Final
Noise Analysis Technical Report

US 60 (Grand Avenue)/35th Avenue/Indian School Road Traffic Intersection Improvements

Maricopa County, Arizona

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Ivan Racic
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June 2023

8/2/2023

Federal Aid No. 060-B(227)T

ADOT (TRACS) No. 060 MA 159 F0272 01L

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being, or have been, carried out by the Arizona Department of Transportation pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated April 16, 2019, and executed by the Federal Highway Administration and the Arizona Department of Transportation.

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Contents

Appendices

Figures

Tables

Acronyms and Abbreviations

ADOT ..... Arizona Department of Administration
AECOM ..... AECOM Technical Services, Inc.
CFR ..... Code of Federal Regulations
dB ..... decibel
dBA ..... A-weighted decibel
DCR ..... Design Concept Report
EA ..... Environmental Assessment
FHWA ..... Federal Highway Administration
Leq ..... Equivalent Sound Level
Lmax ..... Maximum Noise Level
LOS ..... Level of Service
Mph ..... miles per hour
NAC ..... Noise Abatement Criteria
NAR ..... Noise Abatement Requirements
Pa ..... Pascal
SLM ..... Sound Level Meter
TNM ..... Traffic Noise Model

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Executive Summary

The Arizona Department of Transportation (ADOT), in coordination with the City of Phoenix and Maricopa Association of Governments, has initiated an Environmental Assessment (EA) and Design Concept Report (DCR) for the US 60 (Grand Avenue), 35th Avenue, and Indian School Road Intersection. The study will evaluate potential transportation improvements at the intersection of US 60 (Grand Avenue), 35th Avenue, Indian School Road, and the BNSF railroad crossing to reduce traffic congestion, enhance safety, and improve pedestrian and bicycle facilities.

The Recommended Alternative would raise 35th Avenue and Indian School Road to create a new raised intersection over Grand Avenue and the BNSF railroad, eliminating the existing at-grade railroad crossings. The Recommended Alternative would result in changes to access for some properties along 35th Avenue closest to the intersection as a result of new elevated roadways and bridges. New connecting roadways would be needed to restore access to some of these properties.

This Noise Analysis Technical Report presents the peak hour traffic noise level analysis and results for the project. Short-term noise level monitoring was conducted within the project limits on January 19, 2023, to describe the existing noise environment. Four measurement locations were chosen to both validate the noise model and to represent noise sensitive receptors adjacent to residences near the project corridor. Noise monitoring helps describe the existing noise environment throughout the project area and capture the contribution of traffic noise from surrounding roadways. Three 10-minute interval equivalent noise level measurements (Leq) were conducted at each site.

ADOT considers mitigation for customers predicted to be impacted by highway traffic noise levels from ADOT's transportation improvement projects. The noise level impact determination used in this analysis is based on the ADOT Noise Abatement Requirements, dated May 2017. **Table 1** shows the summary of this noise analysis. Noise mitigation is not recommended.

Table 1. Summary of Noise Analysis

Parameters	2050 AM Peak No-Build	2050 PM Peak No-Build	2050 AM Peak Build Alternative	2050 PM Peak Build Alternative
Number of Modeled Receivers	58	58	58	58
Number of Representative Receptors	106	106	106	106
Range of Unmitigated Noise Levels, dBA	53 to 77	55 to 76	54 to 75	55 to 76
Number of Barriers Evaluated for Mitigation	N/A	N/A	5	5
Cost of Evaluated Mitigation [a]	N/A	N/A	$1,533,735	$1,533,735

[a] *Barrier cost is based on $35 per square foot.*

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1. INTRODUCTION

The Arizona Department of Transportation (ADOT), in coordination with the City of Phoenix and Maricopa Association of Governments (MAG), has initiated an Environmental Assessment (EA) and Design Concept Report (DCR) for the US 60 (Grand Avenue), 35th Avenue and Indian School Road Intersection. The study will evaluate potential transportation improvements at the intersection of Grand Avenue, 35th Avenue, Indian School Road and the BNSF railroad crossing to reduce traffic congestion, enhance safety and improve pedestrian and bicycle facilities.

The Recommended Build Alternative would raise 35th Avenue and Indian School Road to create a new raised intersection over Grand Avenue and the BNSF railroad, eliminating the existing at-grade railroad crossings. The Recommended Build Alternative would result in changes to access for some properties along 35th Avenue closest to the intersection as a result of new elevated roadways and bridges. New connecting roadways would be needed to restore access to some of these properties.

The Build Alternative consists of the following major elements:

- Removing the existing Indian School Road bridge structure over Grand Avenue and BNSF Railway
- Constructing new bridges for 35th Avenue and Indian School Road to pass over the railroad and Grand Avenue, shifting 35th Avenue to the west and Indian School Road to the north
- Along both Indian School Road and 35th Avenue:
  - Removing portions of the existing 35th Avenue and Indian School Road roadways
  - Constructing a new ramp connecting westbound Indian School Road and northwest-bound Grand Avenue, and a ramp connecting Grand Avenue to eastbound Indian School Road
  - Reconstructing intersecting public roadways and driveways along 35th Avenue and Indian School Road to match the new alignment and roadway elevation
  - Widening shoulders on 35th Avenue and Indian School Road to better accommodate bicycles
  - Reconstructing widened sidewalks along 35th Avenue and Indian School Road to maintain pedestrian connectivity
- Along 35th Avenue:
  - Realigning portions of Clarendon Avenue and reconstructing the 35th Avenue/Clarendon Avenue intersection to create a single, signalized intersection that serves areas located east and west of 35th Avenue by eliminating the offset intersections
- Along Grand Avenue:
  - Restriping Grand Avenue to improve traffic flow at new intersections
  - Adding turn lanes at 33rd Avenue to address re-routing of traffic between Grand Avenue and Indian School Road
- Extending Glenrosa Avenue to the west to connect 35th Avenue and Grand Avenue, creating a new intersection on Grand Avenue to restore all traffic movements between 35th Avenue and Grand Avenue
- Constructing a cul-de-sac on 37th Avenue north of US 60, eliminating the intersection of 37th Avenue and Grand Avenue, which has been identified by ADOT as a high crash location
- Relocating utilities, as needed

- Regrading two existing drainage detention basins where new roadway fill encroaches into the basin
- Constructing six new drainage detention basins to provide lost storage volume at the existing basins and capture increased onsite runoff
- Conducting the following the following field investigations prior to construction to inform detailed design:
  - Drilling geotechnical test drilling to inform design of new bridge structural elements
  - Excavating small potholes to locate utilities within the existing roadway

The Build Alternative would require new right-of-way from properties along both sides of 35th Avenue due to the new elevated roadway. Right-of-way acquisitions include both full and partial acquisitions, with an anticipated 27.65 over 27 acres acquired affecting approximately 74 parcels.

Temporary construction easements (TCEs) will be needed to match existing grade for driveway and sidewalk reconstruction. The specific location and dimension of TCEs will be determined during final design.

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

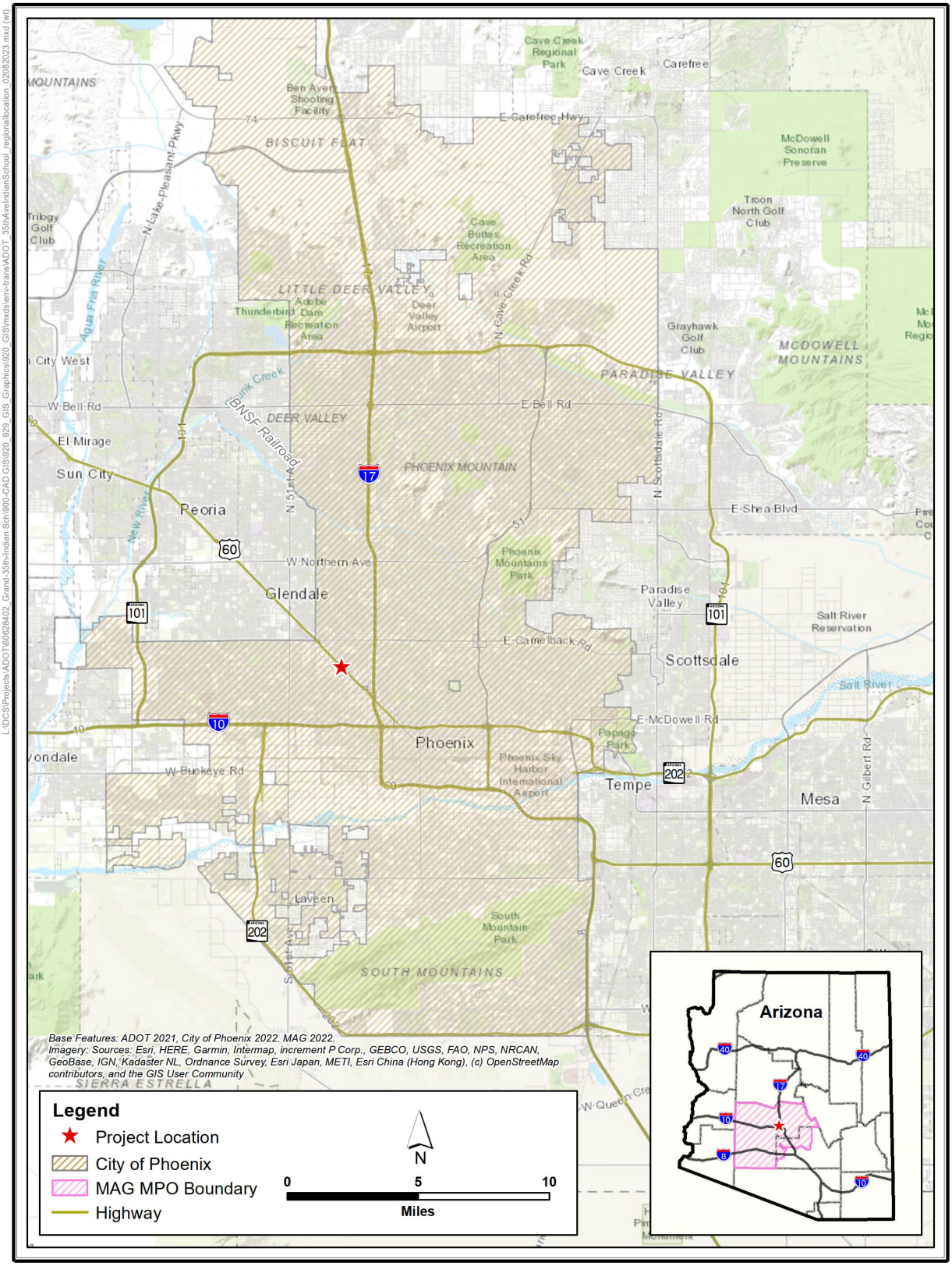


Figure 1. State Location Map

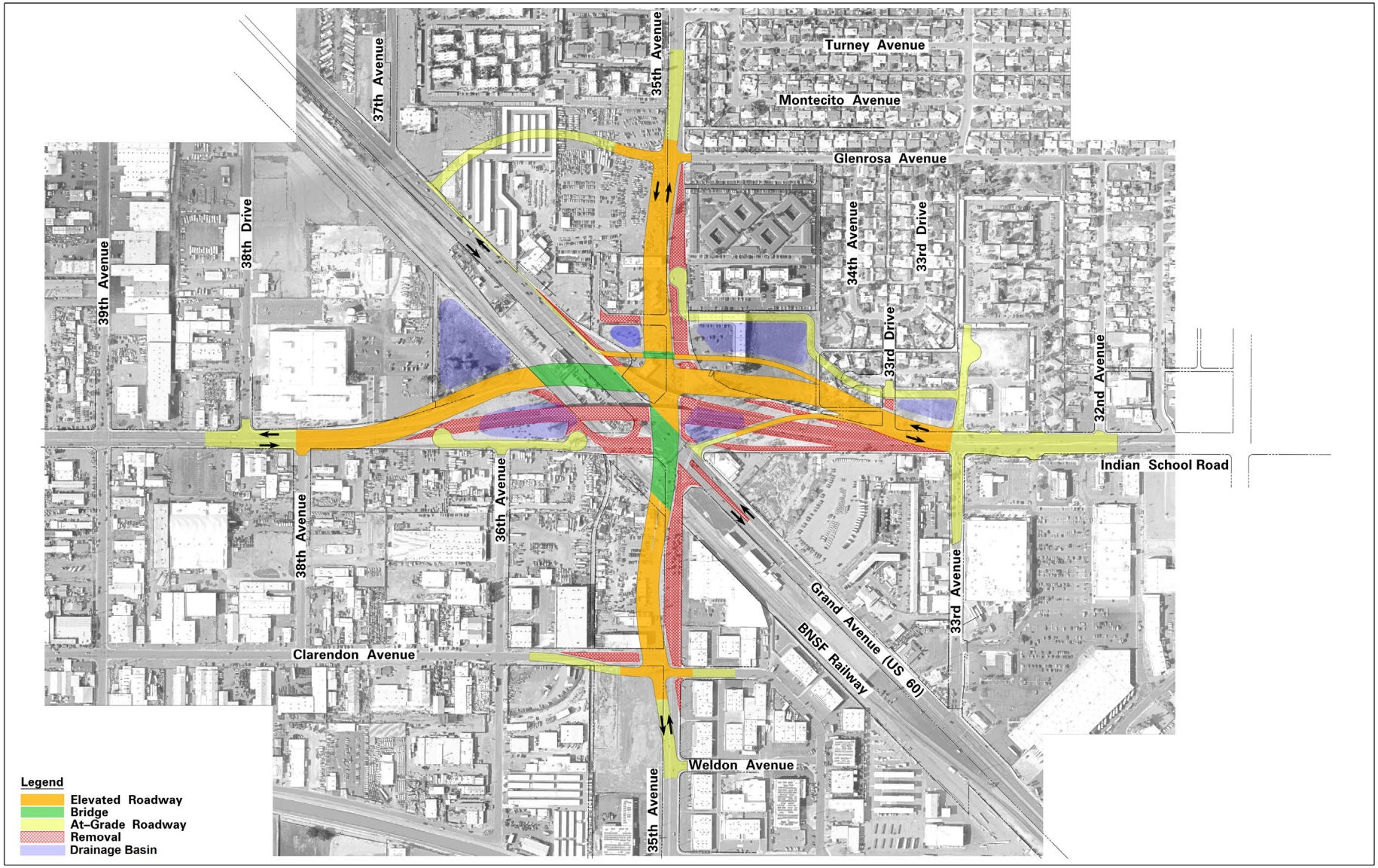


Figure 2. Project Location Map

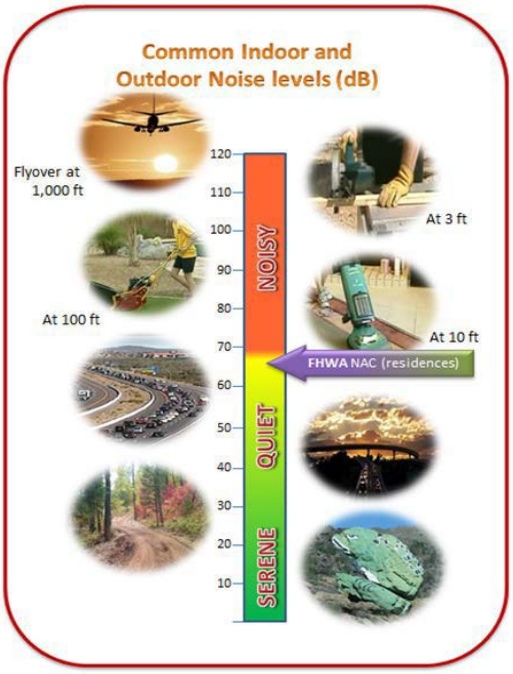
2. NOISE STUDY PROCEDURES

This noise study procedure, as specified by 23 Code of Federal Regulations (CFR) 772, follows 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 Recommended Alternative with the existing noise levels
5. Identify any noise impacts resulting from project construction activities
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. 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. It travels in air at a speed of approximately 1,087 feet per second at sea level and temperature of 32 degrees Fahrenheit (°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.



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

Noise is measured in Pascals (Pa). A healthy human ear can detect a pressure variation of 20 µPa, which is referred to as the threshold of hearing. A logarithmic scale is useful for reporting numbers over a wide scale, but for a smaller span, the decibel (dB) scale is used. Sound pressure level is calculated 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 lower response at low and 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 levels of less than 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.

3.2 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 (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 1-hour period and is the basis for noise criteria used by ADOT.

3.3 Traffic Noise Source, Receiver, Receptor, and Path

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.

As shown on **Figure 3**, the receptor is any location where people are affected by the traffic noise. It can be a residence, park, school, playground, or any other place where frequent human use occurs. An area between the source and the receptor (receiver represents a receptor(s) when modeled with the Federal Highway Administration [FHWA] Traffic Noise Model [TNM]) 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 3 dBA depending on the ground type.

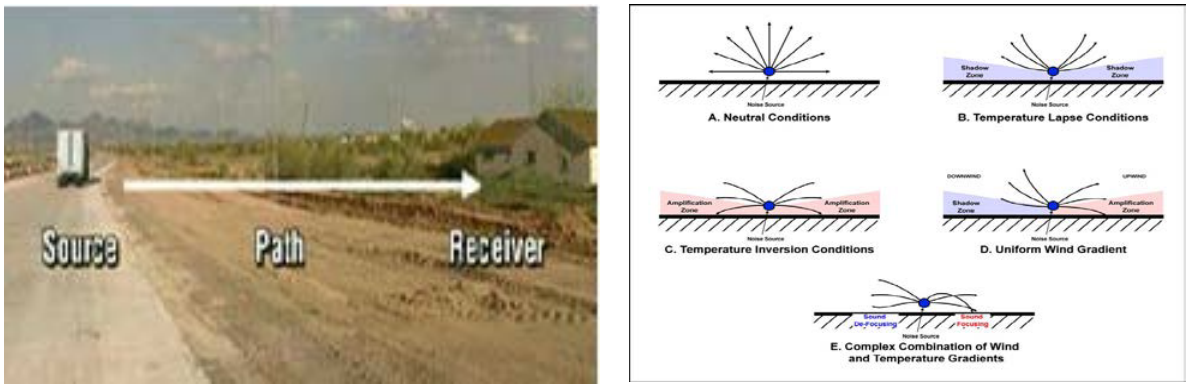


Figure 3. Source-Receiver Noise Path

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.

The ADOT Environmental Planning Noise webpage(https://azdot.gov/business/environmental-planning/noise) contains more information on noise.

4. NOISE ABATEMENT CRITERIA

The ADOT Noise Abatement Requirements (NAR) provide the guidelines used to assess the potential negative impacts from highway traffic noise levels and determine the need for noise abatement. The noise level impact methodology used for this analysis is based on the current ADOT NAR. FHWA has established Noise Abatement Criteria (NAC) and procedures to be used in the planning and design of highways (23 CFR 772). A summary of the NAC for various land uses is presented in **Table 2**.

The ADOT NAR is based on the noise levels approaching the FHWA NAC. ADOT defines "approaching" as within 1 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 ADOT NAR 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 66 dBA. ADOT also indicated that noise levels should be rounded to the nearest integer prior to impact determination and in project reports.

Table 2. FHWA Noise Abatement Criteria

Activity Category	dBA, LAeq1h [a]	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.

Sources: 23 CFR 772 Procedures for Abatement of Highway Traffic Noise and Construction Noise.

[a] The 1-hour equivalent loudness in A-weighted decibels, which is the logarithmic average of noise over a 1-hour period.

5. LAND USES WITHIN PROJECT AREA

The project area is comprised of Category B (residential), Category E (restaurants and offices), and Category F (retail facilities). This analysis focuses on representative noise sensitive receptors in Category B.

6. EXISTING NOISE ENVIRONMENT

Short-term noise level monitoring was conducted within the project limits on January 19, 2023, to describe the existing noise environment. As shown in Appendix A, two measurement locations were chosen to represent noise-sensitive receptors in residential areas.

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

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-PD-96-046, “Measurement of Highway Related Noise.”

The measured noise levels ranged from 59 dBA to 68 dBA. Appendix A shows the location of the noise level monitoring sites, and **Table 3** summarizes the noise level measurements. **Appendix B** shows the measured noise level data.

6.1 Model Validation

Model validation is a process for testing a model to ensure that it produces reliable results and to confirm that traffic noise is the predominant noise source at the receptor locations. In general, validation involves comparing actual noise measurements with the noise levels predicted by the model for existing conditions at the same location. The model is considered to be validated if the model results are within ±3 dBA of the arithmetic average of the three 10-minute interval field measurements recorded at the site for the same conditions. The monitoring site was modeled within ±3 dBA measured at sites Mon 2 and Mon 3. Therefore, the model is considered valid.

Table 3. Summary of Sound Level Measurements (January 19, 2023)

Site Number	Description	Modeled Validation Noise Levels (Leq), dBA	10-Minute Interval Measured Noise Levels (Leq), dBA			
			Interval 1	Interval 2	Interval 3	Arithmetic Average
MON 1	Tamarak Gardens Apartments – 4201 North 35th Avenue	--	67.1	59.4	61.3	62.6
MON 2	U.S. Vets – 3400 Grand Avenue	68.2	68.3	65.8	65.1	66.4
MON 3	Select Apartments – 3222 West Indian School Road	64.9	66.3	65.8	66.0	66.0
Mon 4	3341 West Monterosa Street	--	61.6	59.8	62.8	61.4

7. 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 variables, which include atmospheric conditions, roadway geometries, topographic data, ground types, noise receiver locations, traffic volumes, vehicle speed, and vehicle mix.

7.1 Atmospheric Conditions

Noise level is 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 high and low 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°F for the temperature and 50 percent humidity.

7.2 Roadway Geometry and 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 (AECOM Technical Services, Inc. [AECOM]). Loose soil was used to approximate the ground type between the roadway and receptors.

7.3 Receptor and Receiver Locations

The ADOT NAR defines a “receptor” as a discrete or representative location of a noise-sensitive area(s) for any of the land uses listed in **Table 2**. A “Receiver” is defined as 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.

7.4 Traffic Volumes

The ADOT NAR provides guidelines on the traffic volumes for use in the noise model, using a "worst-case" approach. The "worst-case" approach under ADOT guidelines include using Level of Service (LOS) C traffic volumes (that is, "free-flowing traffic) during the peak hour, with traffic moving at 5 miles per hour (mph) above the posted speed limit. If, however, the future traffic volumes are less than the LOS C volumes, then ADOT guidelines specify that that the lower future year traffic volumes be used in the model. If no other traffic information is available, then 10 percent of the annual average daily traffic volume are used in the noise model. The 2050 Build traffic volumes are shown in Appendix C. Traffic information for this project was obtained from *Initial Design Concept Report US 60, GRAND AVENUE 35th Avenue/Indian School Road Traffic Interchange.* April 2023.

7.5 Vehicle Speed

See Appendix C For the No-Build and Build Condition modeled speeds, which are 5 mph higher than the posted speed limit.

7.6 Vehicle Mix

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 with trucks that produce higher reference levels than cars, and large trucks that produce higher reference levels than small 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 all roadways. The vehicle mix used in this analysis is shown in Appendix C.

8. FUTURE NOISE ENVIRONMENT AND IMPACT DETERMINATION

Table 4 presents the results of the predicted traffic noise levels, based on the TNM 2.5 input assumptions described in the preceding section. A total of 58 receivers were modeled to represent 106 receptors throughout the project area. **Table 4** shows the No-Build (AM and PM peak) and Build (AM and PM peak) modeled noise levels.

Table 4. Modeled Noise Level Results

Receiver ID	NAC Category	Number of Dwelling Units	Description of Receiver	2050 AM Peak Hour No-Build (dBA)	2050 PM Peak Hour No-Build (dBA)	2050 AM Peak Hour Build (dBA)	2050 PM Peak Hour Build (dBA)
E1	F	1	Polaris Refrigeration. Inc	68	70	68	70
E2	F	1	Glowfly glass	68	70	67	69
E3	F	1	Themetech	71	72	66	67
E4	F	1	SuperPawn	76	76	74	75
E5	F	1	Pink & Blue	77	76	74	74
E6	E	1	El Sabroso Hot Dogs	**73**	**73**	**74**	**73**
E7	F	1	AT&T Store	72	72	75	74
E8	E	1	McDonald's	**72**	**72**	**74**	**74**
E9	E	1	Krispy Kreme	**73**	**73**	**75**	**75**
E10	E	1	Wingstop	**73**	**73**	**75**	**75**
E11	F	1	Isaac's Beer/Wine & Smoke Shop	72	73	74	74
E12/MON 3	B	1	Select Apartments, Monitoring site 3	**69**	**69**	**70**	**71**
E13	F	1	Advance Auto Parts	71	71	73	73
E14	F	1	Family Dollar	71	72	74	74
E15	B	7	Apartments	64	64	**68**	**69**
E15a	B	3	Single Family Home	58	58	62	63
E16	B	4	Apartments	59	60	64	65
E17	B	1	Single Family Home	60	61	65	65
E18	B	1	Single Family Home	57	58	63	64
E19	B	1	Single Family Home	60	60	65	**66**
E20	B	1	Single Family Home	59	59	64	64
E21	B	5	Tamarak Gardens Apartments	53	55	54	55
E22	B	5	The Franciscan Apartments	55	56	56	57
E23	B	4	The Franciscan Apartments	**70**	**73**	**68**	**70**
E24	B	5	The Franciscan Apartments	**70**	**73**	**69**	**71**

Receiver ID	NAC Category	Number of Dwelling Units	Description of Receiver	2050 AM Peak Hour No-Build (dBA)	2050 PM Peak Hour No-Build (dBA)	2050 AM Peak Hour Build (dBA)	2050 PM Peak Hour Build (dBA)
E25	B	1	Single Family Home	62	65	62	64
E26	B	1	Single Family Home	57	58	58	59
E27	B	1	Single Family Home	55	57	57	58
E28	B	1	Single Family Home	56	57	57	59
W1	F	1	Copper State Bolt & Nult Co	66	67	65	67
W2	F	1	HVAC Mirage	66	66	63	63
W3	F	1	Grand Ave Swapmeet Parking lot	68	69	64	65
W4	F	1	U-Haul Neighborhood Dealer	71	70	67	67
W5	F	1	U-Haul Neighborhood Dealer	68	68	66	66
W6	F	1	Elite RV Rentals	69	69	67	67
W7	F	1	Construction Guide LLC	69	69	68	68
W8	F	1	Arizona Auto Exchange LLC	74	73	72	71
W9	F	1	El Zafiro Banquet Hall	73	73	73	72
W10	F	1	Sunvalco Athletic	76	76	76	75
W11	E	1	Sushinola Roll	75	76	74	75
W12	E	1	Shasta Industries Corporate Headquarters	72	73	72	73
W13	F	1	C&K Trucking	67	66	66	66
W14	B	2	LampLighter Mobile Home Park	**74**	**75**	**75**	**76**
W15	B	2	LampLighter Mobile Home Park	**68**	**68**	**69**	**69**
W16	B	2	LampLighter Mobile Home Park	**68**	**69**	**69**	**70**
W17	B	2	LampLighter Mobile Home Park	**67**	**67**	**67**	**68**

Receiver ID	NAC Category	Number of Dwelling Units	Description of Receiver	2050 AM Peak Hour No-Build (dBA)	2050 PM Peak Hour No-Build (dBA)	2050 AM Peak Hour Build (dBA)	2050 PM Peak Hour Build (dBA)
W18	B	2	LampLighter Mobile Home Park	65	65	65	66
W19	B	2	Single Family Home	61	61	62	62
W20	B	2	Single Family Home	61	61	62	62
W21	B	2	The Resort on 35th	62	62	63	64
W22	B	2	The Resort on 35th	61	61	62	63
W23	B	2	The Resort on 35th	61	61	63	63
W24	B	2	The Resort on 35th	60	61	62	62
W25	B	2	The Resort on 35th	61	61	62	63
W26	B	4	FountainHead Apartments	62	63	63	64
W27	B	4	FountainHead Apartments	64	65	64	**66**
W28	B	3	Canyon 35 Apartments	**70**	**71**	**70**	**72**
W29	B	3	Canyon 35 Apartments	**70**	**71**	**69**	**71**

*Note: **Bolded** values are equal to or greater than ADOT NAR noise impact threshold of **66** dBA for Category B.*

The modeled noise levels range from 53 dBA to 77 dBA for the AM Peak Hour No-Build Condition and from 55 dBA to 76 dBA for the PM Peak Hour No-Build Condition. The AM Peak Hour Build Alternative noise levels range from 54 dBA to 76 dBA and 55 dBA to 76 dBA for the PM Peak Hour Build Alternative. The modeled noise levels for the Build Alternatives are equal to or greater than the ADOT NAR noise impact threshold of 66 dBA for Category B. Therefore, mitigation evaluation is required for this area. Appendix A shows the locations of the modeled noise receivers from **Table 4**.

9. MITIGATION ANALYSIS

The ADOT NAR provides guidelines for noise abatement analysis. These guidelines have two components, feasibility and reasonableness. The feasibility components consist of the engineering and acoustic features, which address safety, barrier height, topography, drainage, utilities, maintenance requirements, property access, and overall project purpose and encompasses the constructability of the noise abatement. To be acoustically feasible, the noise abatement must achieve at least a 5 dBA reduction at 50 percent of the impacted receptors.

Three factors must be met for a noise abatement action to be considered reasonable. The first factor is based on the viewpoints or preferences of the property owners and residents. The viewpoints of the property owners and residents shall be taken into account when determining whether the barrier should be constructed or not. The second is based on the noise reduction

design goal. The ADOT NAR states that the noise barrier should be designed to reduce the projected unmitigated noise levels by at least 7 dBA for 50 percent of the benefited receptors closest to the transportation facility. The third factor is based on the cost effectiveness of the noise abatement. The maximum reasonable cost of abatement is $49,000 per benefited receptor (cost-per-benefited-receptor) with barrier costs calculated at $35 per square foot, or $85 per square foot if constructed on a structure.

The ADOT NAR defines “benefited receptor” as the recipient of an abatement measure that receives a noise reduction of at least 5 dBA. This would allow a receptor that is not impacted to be considered a “benefited receptor” if it receives a noise reduction of at least 5 dBA from the noise abatement. The “benefited receptor” would be included in the determination of the cost of the noise abatement.

Lands and proposed residential developments permitted after the Date of Public Knowledge for this project will not be eligible for abatement (noise barriers). The Date of Public Knowledge is the date of approval of the National Environmental Policy Act document for this project, as defined in the ADOT NAR. Permitted is defined as a definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of a building permit.

Mitigation was evaluated north of Indian School Road. **Table 5** shows the results of the noise level mitigation analysis.

Table 5. Noise Mitigation Summary

Receiver ID	Number of Dwelling Units	AM Build 2050 (dBA)	AM Build Mitigated (dBA)	Insertion Loss (dBA)	PM Build 2050 (dBA)	PM Build Mitigated (dBA)	Insertion Loss (dBA)	Mitigation
E1	1	68	---	---	70	---	---	No noise threshold for Category F.
E2	1	67	---	---	69	---	---	No noise threshold for Category F.
E3	1	66	---	---	67	---	---	No noise threshold for Category F.
E4	1	74	---	---	75	---	---	No noise threshold for Category F.
E5	1	74	---	---	74	---	---	No noise threshold for Category F.
E6	1	**74**	---	---	**73**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.
E7	1	75	---	---	74	---	---	No noise threshold for Category F.
E8	1	**74**	---	---	**74**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.
E9	1	**75**	---	---	**75**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.
E10	1	**75**	---	---	**75**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.
E11	1	74	---	---	74	---	---	No noise threshold for Category F.
E12/Mon3	1	**70**	69	1	71	69	2	Barrier 1a and 1b are not recommended.
E13	1	**73**	---	---	74	---	---	No noise threshold for Category F.
E14	1	**73**	---	---	74	---	---	No noise threshold for Category F.
For Receivers E15 – E19, Barrier Evaluated at Residential Property Line								
E15	7	**68**	61	7	**69**	62	7	Barrier 2a and 2b evaluated adjacent to residents are not recommended.
E15a	3	62	57	5	63	58	5	Barrier 2a and 2b evaluated adjacent to residents are not recommended.

Receiver ID	Number of Dwelling Units	AM Build 2050 (dBA)	AM Build Mitigated (dBA)	Insertion Loss (dBA)	PM Build 2050 (dBA)	PM Build Mitigated (dBA)	Insertion Loss (dBA)	Mitigation
E16	4	64	61	3	65	62	3	Barrier 2a and 2b evaluated adjacent to residents are not recommended.
E17	1	65	62	3	65	63	2	Barrier 2a and 2b evaluated adjacent to residents are not recommended.
E18	1	63	61	2	64	62	2	Barrier 2a and 2b evaluated adjacent to residents are not recommended.
E19	1	65	61	4	66	62	4	Barrier 2a and 2b evaluated adjacent to residents are not recommended.
For Receivers E15 – E19, Barrier Evaluated at Indian School Road Edge of Pavement								
E15	7	**68**	63	5	**69**	64	5	Barrier 3 evaluated adjacent to Indian School Roadway edge is not recommended.
E15a	3	61	56	5	62	56	6	Barrier 3 evaluated adjacent to Indian School Roadway edge is not recommended.
E16	4	64	59	5	65	59	6	Barrier 3 evaluated adjacent to Indian School Roadway edge is not recommended.
E17	1	65	61	4	65	61	4	Barrier 3 evaluated adjacent to Indian School Roadway edge is not recommended.
E18	1	63	58	5	63	58	5	Barrier 3 evaluated adjacent to Indian School Roadway edge is not recommended.
E19	1	65	58	7	65	59	6	Barrier 3 evaluated adjacent to Indian School Roadway edge is not recommended.
E20	1	64	---	---	64	---	---	Noise levels less than Category B of 66 dBA.
E21	5	54	---	---	55	---	---	Noise levels less than Category B of 66 dBA.
E22	5	56	---	---	57	---	---	Noise levels less than Category B of 66 dBA.
E23	4	**68**	---	---	**70**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 45 dBA interior noise level, less than Category D threshold of 51 dBA.
E24	5	**69**	---	---	**71**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 45 dBA interior noise level, less than Category D threshold of 51 dBA.

Receiver ID	Number of Dwelling Units	AM Build 2050 (dBA)	AM Build Mitigated (dBA)	Insertion Loss (dBA)	PM Build 2050 (dBA)	PM Build Mitigated (dBA)	Insertion Loss (dBA)	Mitigation
E25	1	62	---	---	64	---	---	Noise levels less than Category B of 66 dBA.
E26	1	58	---	---	59	---	---	Noise levels less than Category B of 66 dBA.
E27	1	57	---	---	58	---	---	Noise levels less than Category B of 66 dBA.
E28	1	57	---	---	59	---	---	Noise levels less than Category B of 66 dBA.
W1	1	65	---	---	67	---	---	No noise threshold for Category F.
W2	1	63	---	---	63	---	---	No noise threshold for Category F.
W3	1	64	---	---	65	---	---	No noise threshold for Category F.
W4	1	67	---	---	67	---	---	No noise threshold for Category F.
W5	1	66	---	---	66	---	---	No noise threshold for Category F.
W6	1	67	---	---	67	---	---	No noise threshold for Category F.
W7	1	68	---	---	68	---	---	No noise threshold for Category F.
W8	1	72	---	---	71	---	---	No noise threshold for Category F.
W9	1	73	---	---	72	---	---	No noise threshold for Category F.
W10	1	76	---	---	75	---	---	No noise threshold for Category F.
W11	1	**74**	---	---	**75**	---	---	Due to access into the restaurant, barriers are infeasible.
W12	1	**72**	---	---	**73**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.
W13	1	66	---	---	66	---	---	No noise threshold for Category F.
W14	2	**75**	---	---	**76**	---	---	Due to access into the mobile home park, barriers are infeasible.
W15	2	**69**	---	---	**69**	---	---	Due to access into the mobile home park, barriers are infeasible.
W16	2	**69**	---	---	**70**	---	---	Due to access into the mobile home park, barriers are infeasible.
W17	2	**67**	---	---	**68**	---	---	Due to access into the mobile home park, barriers are infeasible.

Receiver ID	Number of Dwelling Units	AM Build 2050 (dBA)	AM Build Mitigated (dBA)	Insertion Loss (dBA)	PM Build 2050 (dBA)	PM Build Mitigated (dBA)	Insertion Loss (dBA)	Mitigation
W18	2	65	---	---	**66**	---	---	Due to access into the mobile home park, barriers are infeasible.
W19	2	62	---	---	62	---	---	Noise levels less than Category B of 66 dBA.
W20	2	62	---	---	62	---	---	Noise levels less than Category B of 66 dBA.
W21	2	63	---	---	64	---	---	Noise levels less than Category B of 66 dBA.
W22	2	62	---	---	63	---	---	Noise levels less than Category B of 66 dBA.
W23	2	63	---	---	63	---	---	Noise levels less than Category B of 66 dBA.
W24	2	62	---	---	62	---	---	Noise levels less than Category B of 66 dBA.
W25	2	62	---	---	63	---	---	Noise levels less than Category B of 66 dBA.
W26	4	63	---	---	64	---	---	Noise levels less than Category B of 66 dBA.
W27	4	64	---	---	66	---	---	Due to access into the apartments, barriers are infeasible.
W28	3	**70**	---	---	**72**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.
W29	3	**69**	---	---	**71**	---	---	No exterior frequent use area, use 25 dBA transmission reduction to get 49 dBA interior noise level, less than Category D threshold of 51 dBA.

*Note: **Bolded** values are equal to or greater than ADOT NAR noise impact threshold of 66 dBA.*

9.1 Summary of Evaluated Noise Barriers

The **Table 6** summarizes the evaluated noise barriers north of Indian School Road.

Table 6. Evaluated Noise Barrier Summary

Noise Barrier Description	Barrier Height Range, ft	Length, ft	Area, ft²	Cost	Number of Benefited Receptors	Meets Noise Reduction Design Goal	Cost per Benefited Receptor
Barrier 1a	20	88	1,769	$61,915	N/A	No	N/A
Barrier 1b	20	128	2,550	$89,250			
Barrier 2a	20	288	5,754	$201,390	10	Yes	$54,250
Barrier 2b	20	487	9,746	$341,110			
Barrier 3	20	1,200	24,002	$840,070	16	No	$52,504

Note: Barrier cost is based on $35 per square foot. Noise reduction design goal provides a 7 dBA reduction in noise to at least 50% of receptors closest to facility.

10. CONSTRUCTION NOISE AND VIBRATION

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 (Lmax) of the construction equipment at 50 feet for different phases of roadway construction.

Table 7. Construction Equipment Noise

Phase	Equipment	Noise Limit (Lmax) at 50 feet, dBA
Site Clearing	Dozer	85
	Concrete saw	90
	Chainsaw	85
	Excavator	85
Grading & Earthwork	Scraper	85
	Bobcat	85
	Grader	85
Foundation	Backhoe	80
	Front End Loader	80
	Crane	85
Base Preparation	Post Pounder	85
	Trucks (concrete, fuel, haul, water, bucket, dump)	85

Source- FHWA Highway Construction Noise Handbook; August 2006

ADOT has set forth guidelines for construction noise in the Standard Specifications for Road and Bridge Construction, 2008. Per ADOT specifications 104.08, Prevention of Air and Noise Pollution:

> "The contractor shall comply with all local sound control and noise rules, regulations and ordinances which apply to any work pursuant to the contract.
>
> Each internal combustion engine used for any purpose on the work or related to the work shall be equipped with a muffler or a type recommended by the manufacturer. No internal combustion engine shall be operated on the work without its muffler being in good working condition."

Ground vibration and ground-borne 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. COORDINATION WITH LOCAL OFFICIALS

The representatives of the City of Phoenix and MAG were involved in course of conducting the analysis. The analysis and the results will be included in the environmental assessment and presented to the public and the local officials with planning responsibility as a part of the public involvement process of the environmental analysis. Upon request of the local land use planning agency or local public agency, noise contour lines may be produced during the noise analysis process for project alternative screening and planning purposes only, as per ADOT NAR, Section 4, Point (e).

12. STATEMENT OF LIKELIHOOD

The FHWA-approved TNM2.5 was used to evaluate traffic noise for the 2050 No-Build and Build Alternatives for both AM and PM Peak Hours. Under the No Build Alternative, traffic noise levels would exceed ADOT's threshold for noise abatement consideration at 15 receivers; however, because the No Action condition would not result in construction of the proposed roadway, no traffic noise mitigation measures would be warranted.

Traffic noise levels would exceed ADOT's threshold for noise abatement consideration at 16 receiver locations (representing 37 receptors) for the AM Peak Hour Condition and at 17 receiver locations (representing 38 receptors) for the PM Peak Hour Condition. Five noise barriers were evaluated as mitigation, but none are recommended. Barriers 1a and 1b did not meet the acoustic feasibility criteria of achievement of at least a five dBA noise reduction at 50% of impacted Receptors. Barriers 2a, 2b, and 3 exceeded the maximum reasonable cost of abatement of $49,000 per benefited Receptor.

A final determination of noise abatement measures will be made upon completion of the project design, the public involvement process, and concurrence with the ADOT NAR.

13. REFERENCES

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ADOT. 2017. *Noise Abatement Requirements*. May 2017. https://azdot.gov/sites/default/files/2019/06/noise-abatement-requirements-may2017.pdf.

AECOM. 2023. *Initial Design Concept Report US 60, GRAND AVENUE 35th Avenue/Indian School Road Traffic Interchange*. April 2023.

FHWA. 1996. *Measurement of Highway Related Noise*. FHWA-PD-96-046. https://rosap.ntl.bts.gov/view/dot/8964.

FHWA. 2006. *FHWA Highway Construction Noise Handbook*. August 2006. https://rosap.ntl.bts.gov/view/dot/8837.

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Appendix A: Receiver, Monitoring, and Evaluated Barrier Locations

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Revised: 6/27/2023
SOURCE: Maricopa County Aerials 2022

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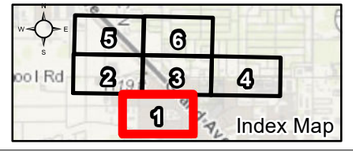
Noise Receivers | Monitoring Sites | Evaluted Barriers



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Environmental Consulting, LLC

US 60 (Grand Ave): 35th Ave/Indian School Rd

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Revised: 6/27/2023
SOURCE: Maricopa County Aerials 2022

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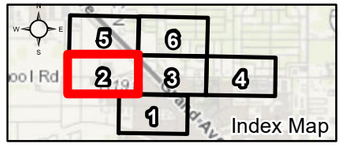
Noise Receivers Monitoring Sites Evaluted Barriers



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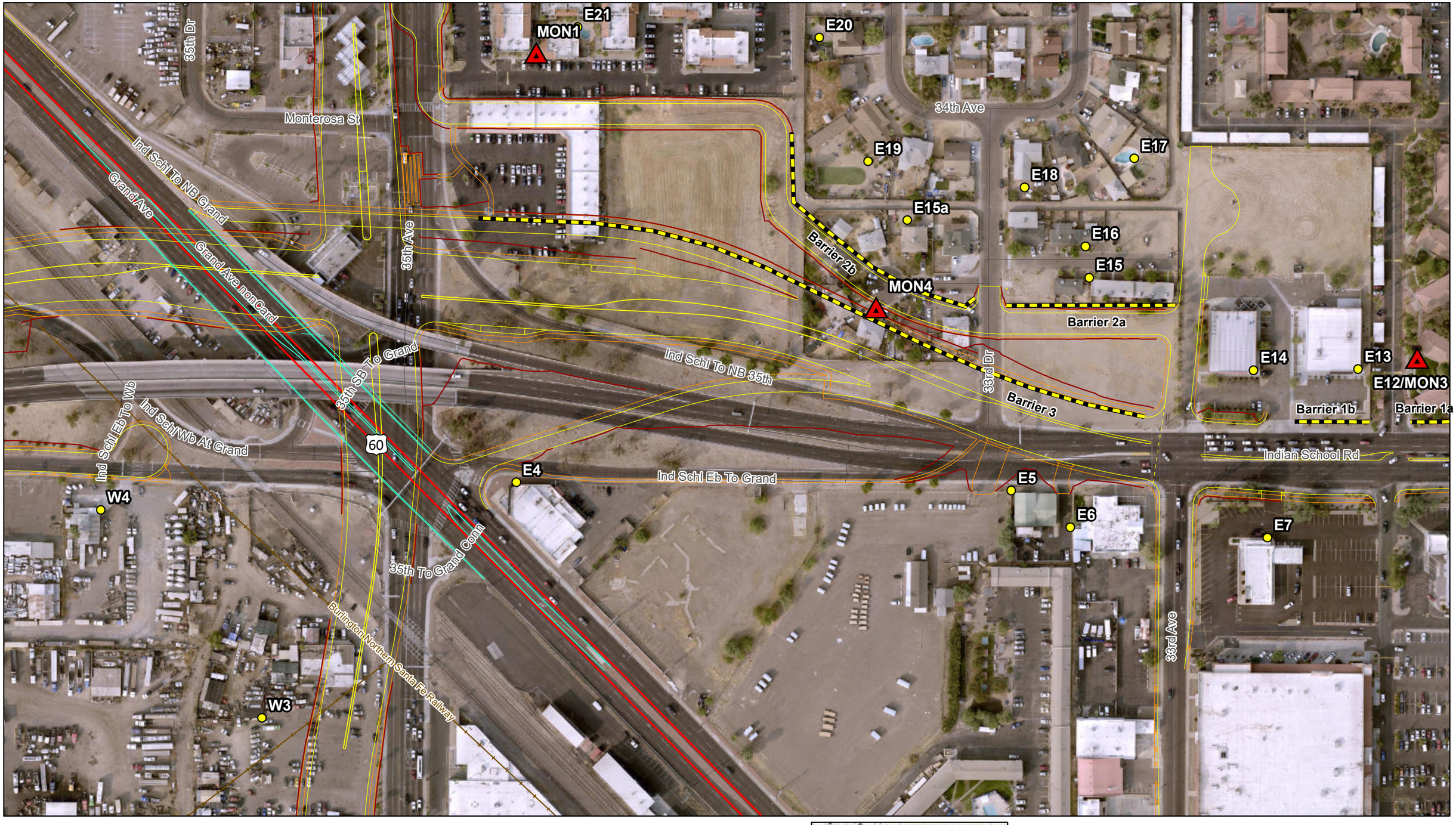
Environmental Consulting, LLC

US 60 (Grand Ave): 35th Ave/Indian School Rd



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SOURCE: Maricopa County Aerials 2022

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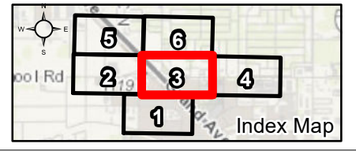
Noise Receivers | Monitoring Sites | Evaluted Barriers



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Environmental Consulting, LLC

US 60 (Grand Ave): 35th Ave/Indian School Rd

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Revised: 6/27/2023
SOURCE: Maricopa County Aerials 2022

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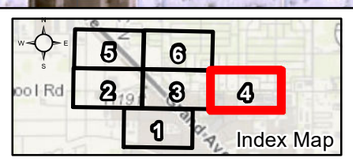
Noise Receivers | Monitoring Sites | Evaluted Barriers



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Environmental Consulting, LLC

US 60 (Grand Ave): 35th Ave/Indian School Rd

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Revised: 6/27/2023
SOURCE: Maricopa County Aerials 2022

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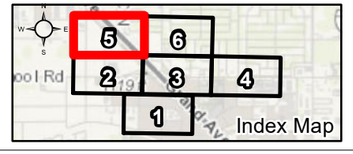
Noise Receivers | Monitoring Sites | Evaluted Barriers



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US 60 (Grand Ave): 35th Ave/Indian School Rd

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Revised: 6/27/2023
SOURCE: Maricopa County Aerials 2022

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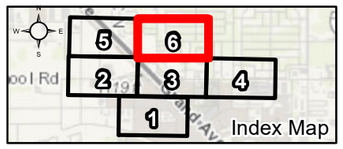
Noise Receivers | Monitoring Sites | Evaluted Barriers



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US 60 (Grand Ave): 35th Ave/Indian School Rd

Appendix B: Noise Measurement Data

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US 60 (Grand Ave): 35th Ave/Indian School TI - Noise Monitoring Data

1	Date	Sky	Temp °F	Humidity %	Wind Speed/Dir	Project	Day Of Week	Staff	Meter	Batt Check	Calibraton	# Traffic Lanes/Observed Speed	Receptor Above, Below Or Same Elevation As Roadway
	1/19/23	Sunny	60	32%	NE 3 Mph	US 60/35th Ave	Thursday	AN/EB	Larson Davis	Yes	Yes	5 / 40 mph	Same

Mon 1 33° 29'48.59"N - 112°08'00.76"W	Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
	1	NB						0	16:31:00	16:41:00	0:10:00	67.1	54.4	85.8
	1	SB						0						
	2	NB						0	16:42:00	16:52:00	0:10:00	59.4	52.5	72.5
	2	SB						0						
	3	NB						0	16:52:00	17:02:00	0:10:00	61.3	53.3	76.7
	3	SB						0						
	Total		0	0	0	0	0	0						

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
	1/26/23	Sunny	47	29%	S 8 Mph	US 60/35th Ave	Thursday	AN/EB	Larson Davis	Yes	Yes	6 / 45 mph	Same

Mon 2 33° 29'33.73"N - 112°07'51.49"W	Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
	1	EB	190	2	12	0	0	204	9:37:00	9:47:00	0:10:00	68.3	49.1	87.5
	1	WB	132	8	6	0	0	146						
	2	EB	169	9	8	0	1	187	9:50:00	10:00:00	0:10:00	65.8	48.7	75.5
	2	WB	120	8	7	0	0	135						
	3	EB	149	8	15	0	0	0	10:01:00	10:11:00	0:10:00	65.1	45.9	77.2
	3	WB	128	4	4	0	0	136						
	Total		888	39	52	0	1	980						

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
	1/19/23	Sunny	57	35%	NE 4 Mph	US 60/35th Ave	Thursday	AN/EB	Larson Davis	Yes	Yes	6 / 40 mph	Same

Mon 3 33° 29'43.48"N - 112°07'42.97"W	Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
	1	EB	255	3	2	0	0	260	17:23:00	17:33:00	0:10:00	66.3	52.3	79.4
	1	WB	241	1	9	0	0	251						
	2	EB	220	3	0	0	2	225	17:35:00	17:45:00	0:10:00	65.8	52.6	80.1
	2	WB	308	3	6	1	0	318						
	3	EB	156	3	1	1	0	161	17:46:00	17:56:00	0:10:00	66.0	52.1	76.5
	3	WB	328	4	7	1	0	340						
	Total		1508	17	25	3	2	1555						

4	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
	1/26/23	Sunny	38	42%	S 7 Mph	US 60/35th Ave	Thursday	AN/EB	Larson Davis	Yes	Yes	6 / 40 mph	Same

Mon 3 33° 29'44.31"N - 112°07'53.92"W	Sample	Axis	Autos	Medium Trucks	Heavy Trucks	Buses	Motorcycles	Total	Start Time	End Time	Duration	LaEQ	LaMin	LaMax
		EB						0	8:20:00	8:30:00	0:10:00	61.6	53.4	73.3
		WB						0						
		EB						0	8:31:00	8:41:00	0:10:00	59.8	51.7	72.5
		WB						0						
		EB						0	8:41:00	8:51:00	0:10:00	62.8	49.5	74.9
		WB						0						
	Total		0	0	0	0	0	0						

Appendix C: TNM 2.5 Traffic Volumes

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US 60 (Grand Ave)/35th Ave/Indian School TI
2050 Build AM Peak Hour TNM Traffic Volumes

Roadway Segment	Modeled Hourly Volume	Auto%	MT%	HT%	Buses
GrandAve_EB (South of Glenrosa Ave)	2,710	91	1	8	0
GrandAve_EB (North of Glenrosa Ave)	2,970	91	1	8	0
GrandAve_WB (South of Glenrosa Ave)	1,000	91	1	8	0
GrandAve_WB (North of Glenrosa Ave)	1,100	91	1	8	0
IndianSchoolRd_WB (East segment)	1,370	86	6	7	1
IndianSchoolRd_WB (West segment)	1,110	86	6	7	1
IndianSchoolRd_EB (East segment)	3,465	86	6	7	1
IndianSchoolRd_EB (West segment)	2,935	86	6	7	1
35th Ave_NB (North segment)	815	95	1	3	1
35th Ave_NB (South segment)	800	95	1	3	1
35th Ave_SB (North segment)	735	95	1	3	1
35th Ave_SB (South segment)	700	95	1	3	1
GrandAvetoIndianSchoolRdEB	255	95	4	1	0
IndianSchoolRdtoGrandAveWB	310	94	5	1	0
33th Ave NB (South segment)	470	92	6	2	0
33th Ave NB (North segment)	150	99	1	0	0
33th Ave SB (South segment)	850	92	6	2	0
33th Ave SB (North segment)	125	99	1	0	0
Connector_EB	205	92	6	2	0
Connector_WB	430	92	6	2	0

US 60 (Grand Ave)/35th Ave/Indian School TI
2050 Build PM Peak Hour TNM Traffic Volumes

Roadway Segment	Modeled Hourly Volume	Auto%	MT%	HT%	Buses
GrandAve_EB (South of Glenrosa Ave)	935	91	1	8	0
GrandAve_EB (North of Glenrosa Ave)	1,410	91	1	8	0
GrandAve_WB (South of Glenrosa Ave)	2,520	91	1	8	0
GrandAve_WB (North of Glenrosa Ave)	2,700	91	1	8	0
IndianSchoolRd_WB (East segment)	2,660	86	6	7	1
IndianSchoolRd_WB (West segment)	2,435	86	6	7	1
IndianSchoolRd_EB (East segment)	2,160	86	6	7	1
IndianSchoolRd_EB (West segment)	1,705	86	6	7	1
35h Ave_NB (North segment)	1,800	95	1	3	1
35h Ave_NB (South segment)	1,595	95	1	3	1
35h Ave_SB (North segment)	975	95	1	3	1
35h Ave_SB (South segment)	810	95	1	3	1
GrandAvetoIndianSchoolRdEB	270	95	4	1	0
IndianSchoolRdtoGrandAveWB	610	94	5	1	0
33th Ave NB (South segment)	1,210	92	6	2	0
33th Ave NB (North segment)	395	99	1	0	0
33th Ave SB (South segment)	495	92	6	2	0
33th Ave SB (North segment)	135	99	1	0	0
Connector_EB	325	92	6	2	0
Connector_WB	340	92	6	2	0

US 60 (Grand Ave)/35th Ave/Indian School TI
2050 No-Build AM Peak Hour TNM Traffic Volumes

Roadway Segment	Modeled Hourly Volume	Auto%	MT%	HT%	Buses
GrandAve_EB (North of 35th Ave)	2,855	91	1	8	0
GrandAve_EB (South of 35th Ave)	3,100	91	1	8	0
GrandAve_WB (North of 35th Ave)	750	91	1	8	0
GrandAve_WB (South of 35th Ave)	780	91	1	8	0
IndianSchoolRd_WB (East of 33rd Ave)	1,470	86	6	7	1
IndianSchoolRd_WB (West of 33rd Ave)	1,465	86	6	7	1
IndianSchoolRd_EB (East of 33rd Ave)	2,875	86	6	7	1
IndianSchoolRd_EB (West of 33rd Ave)	2,965	86	6	7	1
35h Ave_NB (North segment)	730	95	1	3	1
35h Ave_NB (South segment)	890	95	1	3	1
35h Ave_SB (North segment)	960	95	1	3	1
35h Ave_SB (South segment)	790	95	1	3	1
GrandAvetoIndianSchoolRdEB	465	95	4	1	0
GrandAvetoIndianSchoolRdWB	250	95	4	1	0
IndianSchoolRdtoGrandAveEB	320	94	5	1	0
IndianSchoolRdto35thAveNB	350	98	1	1	0
IndianSchoolRdEBtoWB	300	94	4	2	0
IndianSchoolRdtoGrandAve	420	96	3	1	0

US 60 (Grand Ave)/35th Ave/Indian School TI
2050 No-Build PM Peak Hour TNM Traffic Volumes

Roadway Segment	Modeled Hourly Volume	Auto%	MT%	HT%	Buses
GrandAve_EB (North of 35th Ave)	1,390	91	1	8	0
GrandAve_EB (South of 35th Ave)	1,100	91	1	8	0
GrandAve_WB (North of 35th Ave)	1,810	91	1	8	0
GrandAve_WB (South of 35th Ave)	2,150	91	1	8	0
IndianSchoolRd_WB (East of 33rd Ave)	2,635	86	6	7	1
IndianSchoolRd_WB (West of 33rd Ave)	3,040	86	6	7	1
IndianSchoolRd_EB (East of 33rd Ave)	2,100	86	6	7	1
IndianSchoolRd_EB (West of 33rd Ave)	1,855	86	6	7	1
35h Ave_NB (North segment)	1,620	95	1	3	1
35h Ave_NB (South segment)	1,560	95	1	3	1
35h Ave_SB (North segment)	940	95	1	3	1
35h Ave_SB (South segment)	890	95	1	3	1
GrandAvetoIndianSchoolRdEB	510	95	4	1	0
GrandAvetoIndianSchoolRdWB	540	95	4	1	0
IndianSchoolRdtoGrandAveEB	600	94	5	1	0
IndianSchoolRdto35thAveNB	400	98	1	1	0
IndianSchoolRdEBtoWB	300	94	4	2	0
IndianSchoolRdtoGrandAve	275	96	3	1	0

Appendix D: List of TNM Runs

- US60_Build_v4_AM - 2050 AM Peak Hour Build
- US60_Build_v4_PM - 2050 PM Peak Hour Build
- US60_NoBuild_v3_AM - 2050 AM Peak Hour No-Build
- US60_NoBuild_v3_PM - 2050 PM Peak Hour No-Build
- MON2 – Validation file for Monitoring Site #2
- MON3 – Validation file for Monitoring Site #3

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