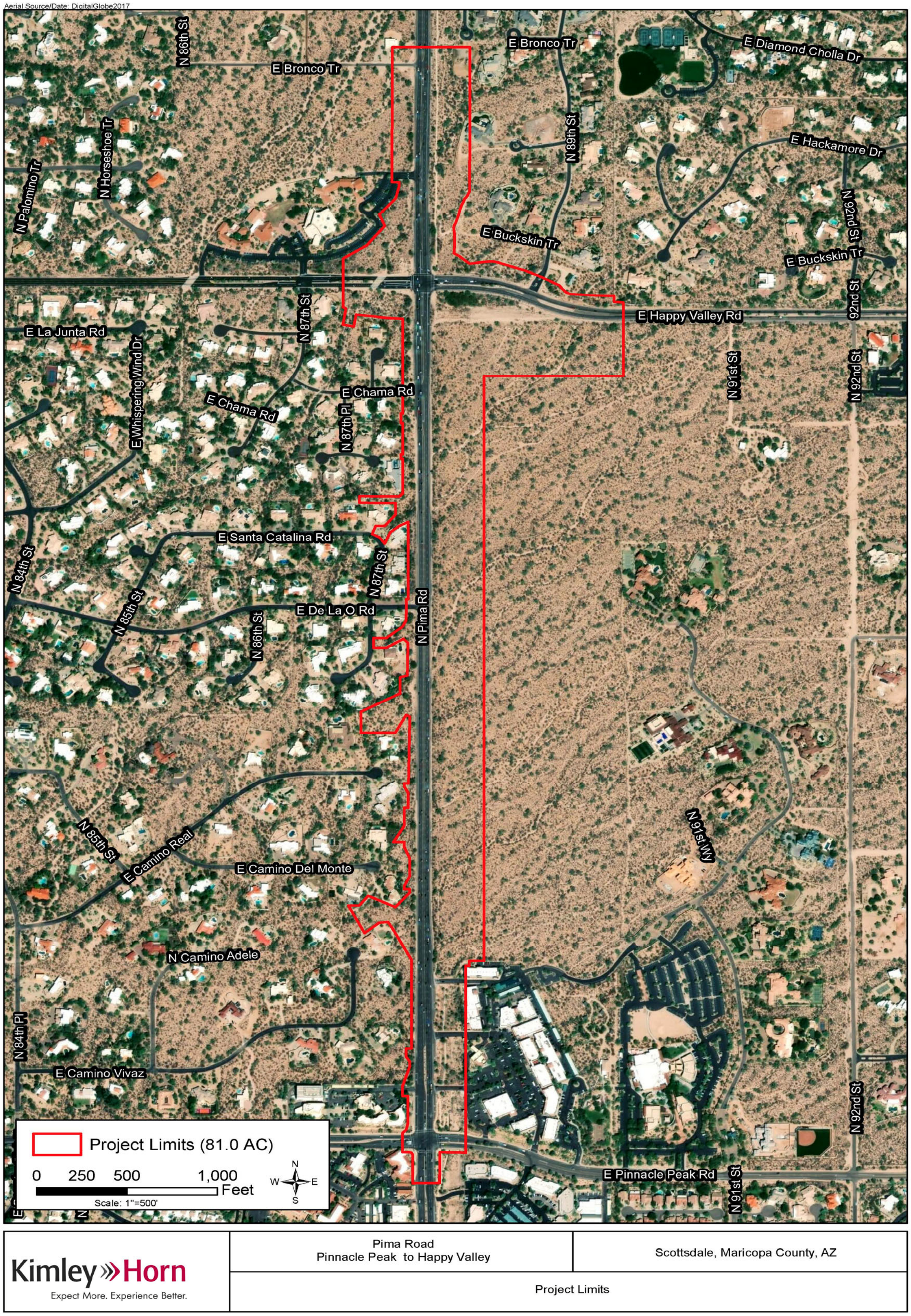
This project is currently listed in the City's FY 2015/16 to FY 2019/20 Five-Year Capital Improvement Plan. The project is not anticipated to be programmed with Federal funds. Funding is through the MAG Regional Transportation Plan (RTP) Arterial Life Cycle Program (ALCP) which uses a 70% regional and 30% local funding match.

The purpose of the project is to reconstruct Pima Road from a five-lane roadway with a center two-way left-turn lane to a six-lane rural major arterial section with curb and gutter and raised median in order to improve capacity and operational efficiency. The roadway reconstruction will tie into the existing six-lane roadway north of Pinnacle Peak (at the south end of the project, approximately 500 feet north of Pinnacle Peak Road) and will taper down to a five-lane cross-section approximately one-quarter mile (¼ mile) north of Happy Valley Road. Reconstructing Pima Road is consistent with Scottsdale's Regional Transportation Plan and goals to develop and maintain a safe, effective, and efficient transportation system.

The project location and project study area are shown in **Figure 1** and **Figure 2**, respectively.

Figure 1. Project Location Map

Figure 2. Project Study Area



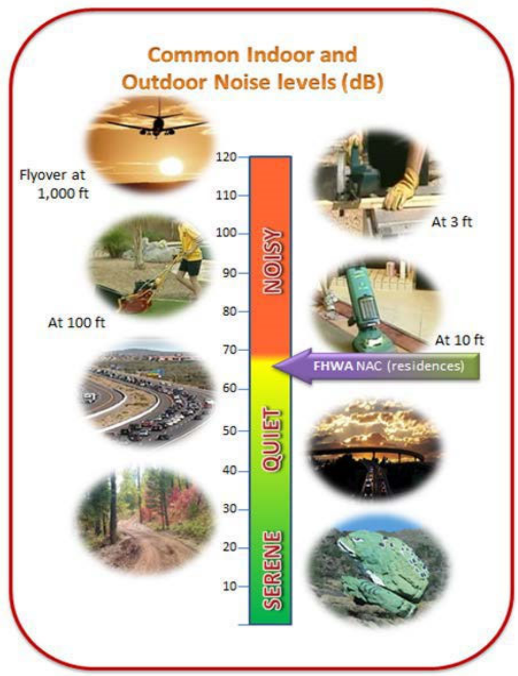
2.0 NOISE STUDY PROCEDURES

Noise study procedures, as specified in 23 C.F.R. § 772, follow a six-step process:

1. Identify noise-sensitive land uses,
2. Determine existing noise levels,
3. Predict future (Design Year) noise levels,
4. Determine traffic noise impacts at the noise-sensitive receptors by comparing future (Design Year) noise levels of the Proposed Alternatives with the existing noise levels,
5. Identify any noise impacts resulting from project construction activities, and
6. Provide and evaluate information from local land use planning agencies regarding predicted future (Design Year) noise levels for use in land development decisions.

3.0 FUNDAMENTALS OF TRAFFIC NOISE

Sound is the sensation produced by stimulation of the hearing organs produced by continuous and regular vibrations of a longitudinal pressure wave that travels through an elastic medium (air, water, metal, wood) and can be heard when they reach a person's or animal's ear. When sound travels through air, the atmospheric pressure wave variations occur periodically. Sound travels in air at a speed of approximately 1,087 feet per second at sea level and temperature of 32 °F. Noise is usually defined as any "unwanted sound," and consists of sounds that are perceived as interfering with communication, work, rest, and recreation. It is characterized as a non-harmonious or discordant group of sounds.



Sound Pressure Levels, Decibels, Frequencies and A-Weighted Decibels-dBA

Noise can be measured in Pascals (Pa). A healthy human ear can detect a pressure variation of 20 µPa and is referred to as the threshold of hearing. A logarithmic scale is useful for handling numbers on a wide scale, but for a smaller span, the decibel or (dB) scale is used. Sound pressure level (SPL) is calculated is using measured sound level and the hearing threshold of 20 µPa or 20 x 10-6 Pa as the reference level, this level can also be defined as 0 dB. The decibel alone is insufficient to describe how the human ear responds to sound pressures at all frequencies. The human ear has peak response in the range of 2,500 to 3,000 Hz and has a somewhat low response at low or even high frequencies. In response to the human ear sensitivity, the A-weighted noise level, referenced in units of dBA, was determined to better represent people's perception of sound levels. This dBA unit of measurement is used in noise studies and reporting. Changes in sound level under 3 dBA are not perceptible to the human ear, while the human ear perceives a

10 dBA increase in sound level to be a doubling of sound.

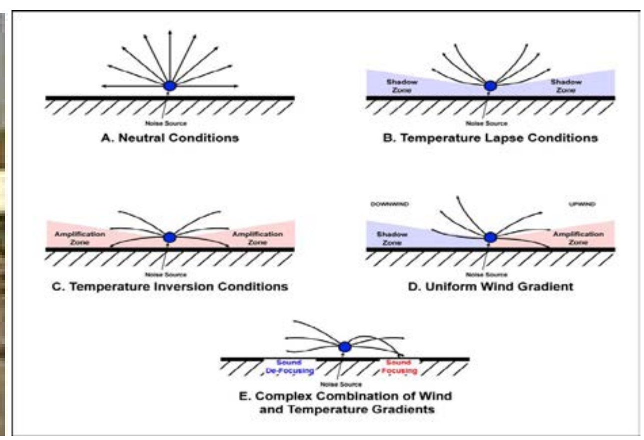
Noise Descriptors

The most commonly used noise descriptor in traffic noise analysis is the Equivalent Sound Level (Leq). Leq represents an average of the sound energy occurring over a specified period of time (for example, 1 hour). In effect, the Leq is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level [LAeq(h)] is the energy average of A-weighted sound levels occurring during a one-hour period, and is the basis for noise criteria used by the COS.

What are source, receiver, receptor, and path when talking about traffic noise?

Traffic noise is a combination of the noises produced by vehicle engines, exhaust, and tires. The source of highway traffic comes from vehicles traveling on highways. The noise level at the Source depends on pavement type, number of heavy trucks, traffic volumes, and traffic speeds. The predominant noise sources in vehicles at speeds less than 30 mph are engine and exhaust. At speeds greater than 30 mph, tire noise becomes the dominant noise source.

In the illustration below, the Receptor is any location where people are affected by the traffic noise. It can be residence, park, school, playground and any other place where frequent human use occurs. An area between the source and the receptor (receiver represents a receptor(s) when modeled in FHWA Traffic Noise Model) is considered a path. Depending on the path surface, propagation of sound may be reduced; such is the case for the soft ground and fresh snow. Doubling the distance between the source and receptor reduces noise by three dBA depending on the ground.



Air changes its density due to variation of humidity and temperature, and wind influences refraction of sound waves. Wind, humidity, and temperature may have a significant impact, but only influences the receptors located a long distance from the source. As residents are usually much closer to the noise source, any atmospheric conditions are insignificant for consideration.

4.0 NOISE IMPACT CRITERIA

The COS RNAP provides the guidelines used to assess the potential negative impacts from highway traffic noise levels and determines the need for noise abatement. The noise level impact methodology used for this analysis is based on the current COS RNAP. The Federal Highway Administration (FHWA) has established Noise Abatement Criteria (NAC) and procedures to be used in the planning and design of highways. A summary of the NAC for various land uses is presented in Table 2.

The COS RNAP is based on the noise levels approaching the FHWA NAC. COS defines “approaching” as within 3 dBA of the FHWA NAC for Activity Categories A, B, C, D, and E. There are no noise impact thresholds for Activity Category F or G. The COS RNAP determines highway traffic noise level impacts and considers mitigation for residential land uses when the predicted noise level is equal to or greater than the noise impact threshold of 64 dBA. Noise levels are rounded to the nearest integer prior to impact determination and in project reports.

TABLE 2
FHWA NOISE ABATEMENT CRITERIA[1]

Activity Category	dBA, L_{Aeq1h}[2]	Activity Description
A	57 (exterior)	Land on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential.
C	67 (exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio structures, recording studios, schools, and television studios.
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in categories A–D or F.
F	---	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	---	Undeveloped lands that are not permitted.

1. Sources: Federal Highway Administration (2011); 23 Code of Federal Regulations § 772.
2. The 1-hour equivalent loudness in A-weighted decibels, which is the logarithmic average of noise over a 1-hour period.

5.0 LAND USES WITHN PROJECT STUDY AREA

The project area is comprised of Category B (residential), Category C (church), Category E (restaurants), Category F (retail facilities) and Category G (undeveloped lands). This analysis focuses on representative noise sensitive receptors in Categories B, C, and E. Residential noise-sensitive land uses were examined for this study. According to the COS RNAP, "The City does not typically mitigate for commercial or industrial uses".

6.0 EXISTING NOISE ENVIRONMENT

Short-term noise level monitoring was conducted within the project limits on January 16, 2019 to describe the existing noise environment. Three measurement locations were chosen to represent noise sensitive receptors in residential communities along the project corridor.

Three 10-minute interval equivalent noise level measurements (Leq) were conducted at each site. Noise level monitoring helps describe the existing noise environment throughout the project area and capture the contribution of traffic noise from surrounding roadways. Measured noise levels may include contributions from other noise sources, including but not limited to, airplanes, wind, birds, insects, landscaping equipment, etc.

The equipment used for the noise level monitoring was a Larson Davis Model LXT Class 1 integrating sound level meter (SLM). The SLM was calibrated in the field before each measurement using a Larson Davis Model CAL200. Existing noise measurements were collected under meteorologically acceptable conditions when the pavement was dry and winds were calm or light. Additional data collected at each monitoring location included atmospheric conditions such as general wind speed and direction, humidity, dewpoint, barometric pressure, and ambient temperature. Measurements were collected based on the acceptable collection of existing noise level readings per FHWA Report number FHWA- HEP-18-065, and "Noise Measurement Handbook."

The measured noise level ranged from 59 dBA to 75 dBA. The first monitoring site (Mon 1) was taken adjacent to the back yard of a residential home to establish existing noise levels for the homes to the west of Pima Road. Mon 2 and Mon 3 were taken closer to Pima Road to validate the noise model. Appendix A shows the location of the noise level monitoring sites, and Table 3 shows the summary of the modeled and measured noise levels. Appendix B shows the measured noise level data.

TABLE 3
SUMMARY OF SOUND LEVEL MEASUREMENTS
January 16, 2019

Site Number	Description	Modeled Validation Noise Levels (Leq), dBA	10-Minute Interval Measured Noise Levels (Leq), dBA		
			Interval 1	Interval 2	Interval 3
MON 1	Residence - 8742 E. Camino Real	N/A	59.4	59.6	59.3
MON 2	Validation Site – 40' west of Pima Rd	74.5	73.8	74.0	74.5
MON 3	Validation Site – 75' east of Pima Rd	72.3	71.4	72.1	72.3

7.0 NOISE MODELING METHODOLOGY AND TNM 2.5 VARIABLES

The FHWA-approved Traffic Noise Model version 2.5 (TNM 2.5) is the computer noise model used for the prediction of highway and roadway traffic noise levels. The output of the model is dependent upon several variables, including atmospheric conditions, roadway geometries, topographic data, ground types, noise receiver locations, traffic volumes, vehicle speed, and vehicle mix.

Atmospheric Conditions

Noise levels are affected by temperature and humidity. Temperature gradients cause refraction effects. For example, in the morning, when the ground is still cool from the night before but the upper air is warming due to the sun, noise can bounce between the gradient and the ground, forming regions of higher and lower noise intensity. Noise attenuation is also affected by humidity. Dry air absorbs more acoustical energy than moist air because dry air has a higher density than moist air at a given temperature. For noise modeling purposes, FHWA recommends the default values of 68 degrees Fahrenheit for the temperature and 50 percent humidity.

Roadway Geometry & Topographic Data and Ground Type

The roadway geometries and topographic data for the project were based on preliminary design plans provided by the design engineer (Kimley-Horn). Loose soil was used to approximate the ground type between the roadway and receptors.

Receptor and Receiver Locations

A "receptor" is a discrete or representative location of a noise sensitive area(s) for any of the land uses listed in Table 2. A "Receiver" is a location used in noise modeling to represent the measured and predicted noise level at a particular point. The noise-sensitive receptors are located in the backyard or common outdoor areas of use.

Traffic Volumes

Traffic volumes used in the noise model should represent a "worst-case" approach. In general, this should reflect Level of Service (LOS) C traffic conditions during the peak hour, with traffic moving at 5 miles per hour (mph) above the posted speed limit. Also, if the future traffic volumes are less than the maximum LOS C volumes, then the future traffic volumes will be utilized. If no other traffic information is available, the peak hourly volume should be 10 percent of the annual average weekday traffic (AWDT) volume. Traffic information was provided by Kimley-Horn in the "Pima Road Improvements, Pinnacle Peak Road to Happy Valley Road Traffic Impact Analysis" and supplemental data was provided by the Maricopa Association of Governments (MAG). The 2040 No-Build and Build Conditions were modeled with peak hourly volumes along Pima Road. These volumes are shown in Appendix C.

Vehicle Speed

The posted speed limit on Pima Road within the project limits is 50 miles per hour (mph). The No-Build and Build vehicle speeds were modeled along Pima Road for autos, medium trucks, and heavy trucks at 55 mph.

Vehicle Mix

The percentages of vehicles by type (vehicle mix) is an important input for the noise model, The percentages of vehicles by type (vehicle mix) is an important input for the noise model, because different vehicle types exhibit different base or reference noise emission levels, such as trucks that produce higher reference levels than cars, and larger trucks that produce higher reference levels than smaller trucks. Vehicle types are defined as follows:

- Cars (Auto): All vehicles with two axles and four wheels designed primarily for passenger transportation or cargo (light trucks). Generally, the gross vehicle weight is less than 10,000 pounds.
- Medium Trucks: All vehicles having two axles and six wheels designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 10,000 pounds but less than 26,400 pounds.
- Heavy Trucks: All vehicles having three or more axles and designed for the transportation of cargo. Generally, the gross weight is greater than 26,400 pounds.

This noise analysis focuses on automobile, medium truck, and heavy truck usage on the roadways. The vehicle mix used in this analysis is shown in Appendix C.

8.0 FUTURE NOISE ENVIRONMENT AND IMPACT DETERMINATION

Tables 4 shows the modeled No-Build and Build results of the predicted (2040) traffic noise levels, based on the TNM 2.5 input assumptions described in the preceding section. A total of 38 receivers were modeled to represent the residential homes west of Pima Road. The location of the modeled receivers are shown in Appendix A.

TABLE 4
Modeled Noise Level Results
Pima Road, Pinnacle Peak to Happy Valley

Receiver ID	NAC Category	No of Dwelling Units	2040 No-Build Unmitigated (dBA)	2040 Build Unmitigated (dBA)
R1	B	1	61	63
R2	B	1	**65**	**67**
R3	B	1	63	**65**
R4	B	1	61	62
R5	B	1	60	62
R6	B	1	63	**65**
R7	B	1	**64**	**66**
R8	B	1	63	**64**
R9	B	1	**66**	**67**
R10	B	1	61	63
R11	B	1	63	**64**
R12	B	1	**66**	**68**
R13	B	1	**65**	**67**
R14	B	1	60	62
R15	B	1	63	**64**
R16	B	1	61	63
R17	B	1	**64**	**64**
R18	B	1	63	**65**
R19	B	1	**68**	**69**

TABLE 4
Modeled Noise Level Results
Pima Road, Pinnacle Peak to Happy Valley

Receiver ID	NAC Category	No of Dwelling Units	2040 No-Build Unmitigated (dBA)	2040 Build Unmitigated (dBA)
R20	B	1	63	**65**
R21	B	1	63	**65**
R22	B	1	**68**	**69**
R23	B	1	**66**	**67**
R24	B	1	**66**	**67**
R25	B	1	**64**	**66**
R26	B	1	**68**	**69**
R27	B	1	63	**65**
R28	B	1	**65**	**66**
R29	B	1	**64**	**66**
R30	B	1	**66**	**67**
R31	B	1	**64**	**66**
R32	B	1	**68**	**70**
R33	B	1	**65**	**67**
R34	B	1	**65**	**67**
R35	B	1	63	**65**
R36	B	1	**67**	**68**
R37	B	1	56	58
R38	B	1	61	62

Note: **Bolded** values are equal to or greater than COS RNAP noise impact threshold of 64 dBA for Category B land uses.

The modeled noise levels range from 56 to 68 dBA for the No-Build Condition and from 58 dBA to 69 dBA for the Build Condition. The modeled noise levels for the Build Condition are equal to or greater than the COS RNAP noise impact threshold of 64 dBA at 30 of the 38 Category B receivers. Therefore, mitigation evaluation is required for this project.

9.0 MITIGATION ANALYSIS

The COS RNAP provides the following guidelines for noise abatement analysis:

- Noise barriers should reduce noise levels by at least 5 decibels and the mitigated noise level should be below the threshold for abatement (64 dBA).
- Noise barriers may consist of walls, vegetation, or berms, or a combination of these. Noise mitigation alternatives to sound walls are preferred.
- The height for noise barriers will be as recommended in the noise study.
- The installation of noise barriers within scenic corridors and the Environmentally Sensitive Lands (ESL) or Foothills Overlay (F-O) zoning overlay districts may be subject to the approval of the Development Review Board and the City Council, as they may conflict with current City policies and practices.
- The City will not mitigate for isolated properties, such as one or two homes by themselves.
- The City will generally only mitigate the first floor of residences.
- Various non-noise considerations are also included in the feasibility and reasonableness evaluation, including vehicle safety, aesthetics, security, drainage, financial feasibility, and emergency vehicle access.

- The maximum recommended cost of abatement is $60,000 per benefited developed property. Benefited residential developed properties include all single-family dwellings (apartments, manufactured homes, condominiums, detached homes) whether occupied by the owner or a renter, which receive a 5 dBA noise reduction from proposed mitigation measures. For benefited properties such as parks, schools, hospitals, and churches, noise abatement will be considered on a case by case basis.

Mitigation was evaluated for the residential homes west of Pima Road. Table 10 shows the results of the noise level mitigation analysis.

TABLE 5
Noise Mitigation
Pima Road, Pinnacle Peak to Happy Valley

Receiver ID	No of Dwelling Units	2040 Build Unmitigated (dBA)	2040 Build Mitigated (dBA) at 12-foot Barrier Height	Insertion Loss (dBA)
R1	1	63	58	5
R2	1	**67**	61	6
R3	1	**65**	60	5
R4	1	62	57	5
R5	1	62	56	6
R6	1	**65**	59	6
R7	1	**66**	60	6
R8	1	**64**	58	6
R9	1	**67**	60	7
R10	1	63	57	6
R11	1	**64**	58	6
R12	1	**68**	61	7
R13	1	**67**	61	6
R14	1	62	57	5
R15	1	**64**	59	5
R16	1	63	57	6
R17	1	**64**	59	5
R18	1	**65**	59	6
R19	1	**69**	63	6
R20	1	**65**	60	5
R21	1	**65**	60	5
R22	1	**69**	63	6
R23	1	**67**	61	6
R24	1	**67**	61	6
R25	1	**66**	60	6
R26	1	**69**	61	8
R27	1	**65**	59	6
R28	1	**66**	61	5
R29	1	**66**	60	6
R30	1	**67**	61	6
R31	1	**66**	60	6
R32	1	**70**	63	7

TABLE 5 Noise Mitigation Pima Road, Pinnacle Peak to Happy Valley				
Receiver ID	**No of Dwelling Units**	**2040 Build Unmitigated (dBA)**	**2040 Build Mitigated (dBA) at 12-foot Barrier Height**	**Insertion Loss (dBA)**
R33	1	**67**	61	6
R34	1	**67**	61	6
R35	1	**65**	61	4
R36	1	**68**	63	5
R37	1	58	57	1
R38	1	62	59	3
Note: **Bolded** values are equal to or greater than COS RNAP noise impact threshold of 64 dBA for Category B land uses.				

Table 6 summarizes the evaluated noise barrier located west of Pima Road at the COS right-of-way.

TABLE 6 Noise Barrier Summary Pima Road, Pinnacle Peak to Happy Valley						
Noise Barrier Description	**Barrier Height Range, ft**	**Length, ft**	**Area, ft^2**	**Cost**	**Number of Benefited Receptors**	**Cost per Benefited Receptor**
Barrier 1A, 1B, and 1C (along R/W)	12	4,702	56,432	$1,975,120	35	$56,432
1. Mitigation cost is based on $35/ft^2 for new construction						

10.0 CONSTRUCTION NOISE

Construction noise is anticipated for roadway improvement projects and lasts for the duration of the construction. Construction activities are generally of a short-term nature. Depending on the nature of construction operations, the duration of the noise could last from seconds (e.g., a truck passing a customer) to months (e.g., constructing a bridge). Construction noise is also intermittent and depends on the type of operation, location, and function of the equipment and the equipment usage cycle. Table 7 shows the overall predicted maximum noise level (L_{max}) of the construction equipment at 50 feet for different phases of roadway construction.

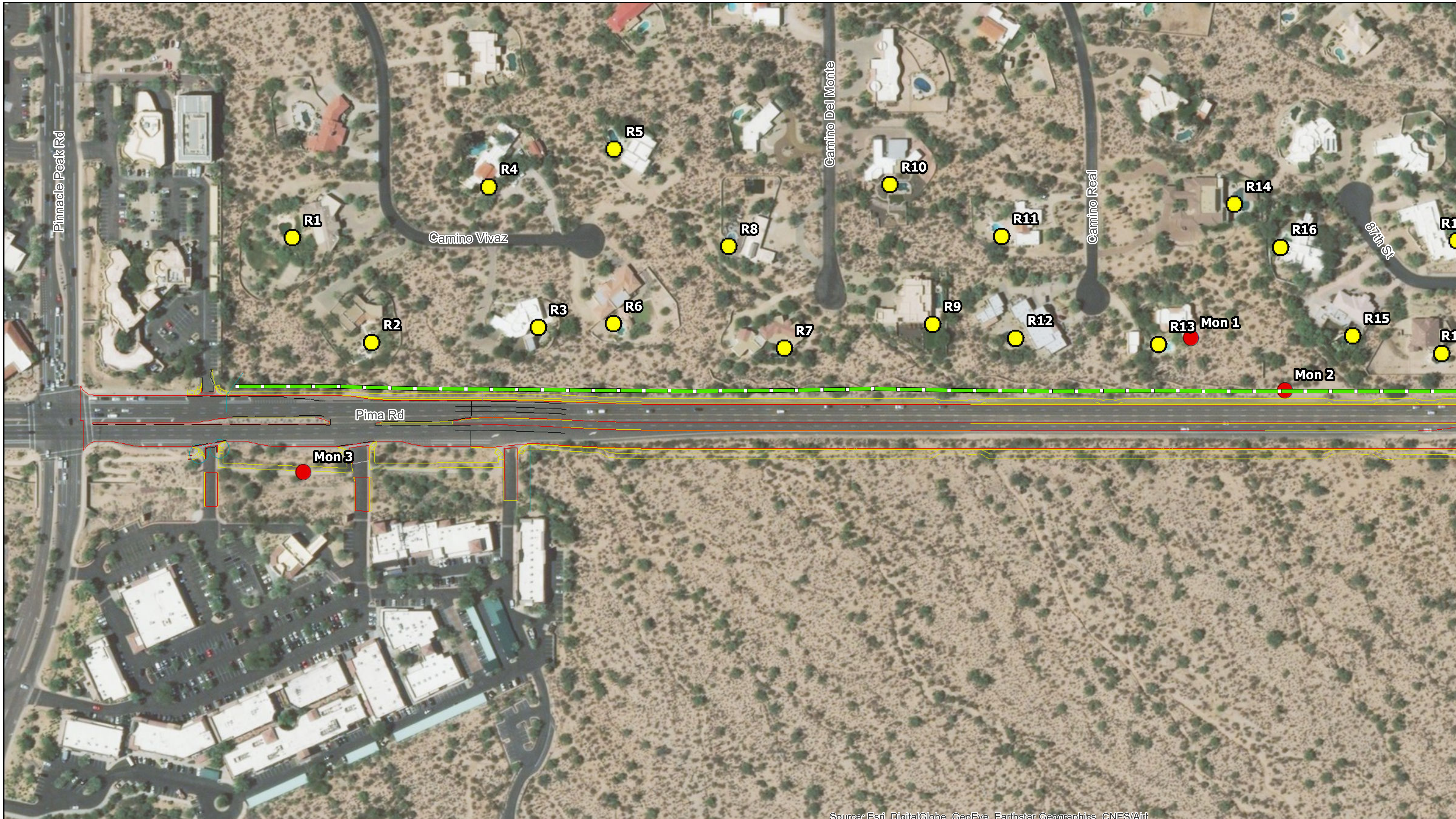
TABLE 7 CONSTRUCTION EQUIPMENT NOISE[1]		
Phase	**Equipment**	**Noise Limit (L_{max}) At 50 feet, dBA**
Site Clearing	Dozer	85
	Backhoe	80
Grading & Earthwork	Scraper	85
	Grader	85
Foundation	Backhoe	80
	Front Loader	80
Base Preparation	Compressor (air)	80
	Dozer	85
1. Source- FHWA Highway Construction Noise Handbook, page 3; August 2006		

Ground vibration and ground-born noise can also be a source of annoyance to individuals who live or work close to vibration-generating activities. Pile driving, demolition activity, blasting, and crack-and-seat operations are the primary sources of vibration, while the impact pile driving can be the most significant source of vibration at construction sites. It is recommended to apply methods that may be practical and appropriate in specific situations, to reduce vibration to an acceptable level.

11.0 STATEMENT OF LIKELIHOOD

The FHWA-approved noise model TNM2.5 was used to evaluate traffic noise for the 2040 No-Build and Build Conditions. Noise impacts occurred at 30 of the 38 modeled noise-sensitive receptors west of Pima Road from Pinnacle Peak Road to Happy Valley Road. The modeled 12-foot barrier shown in Table 6 shows the recommended noise barrier details. A final determination of noise abatement measures will be made upon completion of the project design, the public involvement process, concurrence with the COS RNAP, and City approval.

APPENDIX A – RECEIVER, MONITORING, AND BARRIER LOCATIONS



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Revised: 1/25/2019
SOURCE: World Imagery; Kimley Horn (2018)

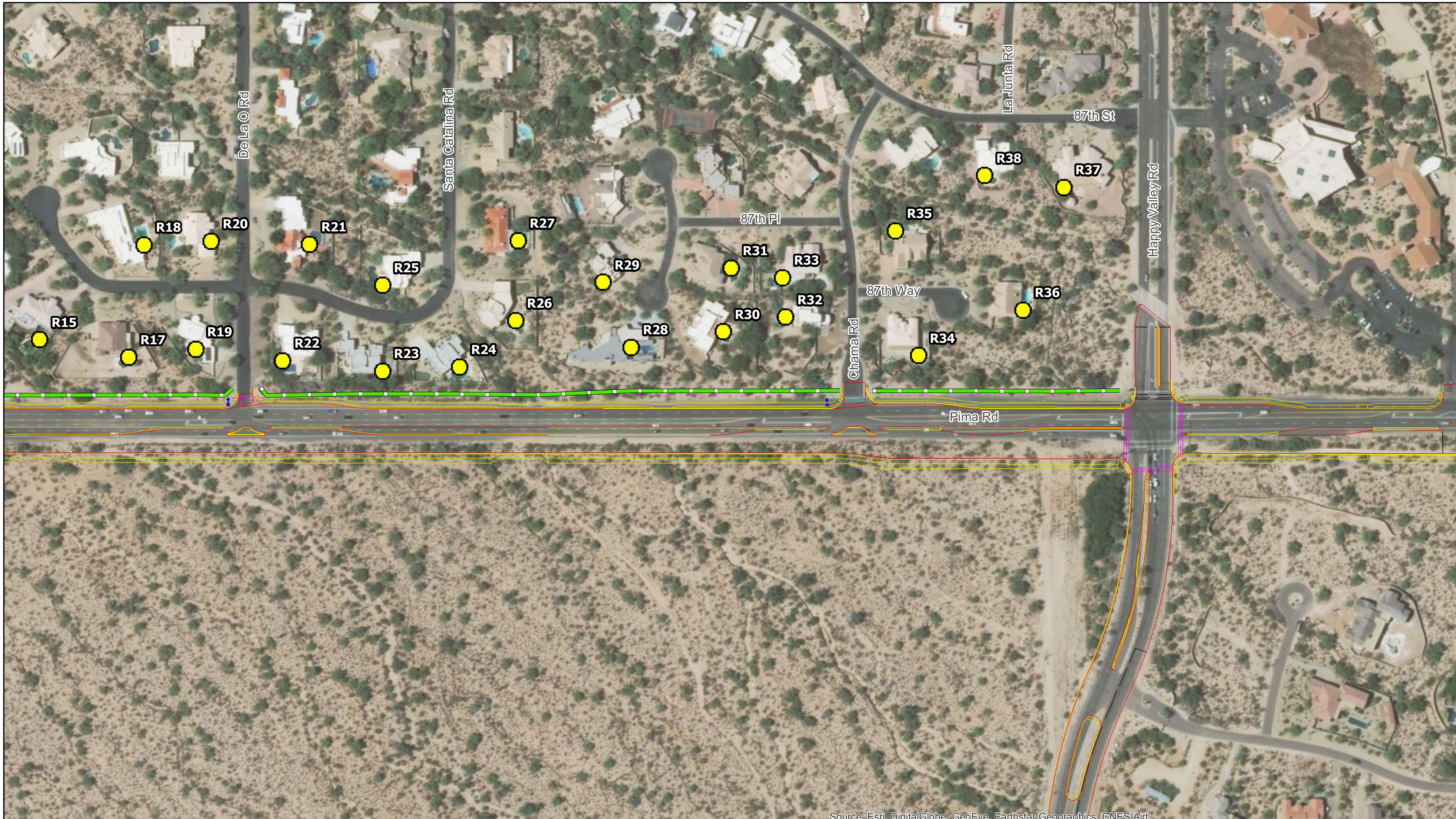
Legend

- Noise Receivers
- Monitoring Sites
- New Noise Barrier

newton Environmental Consulting, LLC

1 2
Map Index

PIMA ROAD, PINNACLE PEAK TO HAPPY VALLEY



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FEET

Revised: 1/25/2019
SOURCE: World Imagery; Kimley Horn (2018)

Legend

Noise Receivers | Monitoring Sites | New Noise Barrier

newton Environmental Consulting, LLC

Map Index: 1 | 2

PIMA ROAD, PINNACLE PEAK TO HAPPY VALLEY

APPENDIX B – NOISE MEASUREMENT DATA

Pima Road, Pinnacle Peak to Happy Valley - Noise Monitoring Data

Receiver 1 - 33° 42' 19.80" N - 111° 53'28.28" W

1	Date	Sky	Temp °F	Humidity %	Wind Speed/Dir	Project	Day Of Week	Staff	Meter	Batt Check	Calibraton	# Traffic Lanes	Receptor Above, Below Or Same Elevation As Roadway
	1/16/19	Partly Sunny	63	54%	SE 3 MPH	Pima Road, Pinnacle Peak to Happy Valley	Wednesday	AN	Larson Davis LXT	Yes	Yes	4	Below

Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
1	QE							2:32:00 PM	2:42:00 PM	0:10:00	59.4	45.2	68.3
1	VE												
2	QE							2:43:00 PM	2:53:00 PM	0:10:00	59.6	47.3	68.4
2	VE												
3	QE							2:54:00 PM	3:04:00 PM	0:10:00	59.3	44.1	68.0
3	VE												
	Total	0	0	0	0	0	0						

Receiver 2 - 33° 42' 21.84" N - 111° 53'26.92" W

2	Date	Sky	Temp °F	Humidity %	Wind Speed/Dir	Project	Day Of Week	Staff	Meter	Batt Check	Calibraton	# Traffic Lanes	Receptor Above, Below Or Same Elevation As Roadway
	1/16/19	Partly Sunny	64	53%	SE 2 MPH	Pima Road, Pinnacle Peak to Happy Valley	Wednesday	AN	Larson Davis LXT	Yes	Yes	4	Same

Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
1	QE	271	2	3	0	0	**276**	3:23:00 PM	3:33:00 PM	0:10:00	73.8	49.9	86.1
1	VE	224	10	14	0	0	**248**						
2	QE	201	1	8	0	0	**210**	3:35:00 PM	3:45:00 PM	0:10:00	74.0	50.8	88.4
2	VE	228	7	5	0	1	**241**						
3	QE	258	2	3	0	3	**266**	3:46:00 PM	3:56:00 PM	0:10:00	74.5	52.5	85.8
3	VE	221	7	4	0	1	**233**						
	Total	1403	29	37	0	5	1,474						

Traffic Counting Log

Receiver 3 - 33° 42' 00.55" N - 111° 53'24.80" W

3	Date	Sky	Temp °F	Humidity %	Wind Speed/Dir	Project	Day Of Week	Staff	Meter	Batt Check	Calibraton	# Traffic Lanes	Receptor Above, Below Or Same Elevation As Roadway
	1/16/19	Partly Sunny	64	54%	SE 3 MPH	Pima Road, Pinnacle Peak to Happy Valley	Wednesday	AN	Larson Davis LXT	Yes	Yes	4	Above

Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
1	QE	239	0	3	0	2	**244**	4:19:00 PM	4:29:00 PM	0:10:00	71.4	51.9	82.8
1	VE	204	4	10	0	0	**218**						
2	QE	332	0	0	0	2	**334**	4:30:00 PM	4:40:00 PM	0:10:00	72.1	51.5	88.1
2	VE	180	9	5	0	2	**196**						
3	QE	335	0	1	0	1	**337**	4:41:00 PM	4:51:00 PM	0:10:00	72.3	51.7	85.8
3	VE	172	7	4	0	1	**184**						
	Total	1462	20	23	0	8	1513						

APPENDIX C – TNM 2.5 TRAFFIC VOLUMES

Pima Road (Pinnacle Peak to Happy Valley) Traffic Volumes

SUMMARY OF RESULTS - BUILD (2040)				
	Peak Hour Volume	**Cars (98.1%)**	**Med (1.4%)**	**Heavy (0.5%)**
Northbound	3,549	3,482	50	18
	Peak Hour Volume	**Cars (98.6%)**	**Med (1.0%)**	**Heavy (0.4%)**
Southbound	2,883	2,843	29	12
SUMMARY OF RESULTS - NO BUILD (2040)				
	Peak Hour Volume	**Cars (98.0%)**	**Med (1.4%)**	**Heavy (0.6%)**
Northbound	2,290	2,244	33	13
	Peak Hour Volume	**Cars (98.0%)**	**Med (1.5%)**	**Heavy (0.5%)**
Southbound	2,253	2,207	33	13