Traffic Noise Technical Memorandum

Prepared for:	City of Henderson, Nevada	**Project Name:**	I-215 Beltway Widening Project – Pecos Road to Stephanie Street
Copy to:	Nevada Department of Transportation		
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Date:	June 2, 2023		

1. Introduction

The City of Henderson (City) proposes to widen the Interstate 215 Bruce Woodbury Beltway (I-215) from Pecos Road to Stephanie Street in the City of Henderson, Clark County, Nevada. This section of I-215 freeway is one of the primary east-west freeway corridors in the Las Vegas Valley and connects the City of Henderson to the rest of the Las Vegas Valley. The I-215 Beltway Widening Project (Project) involves widening of I-215, ramp reconstruction, and local road improvements to the interchanges with I-215 at Pecos Road/St. Rose Parkway and Green Valley Parkway. The Project would also reconstruct ramps at the Valle Verde Drive and Stephanie Street interchanges. Figure 1-1 shows the Project Location Map.

The Project is being completed with funding from Clark County. However, because I-215 is within Nevada Department of Transportation (NDOT) right-of-way, an NDOT encroachment permit is required to construct the improvements. The interstate system is under the jurisdiction of the Federal Highway Administration (FHWA), providing a federal nexus for preparation of an environmental document to comply with the National Environmental Policy Act of 1969 (NEPA). Thus, in compliance with NEPA, the City is preparing documentation to evaluate the potential environmental impacts of the Project. This technical memorandum presents potential impacts to traffic noise associated with the No Action Alternative and the Preferred Alternative and identifies those impacts and proposed mitigation.

2. Project Description

I-215 serves as an important connection between the City of Henderson and the surrounding Las Vegas metropolitan area. The Pecos Road/St. Rose Parkway and Green Valley Parkway interchanges with I-215 provide access to and from the residential and commercial developments at the west edge of the City. Clark County and the City have experienced significant population growth over the last decade. Between 2010 and 2020, Clark County's population grew by over 300,000 residents (an increase of about 20 percent) and the City's population grew by over 60,000 residents (an increase of about 25 percent) (U.S. Census Bureau 2010 and 2020). The regional population is projected to continue to grow.

This segment of I-215 currently experiences congestion due to existing roadway deficiencies and the regional population growth, which has increased current traffic volumes that exceed the roadway's capacity. In addition, existing roadway deficiencies result in increased travel time and contribute to accidents. By 2050, if no improvements are made on I-215 in the Project area, severe congestion with average speeds of less than 15 miles per hour is expected in both the morning and afternoon peak periods in some areas.

The proposed Project would widen I-215 from Pecos Road to Stephanie Street, improve interchanges and ramps, and construct a pedestrian bridge over Green Valley Parkway near Village Walk Drive. The purpose of the Project is to eliminate existing roadway deficiencies and provide transportation improvements to serve existing and future traffic demand.

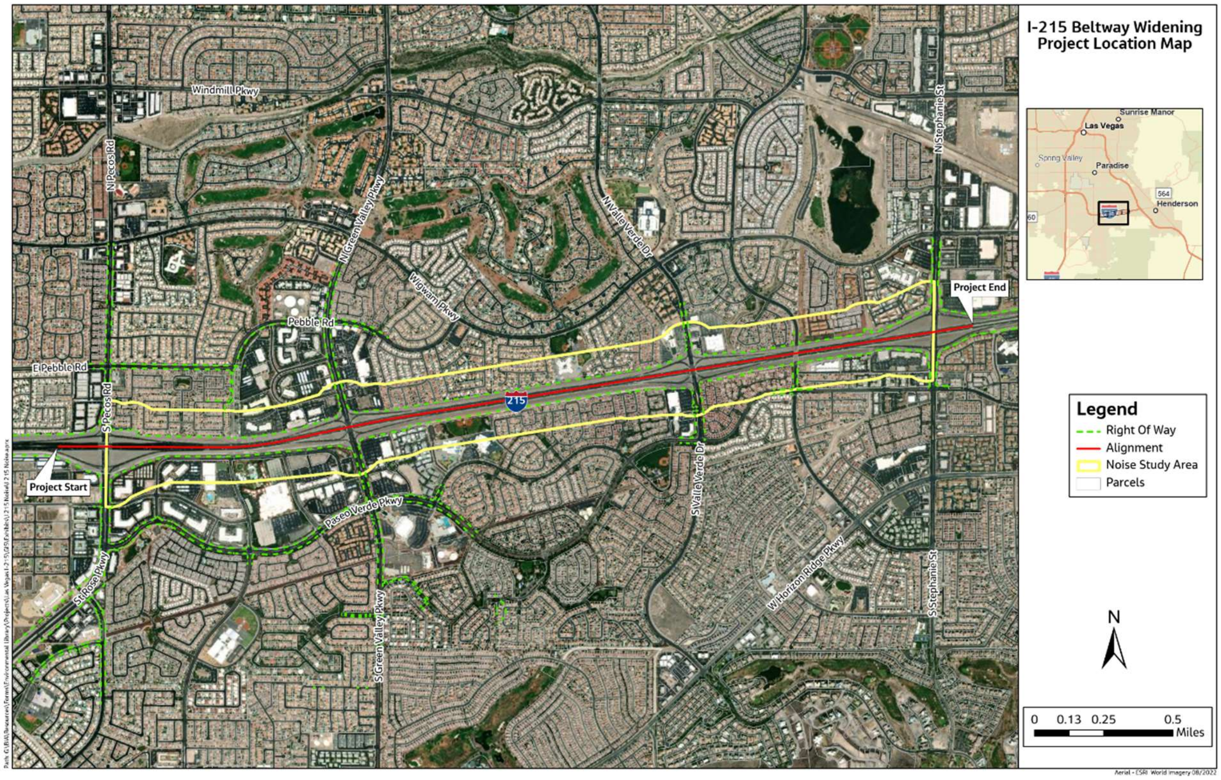


Figure 1-1. Project Location Map

3. Alternatives Evaluated

Two alternatives were evaluated for impacts, the No Action Alternative, and the Preferred Alternative, described in Sections 3.1 and 3.2, respectively.

3.1 No Action Alternative Description

Under the No Action Alternative, none of the improvements included under the Preferred Alternative would be implemented. Only routine maintenance would be performed on I-215. Other planned transportation improvement projects in the area could still move forward. While this alternative would not fulfill the Project’s purpose and need, it is included in the analysis as a baseline for comparison.

3.2 Preferred Alternative Description

The Preferred Alternative would widen I-215 with two additional through lanes in each direction (initially four lanes and at ultimate buildout, five lanes in each direction for a total of ten lanes) and an auxiliary lane between each interchange on I-215 from Pecos Road to Stephanie Street. This configuration is consistent with the improvements identified as part of the Henderson (I-11/I-515/I-215) Interchange project located adjacent to the east limit of this study. See Attachment A for a map of the Preferred Alternative.

Other improvements are described as follows:

- Pecos Road/St. Rose Parkway Interchange
  - Eastbound I-215 exit ramp: Construct additional right-turn lane to St. Rose Parkway for a total of two right-turn lanes.

  - Eastbound I-215 entrance ramp: The movement from northbound St. Rose Parkway to the entrance ramp will be free flow. This eastbound entrance ramp will have four receiving lanes: two from the northbound to eastbound movement and two from the southbound to eastbound movement Eventually, two of the four lanes will drop before merging onto the freeway as a two-lane ramp.
  - Westbound I-215 exit ramp: Widen to two lanes and construct additional left-turn lane, resulting in three left-turn lanes.
  - Along St. Rose Parkway extending to south of the St. Rose Parkway/Paseo Verde Parkway intersection: Extend the northbound outside lane to provide more capacity for vehicles turning right to the I-215 eastbound entrance ramp.
- Green Valley Parkway Interchange
  - Reconstruct interchange as a diverging diamond interchange. Does not require widening of the existing bridge.
  - Reconfigure all ramps to allow for the diverging diamond interchange.
  - Construct one extra approach lane on each exit ramp for a total of two eastbound and two westbound lanes on- and off-ramps.
  - Construct a pedestrian bridge over Green Valley Parkway near Village Walk Drive to remove the east-west at-grade crosswalks (across Green Valley Parkway), enhancing safety for vulnerable road users and improving traffic operations.
- Valle Verde Drive interchange
  - Widen off-ramps from I-215 to two lanes.
- Stephanie Street interchange
  - Widen westbound entrance ramp and eastbound exit ramps to two lanes.

Additionally, the Preferred Alternative would:

- Reconstruct bike trails affected by the Project.
- Reconstruct storm drainage facilities, such as storm drain inlets and pipes.
- Existing noise barriers removed for construction of the preferred alternative will be reconstructed based on barrier analysis results for mitigation of impacted receivers. Remaining existing noise barriers were evaluated and will continue to meet minimum noise reduction standards.
- Construct other ancillary roadway improvements to improve the safety for users of I-215 such as outside shoulders, barrier rails, and retaining walls, as well as pavement markings.
- Install traffic control devices and modify bridge underdeck and ramp lighting.
- Not require the relocation of any homes or businesses.

4. Regulatory Context

The criteria used in this technical memorandum to evaluate traffic noise impacts were derived from the following regulatory sources:

- Federal Highway Administration (FHWA) highway traffic noise standard codified in Title 23 of the *Code of Federal Regulations* (CFR), Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise
- *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA 2011)

- *Traffic and Construction Noise Analysis and Abatement Policy* (NDOT 2022)

The traffic noise analysis documented in this memorandum evaluates existing noise levels and the change in traffic noise that would result from the Preferred Alternative. To comply with 23 CFR 772, FHWA must make every feasible and reasonable effort to provide substantial noise reduction when highway traffic noise impacts occur. Compliance with the regulation is required before FHWA grants federal-aid highway funds for the construction or reconstruction of a highway.

According to 23 CFR 772.3, all highway projects that are developed in conformance with this regulation are deemed to be in conformance with the FHWA traffic noise standard. NDOT's traffic noise policy is consistent with 23 CFR 772 and FHWA guidance. FHWA has approved the NDOT traffic noise policy for use on federal-aid projects in Nevada. In addition, to determine traffic noise impacts under NEPA, an analysis of the No Action Alternative was performed to compare existing and future traffic noise levels.

5. Methods

The highway traffic noise analysis comprised the following tasks:

- Identify noise-sensitive areas and associated receptors (discrete or representative locations in a noise study area [NSA] for the land uses listed in 23 CFR 772) within 500 feet of the Project.
- Determine existing traffic noise levels at selected receptors to characterize the existing noise environment in the NSA.
- Determine future traffic noise levels with and without the Project at the receptors.
- Determine impacted receptors.
- Evaluate highway traffic noise abatement for impacted areas.
- Discuss construction noise.

5.1 Fundamentals of Traffic Noise

Sound from highway traffic is generated primarily from a vehicle's tires, engine, and exhaust. It is commonly measured in decibels.

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as A-weighted decibels (dBA). On the dBA scale, changes in noise levels are perceived as follows:

- A 3-dBA change is barely perceptible.
- A 5-dBA change is readily perceptible.
- A 10-dBA change is perceived as a doubling or halving of noise.

Because traffic sound levels are never constant due to the changing number, type, and speed of vehicles, time of day, and duration, a single value is used to represent the average or equivalent sound level and is expressed as L_{eq}.

5.2 Criteria for Increases in Noise Levels

FHWA has established noise abatement criteria (NAC) for various land use activity areas that are employed to determine when a traffic noise impact will occur (Table 5-1). FHWA guidelines state that traffic noise abatement must be considered when a noise impact occurs at an activity category. A traffic noise abatement measure (TNAM) is any positive action taken to reduce the impact of traffic noise, such as construction of a berm or noise barrier.

Table 5-1. Noise Abatement Criteria

Activity Category	Activity Criterion[a] L_{eq}(h) (dBA)	Evaluation Location	Activity Description
A	57	Exterior	Lands 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[b]	67	Exterior	Residential
C[b]	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare 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, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[b]	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in Categories A through D or F
F	Not applicable	Not applicable	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	Not applicable	Not applicable	Undeveloped lands that are not permitted for development

Source: NDOT 2022.

[a] The L_{eq}(h) activity criteria values are for impact determination only and are not design standards for noise abatement measures.

[b] Includes undeveloped lands permitted for development for this activity category.

A noise impact would occur when either the absolute or relative criterion is met:

- Absolute Criterion: The predicted future traffic noise level at a receiver approach or exceeds the established NAC for a given activity category. NDOT defines "approach" as 1 dBA below the NAC. For example, a noise impact would occur at a Category B residence if the noise level was predicted to be 66 dBA or above (rounded).
- Relative Criterion: The predicted noise level "substantially exceeds" existing noise levels at a receiver, even though the predicted noise level does not approach, equal, or exceed the NAC. NDOT defines "substantially exceeds" as when future noise levels at a receiver exceed existing noise levels by at least 12 dBA (rounded). For example, a noise impact would occur at a Category B residence if the existing level were 52 dBA and the predicted level is 64 dBA.

Most of the sensitive receptors associated with the Project are Category B or C activities. Section 5.4, Assumptions and Limitations, provides more detail on the methods.

5.3 Noise-Sensitive Land Uses

Vehicular traffic on I-215 is the dominant source of highway traffic noise in the Project study area. The land uses adjacent to the Project are primarily residential (Activity Category B), playground (Activity Category C), and commercial use (Activity Category E). The Noise Map in Attachment A shows the locations of the representative receivers.

Noise-sensitive land uses are on both sides of I-215. The noise-sensitive land uses within 500 feet of the Project were organized into NSAs, within which a noise modeling point (receiver) was placed to represent all the dwellings/uses within the NSA. The Project has a total of 116 NSAs, or receivers (Attachment A). The receivers are also listed in Attachment B, Results of the Traffic Noise Analysis.

For noise-sensitive land uses that are not residences, equivalent dwelling units (EQUs) were calculated. EQUs apply to parks, playgrounds, and other similar outdoor areas. For parks, the number of EQUs was calculated based on the average lot size in the NSA (7,000 square feet). Thus, a 14,000-square-foot park would represent 2 EQUs. For example:

- Identify the representative lot size of residential development. The average residential lot size in the community adjacent to the park is 60 feet by 120 feet or 7,200 square feet.
- Next, determine the land area of the impacted portion of a park. Noise modeling predicts noise impacts from the Project to a distance of 350 feet from the right-of-way. The park has 1,000 feet of frontage. Therefore, the total impacted area of the park is 350,000 square feet. If there is unusable land area, such as wooded area that is not accessible to park users within the impacted portion of the park, consider subtracting that area.
- Finally, divide the 350,000 square feet of impacted land area by the typical lot size of 7,200 square feet for an equivalent number of receivers equal to 48.6. Rounding up, the park is representative of 49 equivalent benefited receptors for the reasonableness determination of traffic noise modeling.

Traffic noise levels were evaluated using FHWA's Traffic Noise Model (TNM) Version 2.5. TNM 2.5 is the latest analytical method developed for highway traffic noise prediction. The model is described in detail in the TNM User's Guide (FHWA 1998a) and Technical Manual (FHWA 1998b). TNM 2.5 uses reference energy mean emission levels for automobiles, medium trucks (two axles), and heavy trucks (three or more axles), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, terrain features, and the acoustical characteristics of the site.

TNM 2.5 was developed to predict hourly L_{eq} values for free-flowing and interrupted-flow traffic conditions and is considered to be accurate within ±3 decibels. TNM 2.5 enables the user to input terrain elevation lines to account for the shielding effects of natural terrain. Noise levels are determined under worst-case traffic noise conditions. Primary consideration is given to exterior areas of frequent human use, such as a patio, playground, or picnic area. Unless otherwise stated, all sound levels reported are energy-equivalent levels (L_{eq}) and measured in dBA.

For the traffic noise study, traffic noise levels calculated by TNM 2.5 were validated using onsite traffic-noise-level measurement data. Concurrent traffic counts were made at representative locations for 15 minutes to obtain an L_{eq} value. To model the roadways, receptor locations, and intervening topography within the Project study area, terrain information and roadway geometry data were obtained from the available Project design plans. The model validation is discussed in Section 6.1, Traffic Noise Validation – Measured Noise Levels and Model, and included in Attachment C, Validation Location Map.

Traffic data were used to assess existing and projected future noise exposure for each alternative design. Attachment D, Traffic Data, presents the vehicle traffic noise distribution percentages by roadway and used as input to the TNM. The speeds used in the analysis were posted speed limits. On the I-215, speed limits are 65 miles per hour (mph) on the freeway and up to 45 mph on the ramps.

5.4 Assumptions and Limitations

The following assumptions and limitations were used for the traffic noise analysis for this technical memorandum:

- The existing, No Action Alternative, and Preferred Alternative highway traffic-noise-level modeling used 2021 existing a.m./p.m. and 2050 a.m./p.m. peak traffic, respectively.

- Existing residential noise barriers, masonry walls, large buildings adjacent to the roadway, and other residential barrier walls, excluding wood fencing, were included in the models as barriers. All 6-foot and higher concrete traffic barriers were also included.
- Barrier analysis looked primarily at first-row receivers. Based on the distance to the impacted representative receivers, some of the barriers analyzed included second-row and additional receivers.
- NDOT and FHWA are not required to provide or fund a TNAM within the right-of-way for undeveloped land that is not permitted for development by the date of environmental clearance. In addition, third-party funding cannot be used.

Areas that have an existing TNAM will continue to have a noise barrier that provides an equal or greater acoustical benefit. Replacement traffic noise barriers that do not meet the existing acoustical benefit will be documented thoroughly and individually approved by NDOT.

6. Existing Conditions

This section describes the noise-sensitive land uses and existing traffic noise barriers in the NSA, provides the results of in situ noise monitoring, and the model validation.

6.1 Traffic Noise Validation – Measured Noise Levels and Model

For TNM validation purposes only, short-term noise-level measurements were taken at two locations within the project area to determine the existing noise levels and verify the accuracy of TNM in predicting noise levels. These sites are shown in Attachment C, Validation Location Map. Measurement equipment complied with the American National Standards Institute and the International Electrotechnical Commission for Type I (precision) sound-level equipment. The data collected in these short-term measurements were used for model validation.

Existing measured noise levels adjacent to the Project varied between 65.8 and 67.7 dBA for validation purposes only. The results of the in situ noise level measurements are summarized in the second column of Table 6-1.

Table 6-1. Results of Validation

Monitoring Location Site 1	Measured L_{eq} (dBA)	TNM-Predicted L_{eq} (dBA)	Difference (dBA)
Site 1	67.7	70.6	-2.9
Site 2	65.8	64.8	1.0

The TNM 2.5 input files for existing conditions were developed using the existing roadway geometry and surrounding terrain. Measured traffic noise levels, concurrent traffic counts, and observed vehicle speeds obtained during the noise monitoring effort were used to evaluate the accuracy of the TNM in estimating traffic noise exposure in the Project study area.

Table 6-1 shows the noise levels obtained during the traffic noise measurements and the levels predicted by the TNM. The NDOT *Traffic and Construction Noise Analysis and Abatement Policy* (2022) indicates that field-measured noise levels should be within ± 3 dBA of the predicted noise levels for TNM 2.5 to be considered validated. As shown in Table 6-1, all predictions were within 3 dBA of the measurements. Such differences show agreement between measured and predicted noise levels and indicate that TNM 2.5 may be used to accurately calculate highway traffic noise exposure along the corridor. The validation and noise measurements are included in Attachment C, Validation Location Map.

6.2 Existing Noise Levels

The existing configuration of I-215 was evaluated using onsite traffic-noise-level measurements and TNM 2.5. Existing noise levels (for the year 2021) were used as the baseline conditions for the noise impact assessment. A total of 116 receivers were modeled. The locations of these receivers are shown on the Noise Map in Attachment A.

Traffic noise levels approaching or exceeding the NAC were predicted by TNM to occur at four of the receivers under the existing conditions, which includes the existing traffic noise barriers. Those traffic noise impacts are shown in Attachment B, Results of the Traffic Noise Analysis.

7. Impact Assessment

This section discusses and predicts the traffic noise impacts associated with the proposed improvements.

7.1 Predicted Noise Levels – 2050

Future conditions were modeled for the design year 2050 using the roadway conditions and peak a.m./p.m. traffic volumes for the No Action Alternative and the Preferred Alternative. Many locations approach or exceed the NAC because of their proximity to I-215. Table 7-1 summarizes the modeled traffic noise results and Attachment B contains receiver results. The No Action Alternative and Preferred Alternative noise levels include existing noise barriers.

Table 7-1. Traffic Noise Impacts

Impact Category	No Action a.m.	No Action p.m.	Preferred a.m.	Preferred p.m.
Number of Receivers Modeled	116	116	116	116
Number of Impacted Receivers	4	4	10	10
Noise Levels	40 to 73 dBA	41 to 73 dBA	41 to 73 dBA	41 to 74 dBA
Change in Noise Levels from Existing	1 to 2 dBA	1 to 2 dBA	0 to 9 dBA	-1 to 9 dBA

7.2 Construction Noise

Construction noise would be temporary and intermittent, and the intensity would vary for different areas and the type of construction activity. The construction contractors would adhere to local construction noise ordinances. Mitigation measures for stationary and mobile equipment would be addressed in the construction specifications, as needed, and could address placement, hours of operation, noise level limits, or proper maintenance of equipment.

Noise from construction would add to the noise environment in the study area. The noise modeling receivers shown in Attachment A represent the land uses potentially impacted by construction noise.

As indicated in Table 7-2, construction would generate noise levels ranging from 77 to 110 dBA at a distance of 50 feet. Construction would be temporary and is expected to occur during normal daytime working hours. Construction noise could result in annoyance or sleep disruption if nighttime operations occur or if unusually noisy equipment is used.

Table 7-2. Construction Equipment Noise

Construction Phase	Loudest Equipment	Maximum Sound Level at 50 Feet (dBA)
Paving	Paver, truck	77 dBA
Foundation	Backhoe, loader	79 dBA
Base Preparation	Truck, bulldozer	82 dBA
Clearing and Grubbing	Bulldozer, backhoe	82 dBA
Earthwork	Scraper, bulldozer	84 dBA
Pile Driving	Pile driver	110 dBA

Source: FHWA 2006.

Noise would also be generated during construction by increased truck traffic on some local streets associated with transport of heavy materials and equipment. This noise increase would be of short duration.

Although construction noise impacts would be temporary, the following standard measures are recommended to minimize such impacts:

- Whenever possible, limit operation of heavy equipment and other noisy procedures to the daylight hours.
- Install and maintain effective mufflers on equipment.
- Locate equipment and vehicle staging areas as far from residential areas as possible.
- Limit unnecessary idling of equipment.
- Replace backup beepers with lights.

8. Mitigation Measures

Traffic noise abatement measures were examined for the areas experiencing a traffic noise impact as described in Section 6.3, Predicted Noise Levels – 2050. Constructing noise barriers within the proposed right-of-way is the most practical, reasonable, and effective method of noise mitigation for the Project. A barrier must be both feasible and reasonable to be recommended for further consideration.

8.1 Existing Traffic Noise Barriers

Traffic noise barriers currently exist throughout much of the NSA along I-215. The construction of the Preferred Alternative would result in the removal of some existing traffic noise barriers. The Project team committed to replace traffic noise barriers wherever they currently exist and have the replacement barrier be at least as acoustically beneficial. Replacement traffic noise barriers that cannot meet the existing acoustical benefit will be documented thoroughly and individually approved by NDOT.

Traffic noise barriers will be designed to strive to achieve NDOT’s current noise-reduction design goal (7 dBA), as well as its reasonability and feasibility guidance. NDOT will consider the noise-reduction benefits of the existing barriers in the design of the noise barriers. Traffic noise barriers were also evaluated in this study wherever there were traffic noise impacts, regardless of existing conditions. The map in Attachment A shows the locations of existing noise barriers.

8.2 Barrier Analysis – Feasibility and Reasonableness

A feasibility barrier analysis will be conducted for the receptors that would experience a traffic noise impact. NDOT defines acoustical feasibility as:

> At least a 5 dBA reduction for 50% of the first, or front, row of impacted receptors. This is the minimum requirement and does not preclude achieving the higher noise reduction design goal set in the reasonableness section below. The noise-reduction design goal shall be achieved, to the maximum number of benefited receptors, if criteria can be satisfied (NDOT 2022, page 7).

The traffic noise barriers that meet the feasibility standard will be evaluated for reasonableness. Criteria NDOT use to define reasonableness include (NDOT 2022, pages 8 through 10):

- **The cost-effectiveness of the noise barrier**: A maximum construction cost of $56,000 (2022 U.S. dollars [USD]) is allotted per benefited receptor (i.e., dwelling or EQU) that satisfies NDOT policy criteria (NDOT 2022). A cost of $40 per square foot (2022 USD) of precast concrete noise barrier was used in the cost calculation (NDOT 2022, page 8).
- **The achievement of the noise-reduction design goal:** NDOT has defined the traffic noise-reduction design goal as 7 dBA: "This is a minimum goal, and this goal will be achieved for as many receivers as possible. However, not achieving a higher target goal will not invalidate the process, nor the improved abatement results. The greatest noise reduction possible shall be given to the maximum number of receivers possible while staying within reasonableness cost criteria" (NDOT 2022, page 8).
- **The points of view of the benefited property owners and residents:** Noise barriers will be constructed as modeled and designed for construction unless enough benefited receptors are opposed to their construction. The viewpoints of the benefited receptors will be accepted during the NEPA public involvement process through written comments or comments documented in the public record during a public meeting or hearing.

8.3 Results of Noise Barrier Analysis

Noise abatement measures were considered and analyzed for each impacted receptor location. Abatement measures, typically noise barriers, must provide a minimum noise reduction, or benefit, at or above the threshold of 5 dBA. A barrier is not acoustically feasible unless it reduces noise levels by at least 5 dBA at 50 percent of first-row impacted receptors. To be reasonable, the barrier must not exceed the cost reasonableness allowance of $56,000 per benefited receptor. In addition, an abatement measure may not be reasonable if the construction costs are unreasonably high due to site constraints, as determined through a barrier cost assessment.

A constructability assessment includes but is not limited to the design, build, utilities, existing noise barriers and land use surrounding a proposed barrier location. As a result of the Project's preliminary constructability assessment, some impacted receivers were eliminated from mitigation consideration.

Noise barriers would be feasible and reasonable for the following impacted receivers and therefore are proposed for incorporation into the proposed Project (Table 8-1). Refer to Attachment A for the location of proposed noise abatement barriers.

Table 8-1. Proposed Barriers

Representative Receivers	Benefited Receivers	Barrier Height	Barrier Length	Barrier Cost	Cost/Benefited Receiver	Percent of First Row Benefited
R1-R11*	35	12	2,101	$1,008,480	$28,814	37%
R15*	0	16	117	$74,880	-	0%
R29-R32	55	12	638	$306,240	$5,568	75%
Cost Averaging	90	-	-	$1,389,600	$15,440	-

* These barriers are replacements of existing structures removed by the proposed design. As a result of land use limitations and height restrictions, these replacement barriers may not provide an equal or greater acoustical benefit at all receivers.

Note: - = not applicable

Any subsequent proposed Project design changes may require a reevaluation of this preliminary noise barrier proposal. Adjustments to noise barrier locations may occur during final design. The final decision to construct the proposed noise barrier will not be made until completion of the proposed Project design, utility evaluation, and voting results of adjacent property owners.

8.4 Noise Impact Contour Analysis

To avoid noise impacts that may result from future development of properties adjacent to the Project, per NDOT policy (NDOT 2022), local officials responsible for land use control programs must ensure, to the maximum extent possible, that no new activities are planned or constructed along or within the predicted (2050) noise impact contour areas shown in Table 8-2.

Table 8-2. Noise Impact Contour Areas

Contour Area	Land Use	Impact Contour	Distance from Right-of-Way
Village Park Drive to Green Valley Parkway	NAC Categories B and C	44 dBA	156 feet
Village Park Drive to Green Valley Parkway	NAC Category E	71 dBA	108 feet

9. Information for Local Officials

NDOT will evaluate future changes in traffic noise impacts, if necessary, per NDOT policy (NDOT 2022). Local officials and municipalities must evaluate the compatibility of development in proximity to traffic noise sources. Noise-sensitive land development should not occur near a road or highway that would cause a related impact. If incompatible development is allowed, it will be incumbent on local entities to provide any consequential traffic noise abatement measure needed outside the right-of-way.

Future planning, zoning, and development should consider right-of-way limits to determine appropriate development. In addition, any changes to parameters used in this analysis must be evaluated by local planning officials. Should NDOT develop a Type II traffic noise program in the future, incompatible development allowed in proximity throughout the Project corridor would not be eligible to participate.

10. Conclusions and Recommendations

The purpose of this technical memorandum is to assess existing and future traffic noise levels, evaluate the performance of the existing noise barriers, and recommend traffic noise abatement measures at impacted noise-sensitive land uses. Existing noise levels range from 39 to 71 dBA. The predicted future traffic noise levels for the design year 2050 for the No Action Alternative range from 40 to 73 dBA. The predicted 2050 noise levels for the Preferred Alternative are expected to exceed the NAC at ten receivers and create noise impacts (Table 7-1).

Constructing noise barriers is the most practical, reasonable, and effective method for traffic noise mitigation on the Project. Preliminary analysis indicates that traffic noise barriers can be reconstructed in all areas where they currently exist. Additional traffic noise barriers could be built (shown on the map in Attachment A) as long as the barriers meet regulatory and FHWA guidance and NDOT policy criteria with the City's coordination and oversight.

11. References

Federal Highway Administration (FHWA). 1998a. *Traffic Noise Model User's Guide*. Report No. FHWA-PD-96-009. Federal Highway Administration, Washington D.C.

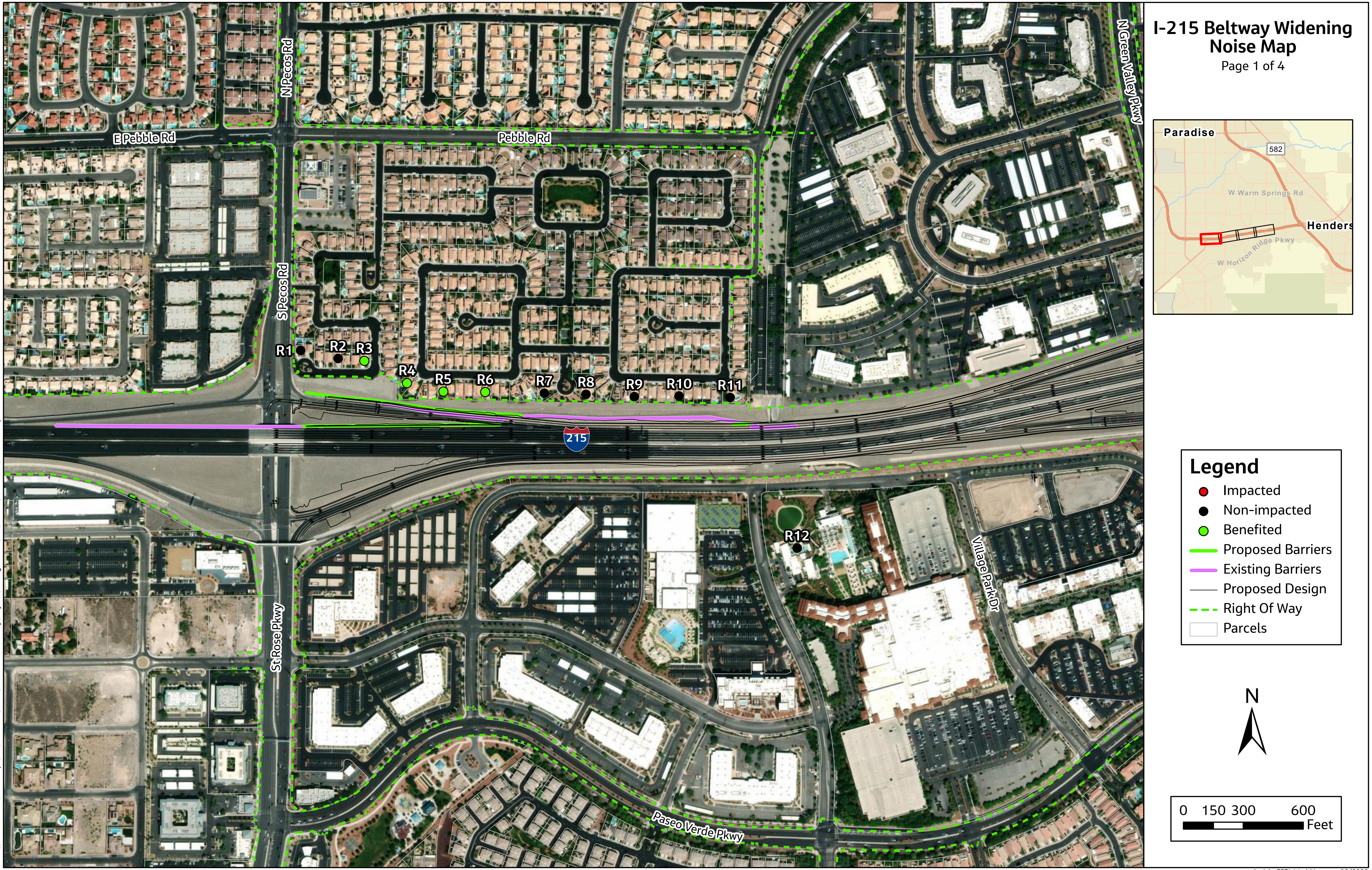
Federal Highway Administration (FHWA). 1998b. *Traffic Noise Model Technical Manual*. Report No. FHWA-PD-96-010. Federal Highway Administration, Washington D.C.

Federal Highway Administration (FHWA). 2006. *Roadway Construction Noise Model User Guide*. https://www.fhwa.dot.gov/ENVIRONMENT/noise/construction_noise/rcnm/rcnm01.cfm.

Federal Highway Administration (FHWA). 2011. Highway Traffic Noise: *Analysis and Abatement Guidance*. Document Number FHWA-HEP-10-025. https://www.fhwa.dot.gov/Environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/polguide02.cfm.

Nevada Department of Transportation (NDOT). 2022. *Traffic and Construction Noise Analysis and Abatement Policy*. October. https://www.dot.nv.gov/home/showpublisheddocument/14255/636637253326570000.

Attachment A
Noise Map



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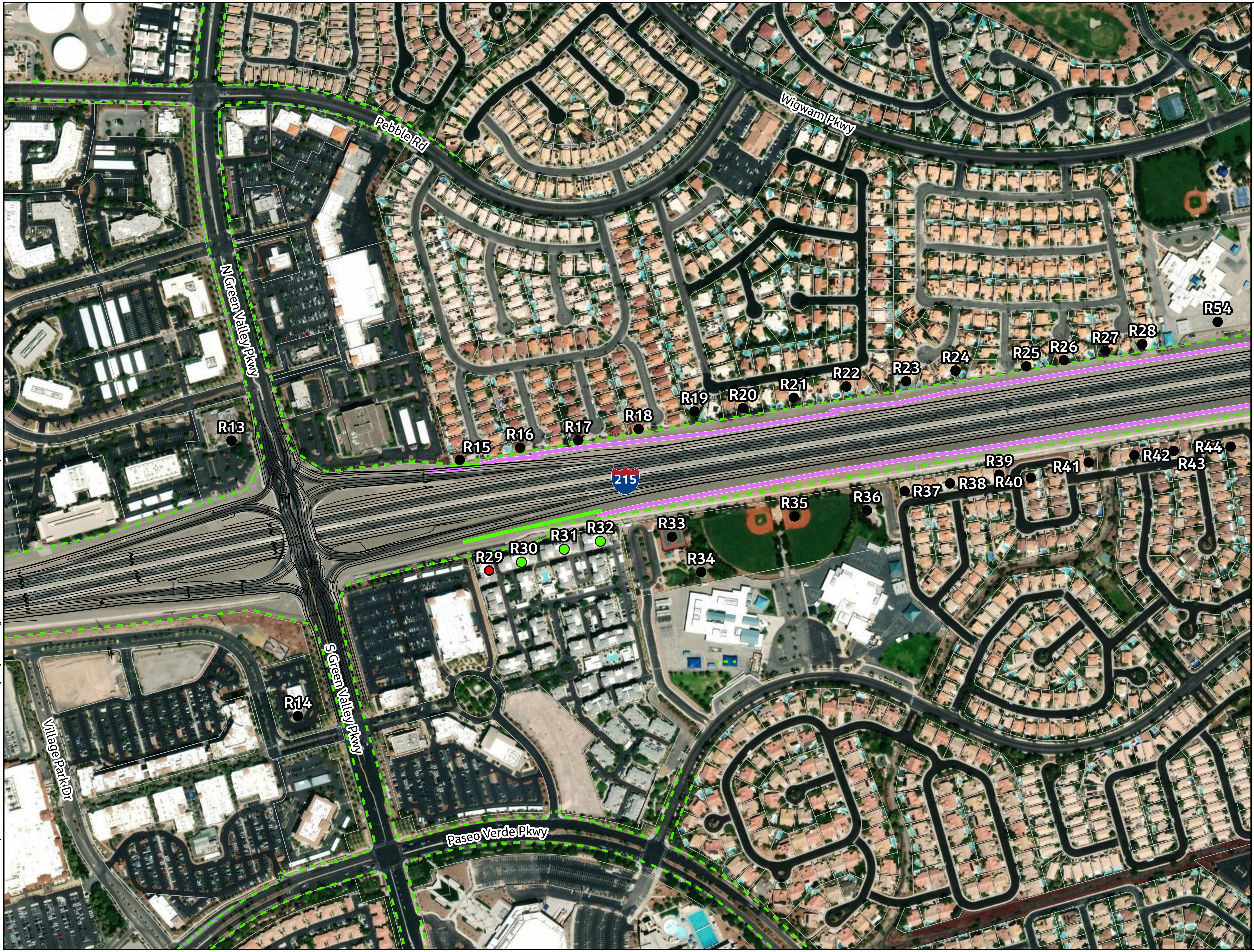
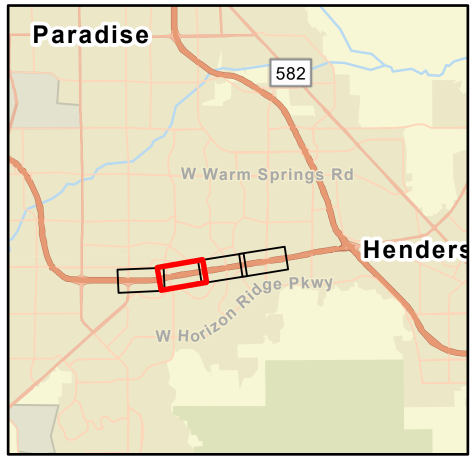
Aerial - ESRI World Imagery 08/2022

I-215 Beltway Widening Noise Map





Legend

- Impacted
- Non-impacted
- Benefited
- Proposed Barriers
- Existing Barriers
- Proposed Design
- Right Of Way
- Parcels

N

0 150 300 600 Feet

Aerial - ESRI World Imagery 08/2022

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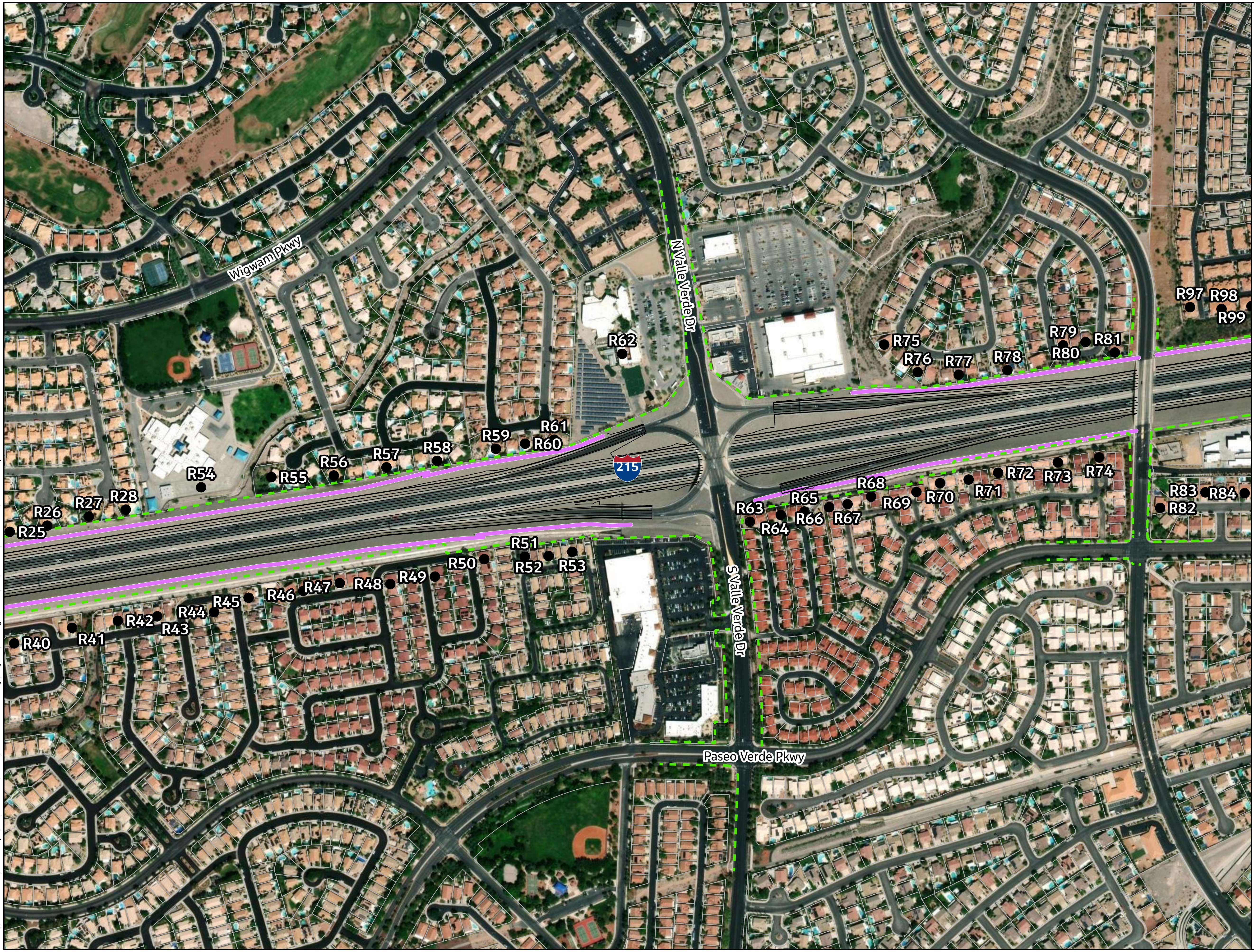
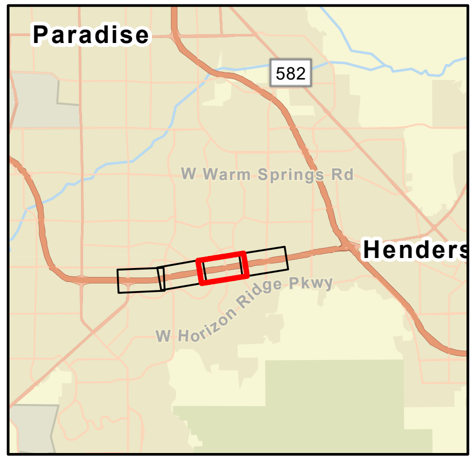
I-215 Beltway Widening Noise Map





Legend

- Impacted
- Non-impacted
- Benefited
- Proposed Barriers
- Existing Barriers
- Proposed Design
- Right Of Way
- Parcels

N

0 150 300 600 Feet

Aerial - ESRI World Imagery 08/2022

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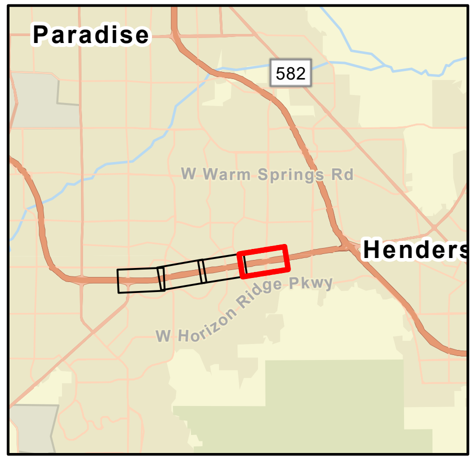
I-215 Beltway Widening Noise Map



Legend

- Impacted
- Non-impacted
- Benefited
- Proposed Barriers
- Existing Barriers
- Proposed Design
- Right Of Way
- Parcels

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Aerial - ESRI World Imagery 08/2022

Attachment B
Results of Traffic Noise Analysis

ATTACHMENT C: RESULTS OF THE TRAFFIC NOISE ANALYSIS

Receiver	NAC	NAC Level (dBA)	Existing Noise Level (dBA) 2021				No Action Noise Level (dBA) 2050				Preferred Noise Level (dBA) 2050			
			a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact
R1	B	67	61	NO	62	NO	63	NO	63	NO	66	**YES**	66	**YES**
R2	B	67	63	NO	63	NO	64	NO	65	NO	68	**YES**	68	**YES**
R3	B	67	61	NO	61	NO	63	NO	63	NO	68	**YES**	68	**YES**
R4	B	67	59	NO	59	NO	61	NO	61	NO	66	**YES**	66	**YES**
R5	B	67	57	NO	57	NO	59	NO	59	NO	66	**YES**	66	**YES**
R6	B	67	58	NO	58	NO	59	NO	59	NO	65	NO	65	NO
R7	B	67	58	NO	59	NO	60	NO	60	NO	62	NO	62	NO
R8	B	67	59	NO	59	NO	60	NO	61	NO	61	NO	61	NO
R9	B	67	56	NO	56	NO	58	NO	58	NO	59	NO	59	NO
R10	B	67	59	NO	59	NO	61	NO	61	NO	62	NO	62	NO
R11	B	67	55	NO	55	NO	56	NO	56	NO	60	NO	60	NO
R12	E	72	66	NO	66	NO	68	NO	68	NO	68	NO	68	NO
R13	E	72	62	NO	63	NO	63	NO	64	NO	63	NO	63	NO
R14	E	72	60	NO	60	NO	61	NO	62	NO	61	NO	62	NO
R15	B	67	61	NO	61	NO	62	NO	63	NO	69	**YES**	69	**YES**
R16	B	67	61	NO	62	NO	63	NO	63	NO	63	NO	64	NO
R17	B	67	61	NO	61	NO	63	NO	63	NO	63	NO	63	NO
R18	B	67	61	NO	61	NO	62	NO	63	NO	63	NO	63	NO
R19	B	67	59	NO	60	NO	61	NO	61	NO	61	NO	61	NO
R20	B	67	60	NO	60	NO	62	NO	62	NO	62	NO	62	NO
R21	B	67	60	NO	60	NO	61	NO	62	NO	61	NO	62	NO
R22	B	67	59	NO	60	NO	61	NO	61	NO	61	NO	61	NO
R23	B	67	60	NO	60	NO	62	NO	62	NO	62	NO	62	NO
R24	B	67	59	NO	60	NO	61	NO	61	NO	61	NO	61	NO

ATTACHMENT C: RESULTS OF THE TRAFFIC NOISE ANALYSIS

Receiver	NAC	NAC Level (dBA)	Existing Noise Level (dBA) 2021				No Action Noise Level (dBA) 2050				Preferred Noise Level (dBA) 2050			
			a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact
R25	B	67	61	NO	61	NO	62	NO	63	NO	63	NO	63	NO
R26	B	67	60	NO	60	NO	62	NO	62	NO	62	NO	62	NO
R27	B	67	60	NO	60	NO	61	NO	62	NO	61	NO	62	NO
R28	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R29	B	67	70	**YES**	70	**YES**	72	**YES**	72	**YES**	72	**YES**	73	**YES**
R30	B	67	70	**YES**	70	**YES**	72	**YES**	72	**YES**	73	**YES**	73	**YES**
R31	B	67	71	**YES**	72	**YES**	73	**YES**	73	**YES**	73	**YES**	74	**YES**
R32	B	67	70	**YES**	70	**YES**	71	**YES**	72	**YES**	72	**YES**	72	**YES**
R33	C	67	61	NO	61	NO	62	NO	63	NO	63	NO	63	NO
R34	C	67	57	NO	57	NO	58	NO	58	NO	58	NO	59	NO
R35	C	67	59	NO	59	NO	61	NO	61	NO	61	NO	61	NO
R36	C	67	58	NO	58	NO	60	NO	60	NO	60	NO	60	NO
R37	B	67	58	NO	58	NO	60	NO	60	NO	60	NO	60	NO
R38	B	67	59	NO	59	NO	60	NO	61	NO	60	NO	61	NO
R39	B	67	59	NO	59	NO	60	NO	61	NO	60	NO	61	NO
R40	B	67	58	NO	58	NO	60	NO	60	NO	60	NO	60	NO
R41	B	67	58	NO	58	NO	59	NO	60	NO	59	NO	60	NO
R42	B	67	58	NO	59	NO	60	NO	60	NO	60	NO	60	NO
R43	B	67	58	NO	58	NO	60	NO	60	NO	60	NO	60	NO
R44	B	67	57	NO	58	NO	59	NO	59	NO	59	NO	59	NO
R45	B	67	58	NO	58	NO	60	NO	60	NO	60	NO	60	NO
R46	B	67	58	NO	59	NO	60	NO	60	NO	60	NO	60	NO
R47	B	67	58	NO	59	NO	60	NO	60	NO	60	NO	60	NO
R48	B	67	58	NO	58	NO	60	NO	60	NO	60	NO	60	NO
R49	B	67	58	NO	59	NO	60	NO	60	NO	60	NO	60	NO

ATTACHMENT C: RESULTS OF THE TRAFFIC NOISE ANALYSIS

Receiver	NAC	NAC Level (dBA)	Existing Noise Level (dBA) 2021				No Action Noise Level (dBA) 2050				Preferred Noise Level (dBA) 2050			
			a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact
R50	B	67	60	NO	60	NO	61	NO	62	NO	62	NO	62	NO
R51	B	67	59	NO	60	NO	61	NO	61	NO	61	NO	61	NO
R52	B	67	60	NO	60	NO	61	NO	62	NO	61	NO	62	NO
R53	B	67	60	NO	60	NO	62	NO	62	NO	62	NO	62	NO
R54	C	67	58	NO	58	NO	59	NO	60	NO	59	NO	60	NO
R55	B	67	58	NO	59	NO	60	NO	60	NO	60	NO	60	NO
R56	B	67	59	NO	59	NO	61	NO	61	NO	61	NO	61	NO
R57	B	67	59	NO	59	NO	60	NO	61	NO	61	NO	61	NO
R58	B	67	59	NO	60	NO	61	NO	61	NO	61	NO	62	NO
R59	B	67	61	NO	61	NO	62	NO	63	NO	63	NO	63	NO
R60	B	67	61	NO	61	NO	62	NO	62	NO	62	NO	63	NO
R61	B	67	61	NO	61	NO	62	NO	63	NO	62	NO	63	NO
R62	D	52	39	NO	39	NO	40	NO	41	NO	41	NO	42	NO
R63	B	67	61	NO	61	NO	62	NO	63	NO	62	NO	62	NO
R64	B	67	60	NO	60	NO	61	NO	62	NO	61	NO	61	NO
R65	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R66	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R67	B	67	60	NO	60	NO	62	NO	62	NO	62	NO	62	NO
R68	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R69	B	67	62	NO	62	NO	63	NO	64	NO	63	NO	64	NO
R70	B	67	62	NO	62	NO	64	NO	64	NO	64	NO	64	NO
R71	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R72	B	67	61	NO	61	NO	62	NO	63	NO	62	NO	62	NO
R73	B	67	62	NO	62	NO	63	NO	64	NO	63	NO	63	NO
R74	B	67	61	NO	61	NO	62	NO	63	NO	63	NO	63	NO

ATTACHMENT C: RESULTS OF THE TRAFFIC NOISE ANALYSIS

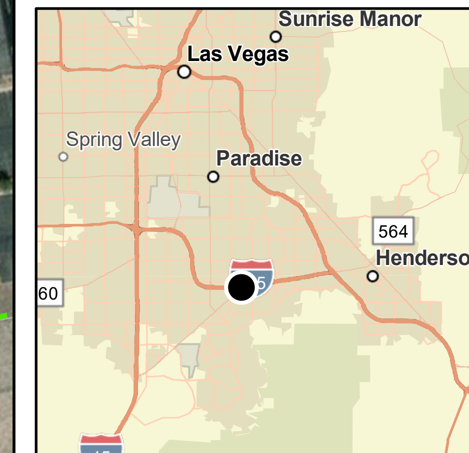
Receiver	NAC	NAC Level (dBA)	Existing Noise Level (dBA) 2021				No Action Noise Level (dBA) 2050				Preferred Noise Level (dBA) 2050			
			a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact
R75	B	67	56	NO	56	NO	57	NO	58	NO	58	NO	58	NO
R76	B	67	60	NO	60	NO	61	NO	62	NO	62	NO	62	NO
R77	B	67	60	NO	60	NO	61	NO	62	NO	61	NO	62	NO
R78	B	67	62	NO	63	NO	64	NO	64	NO	64	NO	64	NO
R79	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R80	B	67	60	NO	61	NO	62	NO	62	NO	62	NO	62	NO
R81	B	67	62	NO	63	NO	64	NO	64	NO	64	NO	64	NO
R82	B	67	53	NO	54	NO	55	NO	55	NO	55	NO	55	NO
R83	B	67	54	NO	54	NO	56	NO	56	NO	56	NO	56	NO
R84	B	67	54	NO	54	NO	55	NO	55	NO	55	NO	55	NO
R85	B	67	53	NO	53	NO	55	NO	55	NO	54	NO	54	NO
R86	B	67	53	NO	53	NO	55	NO	55	NO	54	NO	54	NO
R87	B	67	53	NO	53	NO	55	NO	55	NO	54	NO	54	NO
R88	B	67	53	NO	53	NO	54	NO	55	NO	54	NO	54	NO
R89	B	67	62	NO	62	NO	63	NO	64	NO	64	NO	63	NO
R90	B	67	63	NO	63	NO	64	NO	65	NO	64	NO	64	NO
R91	C	67	61	NO	61	NO	62	NO	63	NO	62	NO	61	NO
R92	B	67	54	NO	54	NO	55	NO	55	NO	55	NO	54	NO
R93	C	67	56	NO	56	NO	57	NO	58	NO	57	NO	56	NO
R94	B	67	54	NO	54	NO	55	NO	55	NO	55	NO	54	NO
R95	B	67	56	NO	56	NO	58	NO	58	NO	57	NO	56	NO
R96	B	67	58	NO	58	NO	59	NO	59	NO	59	NO	57	NO
R97	B	67	52	NO	52	NO	54	NO	54	NO	54	NO	54	NO
R98	B	67	52	NO	52	NO	54	NO	54	NO	54	NO	54	NO
R99	B	67	52	NO	53	NO	54	NO	54	NO	54	NO	54	NO

ATTACHMENT C: RESULTS OF THE TRAFFIC NOISE ANALYSIS

Receiver	NAC	NAC Level (dBA)	Existing Noise Level (dBA) 2021				No Action Noise Level (dBA) 2050				Preferred Noise Level (dBA) 2050			
			a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact	a.m.	Impact	p.m.	Impact
R100	B	67	52	NO	53	NO	54	NO	54	NO	54	NO	54	NO
R101	B	67	52	NO	53	NO	54	NO	54	NO	54	NO	54	NO
R102	B	67	52	NO	53	NO	54	NO	54	NO	54	NO	54	NO
R103	B	67	52	NO	53	NO	54	NO	54	NO	54	NO	54	NO
R104	B	67	52	NO	52	NO	54	NO	54	NO	54	NO	53	NO
R105	B	67	52	NO	52	NO	54	NO	54	NO	53	NO	53	NO
R106	B	67	52	NO	52	NO	54	NO	54	NO	53	NO	53	NO
R107	B	67	53	NO	53	NO	55	NO	55	NO	54	NO	54	NO
R108	B	67	54	NO	54	NO	55	NO	55	NO	55	NO	54	NO
R109	B	67	53	NO	53	NO	54	NO	54	NO	54	NO	53	NO
R110	B	67	55	NO	55	NO	56	NO	57	NO	56	NO	55	NO
R111	B	67	56	NO	56	NO	57	NO	58	NO	56	NO	55	NO
R112	B	67	56	NO	57	NO	58	NO	58	NO	57	NO	56	NO
R113	B	67	56	NO	56	NO	57	NO	58	NO	57	NO	56	NO
R114	B	67	55	NO	56	NO	56	NO	57	NO	56	NO	56	NO
R115	B	67	55	NO	56	NO	56	NO	58	NO	56	NO	57	NO
R116	B	67	56	NO	58	NO	58	NO	59	NO	57	NO	58	NO

Attachment C
Validation Location Map

I-215 Beltway Widening Validation Location Map



Legend

- Validation Site
- Right Of Way
- Alignment
- Parcels

N

0 50 100 200 Feet

Aerial - ESRI World Imagery 08/2022

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Noise Measurement Data Sheet

Site#1 Green Valley Ranch Resort Spa and Casino, Henderson, NV	Date 12/5/22

Noise Meter	Response	Weighting	Battery*
Model: Sound Pro DL	Fast ☐ Slow ☒	A ☒ C ☐	100% *replace if below 50%

Calibrator	Calibrator @ 114 dBA
Model AcoustiCal AC-300 Calibrator	Start 114 End 114

Weather Data

Temperature 61ºF Humidity 34% Wind Speed 12 mph Cloudy

Measurement Data

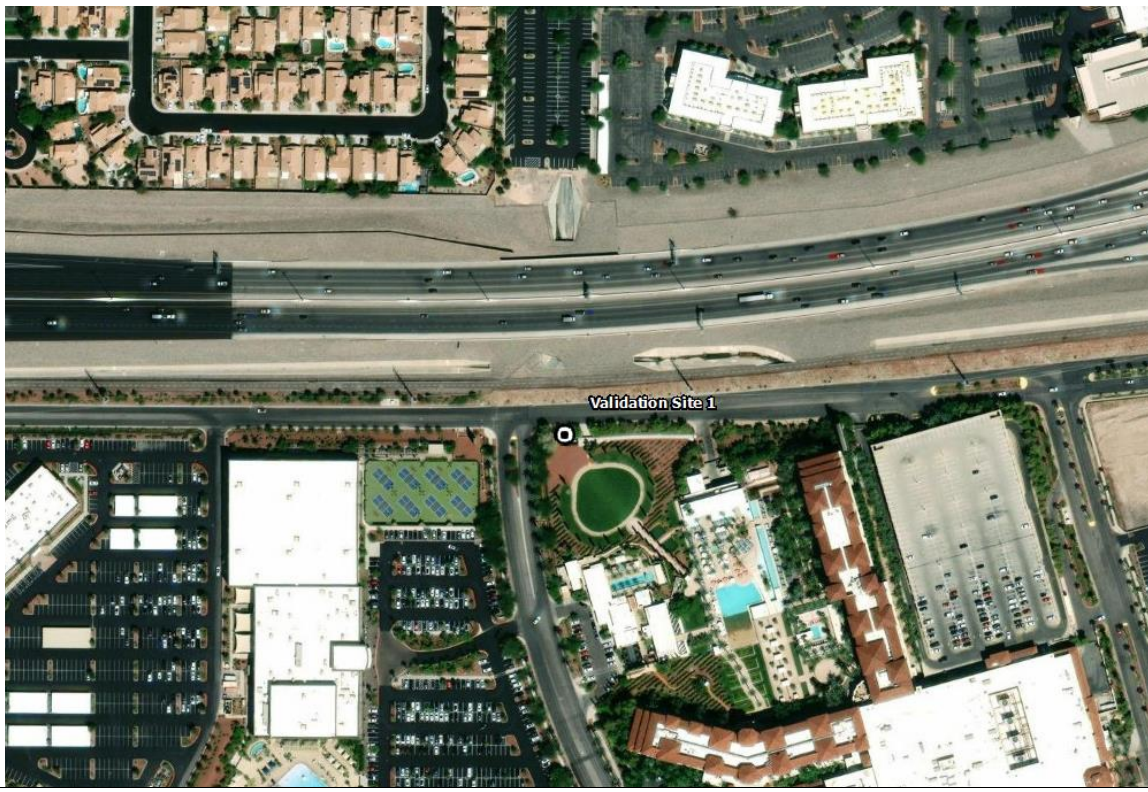
Event	Begin Time	End Time	L_{eq} (dBA)	L_{min} (dBA)	L_{max} (dBA)
1	2:55 PM	3:10 PM	67.7	63.2	77.2

Traffic Data and Average Speeds

Event	Direction	Autos	Medium Trucks	Heavy Trucks	Motorcycle	Buses
Total Average Hourly Count	Westbound (ML)	4,652	168	96	12	28
Total Average Hourly Count	Eastbound (ML)	4,496	240	80	8	8

***For traffic data and average speeds, see attached Traffic Data Spreadsheet**

Site Sketch



Notes

(Major sources, background noise, unusual events, etc.)

Noise Measurement Data Sheet

Site#2 Green Valley Corporate Center, Henderson, NV	Date 12/5/22

Noise Meter	Response	Weighting	Battery*
Model: Sound Pro DL	Fast ☐ Slow ☒	A ☒ C ☐	100% *replace if below 50%

Calibrator	Calibrator @ 114 dBA
Model AcoustiCal AC-300 Calibrator	Start 114 End 114

Weather Data

Temperature 61ºF Humidity 34% Wind Speed 12 mph Cloudy

Measurement Data

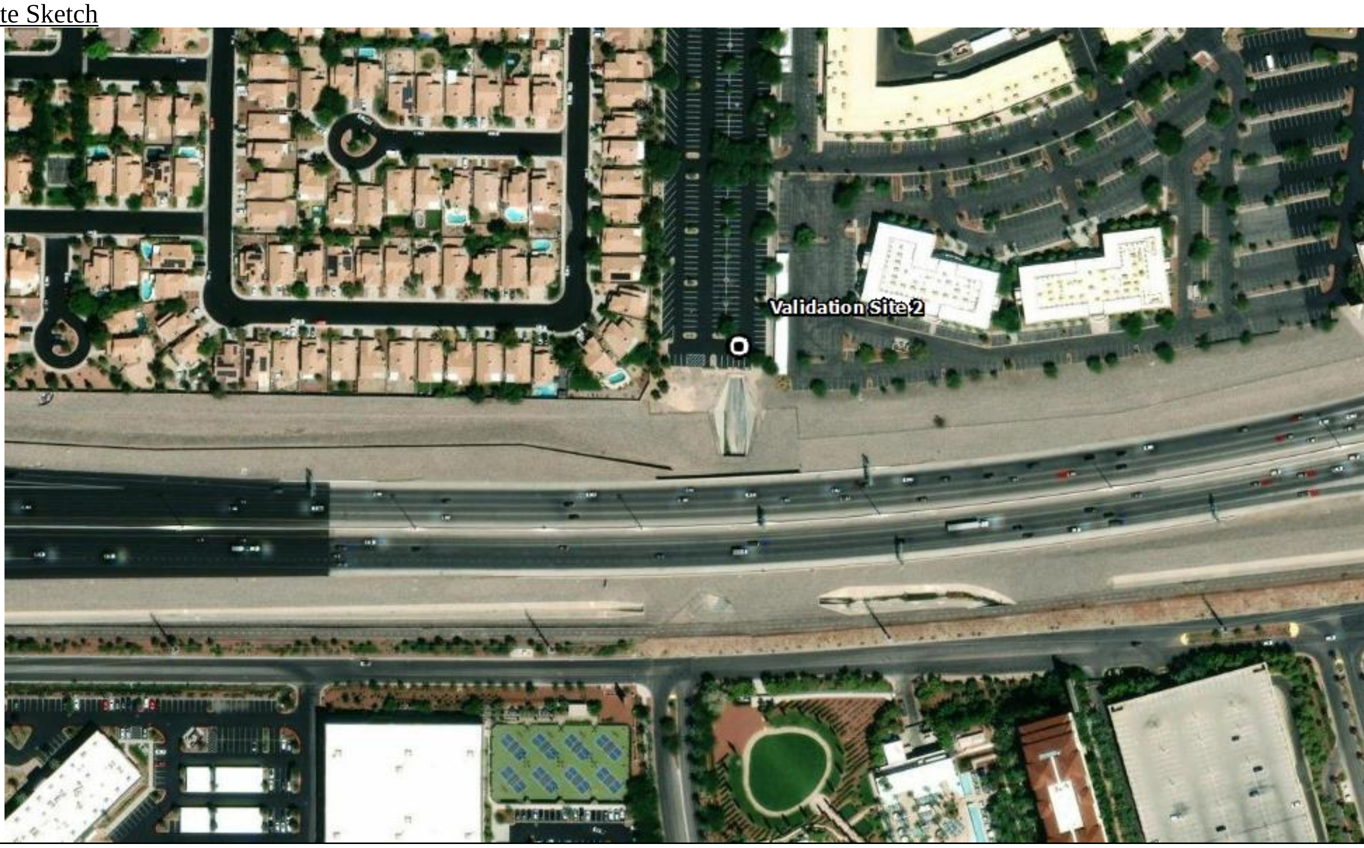
Event	Begin Time	End Time	L_{eq} (dBA)	L_{min} (dBA)	L_{max} (dBA)
1	3:26 PM	3:41 PM	65.8	60.9	78.0

Traffic Data and Average Speeds

Event	Direction	Autos	Medium Trucks	Heavy Trucks	Motorcycle	Buses
Total Average Hourly Count	Westbound (ML)	4,540	116	72	12	44
Total Average Hourly Count	Eastbound (ML)	4,500	96	72	16	24

***For traffic data and average speeds, see attached Traffic Data Spreadsheet**

Site Sketch



Notes

(Major sources, background noise, unusual events, etc.)

INSTRUMENT CALIBRATION REPORT

Pine Environmental Services LLC

3130 Rogerdale Rd., Suite 120
Houston, TX 77042 US
Phone: (713) 331-3924

Pine Environmental Services, Inc.

Instrument ID 13637
Description Quest SoundPro DL-2-1/3
Calibrated 11/22/2022 4:10:11PM

Manufacturer	Quest	**State Certified**	
Model Number	SoundPro DL	**Status**	Pass
Serial Number/ Lot Number	BIJ060018	**Temp °C**	22
Location	Texas	**Humidity %**	48
Department			

Calibration Specifications

Group # 1
Group Name Calibrated to 114db
Test Performed: Yes **As Found Result: Pass** **As Left Result: Pass**

Test Instruments Used During the Calibration **(As Of Cal Entry Date)**

Test Standard ID	Description	Manufacturer	Model Number	Serial Number / Lot Number	Next Cal Date / Last Cal Date/ Expiration Date Opened Date

Notes about this calibration

Calibration Result Calibration Successful
Who Calibrated Ryan A Jones

All instruments are calibrated by Pine Environmental Services LLC according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services LLC of any defect within 24 hours of receipt of equipment
Please call 800-301-9663 for Technical Assistance

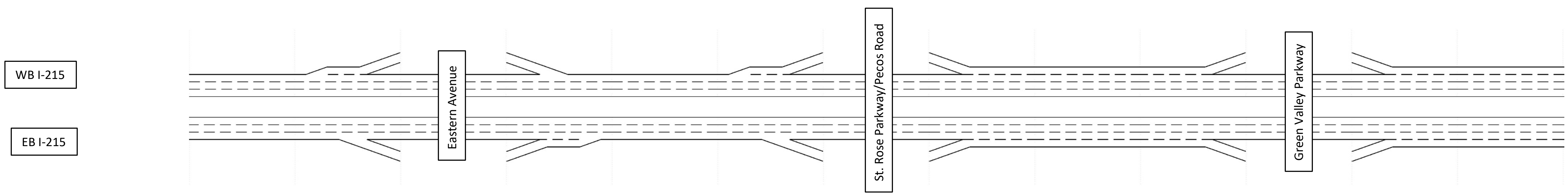
Attachment D
Traffic Data

Assumptions for the Calculation of Medium-Duty Truck Percent needed for Noise Analysis

- Vehicle classification volumes were available from NDOT's *"2021 Vehicle Classification Distribution Report"*
- Volumes for FHWA vehicle classes 4 through 13 are available here
- Assume FHWA Class 4 through Class 6 vehicle categories are medium-duty trucks
- Classification volumes are available for I-215 between US 95 and I-15. This is approximately 11 miles of the I-215 freeway; our Project, Pecos Road to Stephanie Street is included within this stretch. Separate classification volumes are not available for any smaller segments within this 11 mile portion of the I-215 freeway
- Assume truck trips are typically long distance trips and that the truck volumes are constant throughout our Project
- Year 2021 FHWA Class 4 through Class 6 volume (AADT) is 3,015 vehicles
- For year 2050, assuming that the truck volumes also grow at the same rate of the overall traffic, truck growth rate between year 2021 and year 2050 is approximately 1.3%
- Therefore, year 2050 FHWA Class 4 through Class 6 volume (AADT) is 4,385 vehicles
- Over a typical day, assuming the directional distribution for the truck volumes is 50%, approximate directional year 2050 FHWA Class 4 through Class 6 volume through the Project corridor is 2,190 vehicles
- FHWA Class 4 through Class 6 percent for individual segments within our Project are calculated based on the Total AADT for the segments and the FHWA Class 4 through Class 6 volume calculated above

Year 2021 Existing Conditions

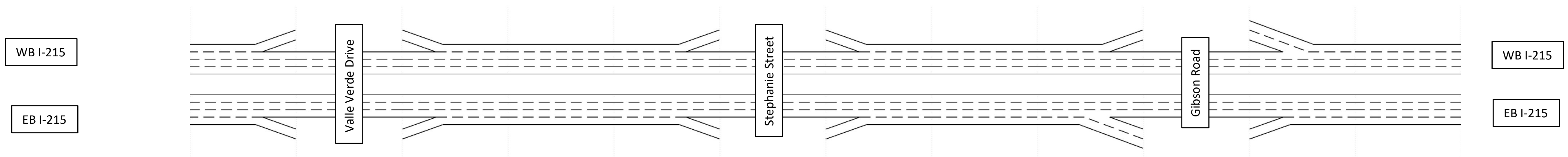
Year 2021 AM Demand Volume (vph)	5,820	1,340	4,480	920	5,400	740	4,660	1,490 1480	6,140	870	5,270	1,340 1350	6,620
Year 2021 PM Demand Volume (vph)	5,290	1,340 1330	3,960	1,180 1170	5,130	890	4,240	1,640	5,880	920	4,960	1,120	6,080
Year 2021 AADT (vpd)	75,000	17,500	57,500	15,000	69,500	11,500	60,000	21,000	79,000	12,000	68,000	17,500	85,500
Truck Percent (FHWA Classes 4 - 6)	2.0%		2.6%		2.2%		2.5%		1.9%		2.2%		1.8%
Total Truck Percent (FHWA Classes 4 - 13)	3.0%		3.9%		3.2%		3.7%		2.8%		3.3%		2.6%



Year 2021 AM Demand Volume (vph)	5,180	1,330	3,850	950	4,800	690 680	4,120	1,290	5,410	910	4,500	830	5,330
Year 2021 PM Demand Volume (vph)	5,890	1,310	4,580	1,200	5,780	770	5,010	1,490 1500	6,510	770 780	5,730	1,180	6,910
Year 2021 AADT (vpd)	76,000	17,000	59,000	15,500	74,500	9,900	64,500	19,000	84,000	11,500	74,000	15,000	89,000
Truck Percent (FHWA Classes 4 - 6)	2.0%		2.6%		2.0%		2.3%		1.8%		2.0%		1.7%
Total Truck Percent (FHWA Classes 4 - 13)	2.9%		3.8%		3.0%		3.4%		2.6%		3.0%		2.5%

Year 2021 Existing Conditions

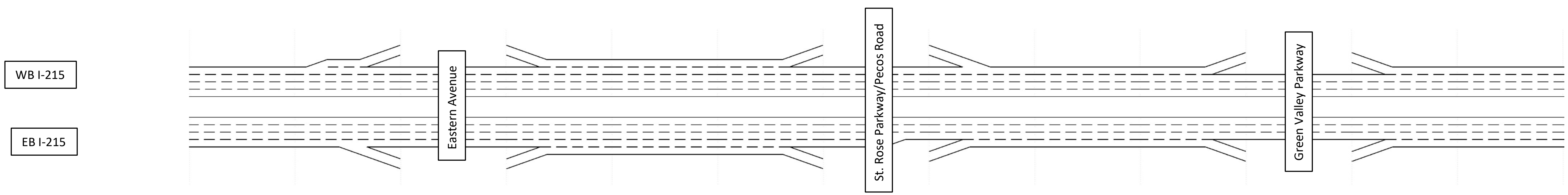
Year 2021 AM Demand Volume (vph)	820 830	5,790	460 470	6,260	1,240 1250	5,010	810	5,820	850	4,970	400	5,370
Year 2021 PM Demand Volume (vph)	540	5,540	650	6,190	1,520 1530	4,660	750	5,410	980	4,430	450	4,880
Year 2021 AADT (vpd)	10,500	74,500	8,400	80,500	19,500	64,500	10,500	75,000	12,500	64,000	5,800	69,000
Truck Percent (FHWA Classes 4 - 6)		2.0%		1.9%		2.3%		2.0%		2.4%		2.2%
Total Truck Percent (FHWA Classes 4 - 13)		3.0%		2.8%		3.4%		3.0%		3.5%		3.2%



Year 2021 AM Demand Volume (vph)	500 510	4,820	450	5,270	1,100	4,170	590	4,760	910	3,850	560	4,410
Year 2021 PM Demand Volume (vph)	960	5,950	380	6,330	1,630	4,700	810	5,510	770	4,740	460	5,200
Year 2021 AADT (vpd)	12,500	76,500	5,800	81,500	21,000	60,500	10,500	71,000	11,500	61,000	7,200	67,000
Truck Percent (FHWA Classes 4 - 6)		2.0%		1.8%		2.5%		2.1%		2.5%		2.3%
Total Truck Percent (FHWA Classes 4 - 13)		2.9%		2.7%		3.7%		3.1%		3.6%		3.3%

Year 2050 No-Action Alternative

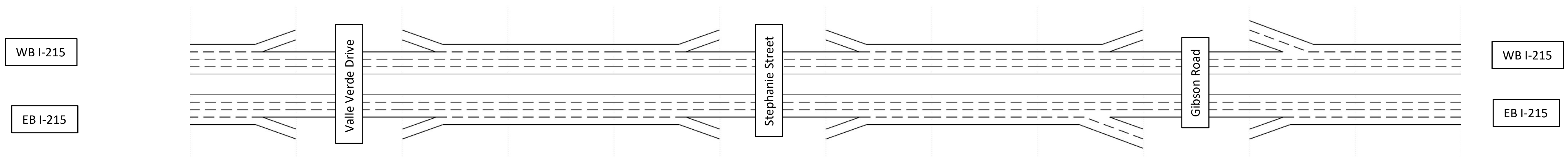
Year 2050 AM Demand Volume (vph)	8,360	1,330	7,030	1,180	8,210	800	7,410	1,730 1720	9,130	1,420 1410	7,720	1,830	9,550
Year 2050 PM Demand Volume (vph)	7,560	1,280	6,280	1,390	7,670	1,050	6,620	1,920 1910	8,530	1,110	7,420	1,360	8,780
Year 2050 AADT (vpd)	108,000	17,000	90,500	18,000	106,000	13,500	95,500	24,500	118,000	18,500	99,500	23,500	123,000
Truck Percent (FHWA Classes 4 - 6)	2.0%		2.4%		2.1%		2.3%		1.9%		2.2%		1.8%
Total Truck Percent (FHWA Classes 4 - 13)	3.0%		3.6%		3.0%		3.4%		2.7%		3.2%		2.6%



Year 2050 AM Demand Volume (vph)	6,620	1,360	5,260	1,290	6,550	750	5,800	2,160	7,960	1,350	6,610	1,000	7,610
Year 2050 PM Demand Volume (vph)	8,040	1,350 1340	6,700	1,550 1540	8,240	800 790	7,450	1,940 1930	9,380	1,060	8,320	1,780	10,100
Year 2050 AADT (vpd)	104,000	17,500	86,500	20,000	106,000	10,500	96,000	28,000	121,000	17,500	107,000	23,000	130,000
Truck Percent (FHWA Classes 4 - 6)	2.1%		2.5%		2.1%		2.3%		1.8%		2.0%		1.7%
Total Truck Percent (FHWA Classes 4 - 13)	3.1%		3.7%		3.0%		3.4%		2.7%		3.0%		2.5%

Year 2050 No-Action Alternative

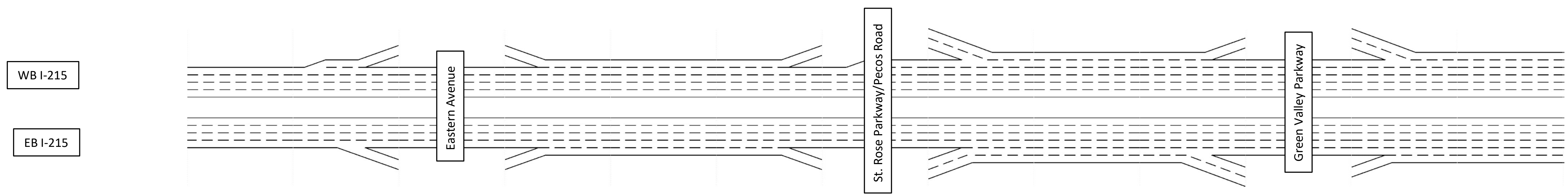
Year 2050 AM Demand Volume (vph)	1,030	8,520	520	9,040	1,530	7,510	850	8,360	1,390	6,970	420	7,390
Year 2050 PM Demand Volume (vph)	650 640	8,140	670 660	8,800	1,810	6,990	880 890	7,880	1,340	6,540	450	6,990
Year 2050 AADT (vpd)	13,500	110,000	8,600	116,000	23,500	97,000	11,500	108,000	18,000	90,000	5,800	95,000
Truck Percent (FHWA Classes 4 - 6)		2.0%		1.9%		2.3%		2.0%		2.4%		2.3%
Total Truck Percent (FHWA Classes 4 - 13)		2.9%		2.8%		3.3%		3.0%		3.6%		3.4%



Year 2050 AM Demand Volume (vph)	560	7,050	470	7,520	1,280	6,240	750	6,990	1,150 1160	5,830	710 720	6,550
Year 2050 PM Demand Volume (vph)	1,180	8,920	500	9,420	1,840 1830	7,590	1,010 1000	8,590	1,230	7,360	650	8,010
Year 2050 AADT (vpd)	15,000	115,000	6,400	121,000	23,500	98,000	13,000	111,000	16,000	95,000	9,100	103,000
Truck Percent (FHWA Classes 4 - 6)		1.9%		1.8%		2.2%		2.0%		2.3%		2.1%
Total Truck Percent (FHWA Classes 4 - 13)		2.8%		2.7%		3.3%		2.9%		3.4%		3.1%

Year 2050 Build Alternative 2

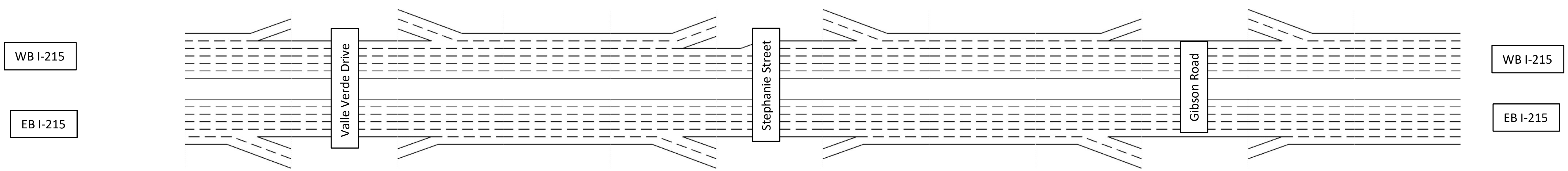
Year 2050 AM Demand Volume (vph)	8,360	1,330	7,030	1,170	8,200	780 790	7,410	1,920	9,330	1,240	8,090	1,460	9,550
Year 2050 PM Demand Volume (vph)	7,560	1,280	6,280	1,320	7,600	980	6,620	2,080	8,700	1,130	7,570	1,210	8,780
Year 2050 AADT (vpd)	108,000	17,000	90,500	17,000	106,000	12,500	95,500	27,000	120,000	16,000	104,000	19,000	123,000
Truck Percent (FHWA Classes 4 - 6)	2.0%		2.4%		2.1%		2.3%		1.8%		2.1%		1.8%
Total Truck Percent (FHWA Classes 4 - 13)	3.0%		3.6%		3.0%		3.4%		2.7%		3.1%		2.6%



Year 2050 AM Demand Volume (vph)	6,620	1,360	5,260	1,280	6,540	750 740	5,800	2,170 2160	7,960	1,350	6,610	1,000	7,610
Year 2050 PM Demand Volume (vph)	8,040	1,350 1340	6,700	1,480	8,180	710	7,470	2,290	9,760	1,080	8,680	1,420	10,100
Year 2050 AADT (vpd)	104,000	17,500	86,500	19,000	105,000	9,700	96,500	29,500	126,000	17,500	112,000	18,500	130,000
Truck Percent (FHWA Classes 4 - 6)	2.1%		2.5%		2.1%		2.3%		1.7%		2.0%		1.7%
Total Truck Percent (FHWA Classes 4 - 13)	3.1%		3.7%		3.1%		3.3%		2.6%		2.9%		2.5%

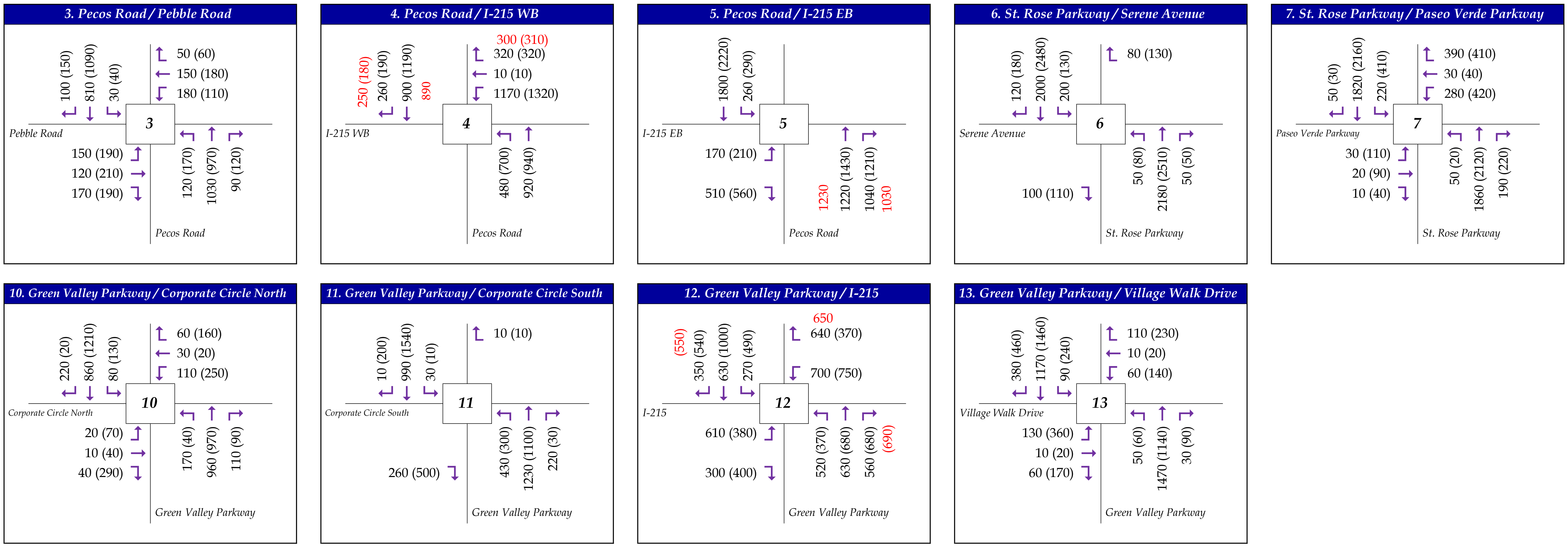
Year 2050 Build Alternative 2

Year 2050 AM Demand Volume (vph)	1,030	8,520	520	9,040	1,530	7,510	850	8,360	1,390	6,970	420	7,390
Year 2050 PM Demand Volume (vph)	650 640	8,140	670 660	8,800	1,810	6,990	880 890	7,880	1,340	6,540	450	6,990
Year 2050 AADT (vpd)	13,500	110,000	8,600	116,000	23,500	97,000	11,500	108,000	18,000	90,000	5,800	95,000
Truck Percent (FHWA Classes 4 - 6)		2.0%		1.9%		2.3%		2.0%		2.4%		2.3%
Total Truck Percent (FHWA Classes 4 - 13)		2.9%		2.8%		3.3%		3.0%		3.6%		3.4%



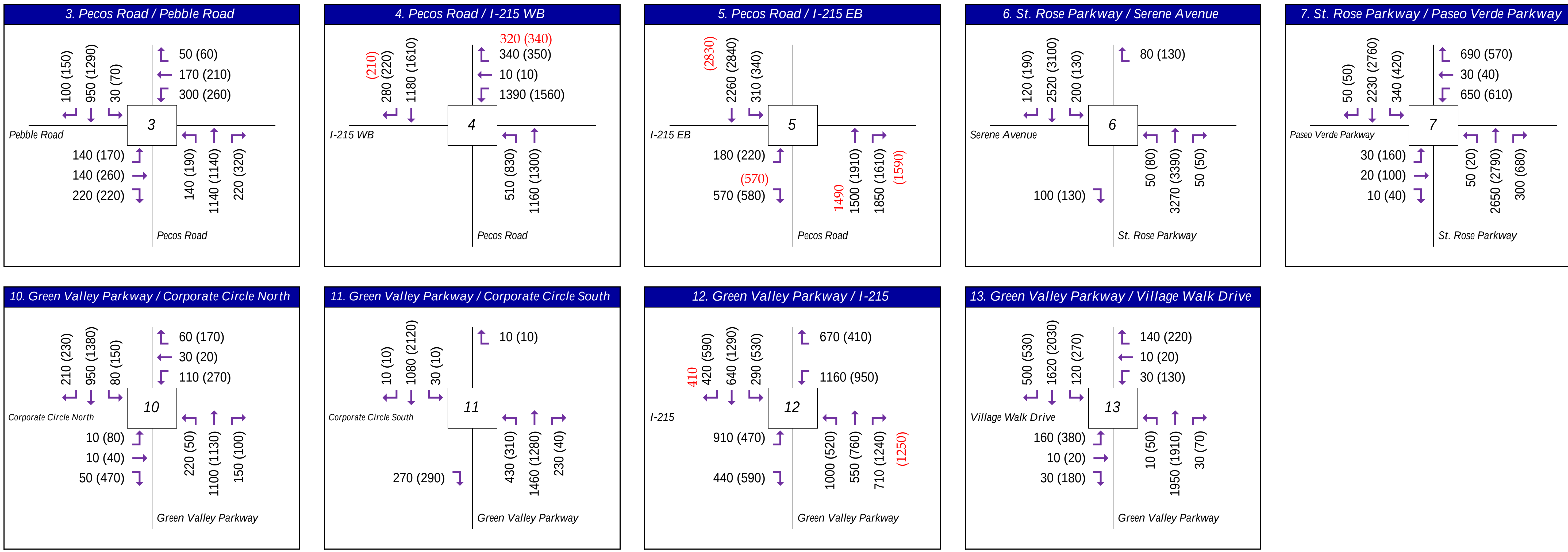
Year 2050 AM Demand Volume (vph)	560	7,050	470	7,520	1,280	6,240	750	6,990	1,150 1160	5,830	710 720	6,550
Year 2050 PM Demand Volume (vph)	1,180	8,920	500	9,420	1,840 1830	7,590	1,010 1000	8,590	1,230	7,360	650	8,010
Year 2050 AADT (vpd)	15,000	115,000	6,400	121,000	23,500	98,000	13,000	111,000	16,000	95,000	9,100	103,000
Truck Percent (FHWA Classes 4 - 6)		1.9%		1.8%		2.2%		2.0%		2.3%		2.1%
Total Truck Percent (FHWA Classes 4 - 13)		2.8%		2.7%		3.3%		2.9%		3.4%		3.1%

Year 2021
AM and PM Peak Hour Volumes



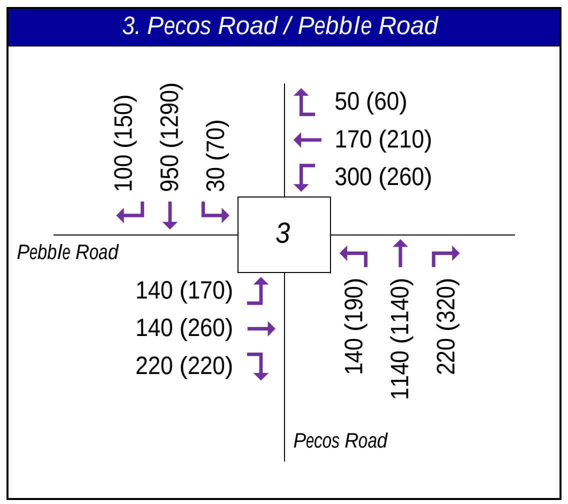
Static Assigned Volumes from the Aimsun Next model are shown as-is. A minimum nominal volume of 10 vph is shown when the volumes in the model are lower.
xx (xx): AM (PM) Peak Hour Volumes; AM Peak Hour = 7:30 AM to 8:30 AM; PM Peak Hour = 4:30 PM to 5:30 PM. Volumes may not be balanced between adjacent intersections due to rounding.

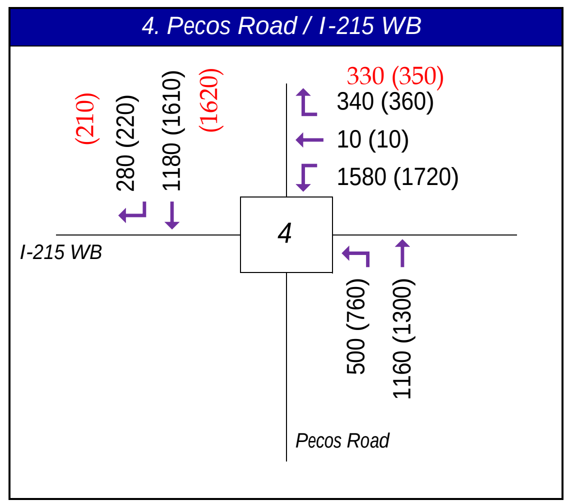
Year 2050 No-Action Alternative
AM and PM Peak Hour Volumes

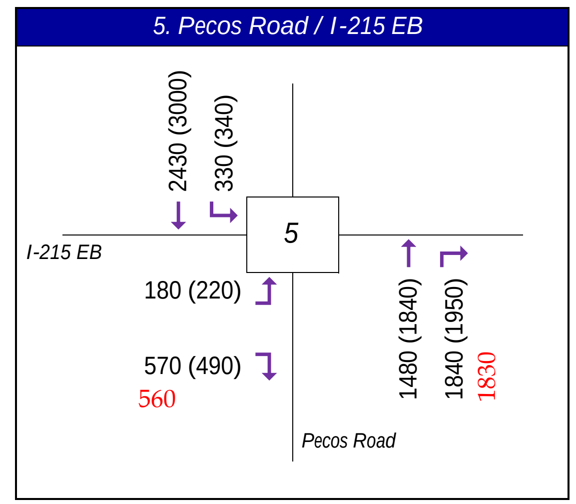


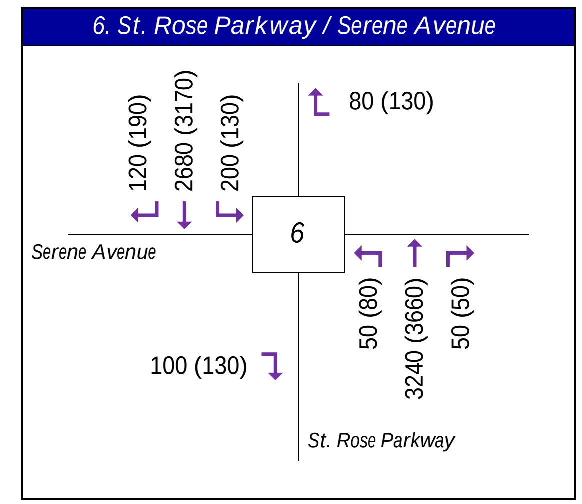
Static Assigned Volumes from the Aimsun Next model are shown as-is. A minimum nominal volume of 10 vph is shown when the volumes in the model are lower.
xx (xx): AM (PM) Peak Hour Volumes; AM Peak Hour = 7:30 AM to 8:30 AM; PM Peak Hour = 4:30 PM to 5:30 PM. Volumes may not be balanced between adjacent intersections due to rounding.

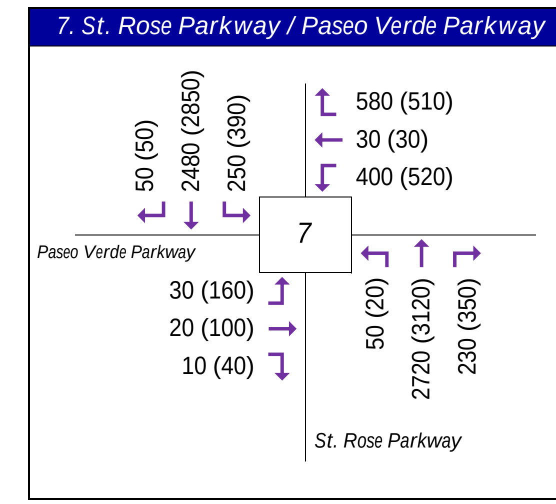
Year 2050 Build Alternative
AM and PM Peak Hour Volumes

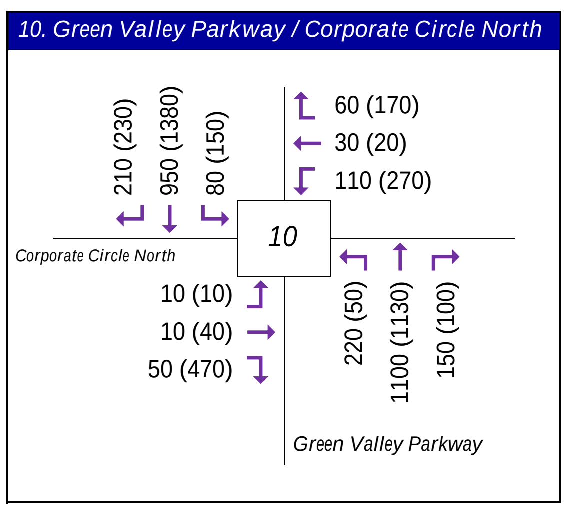


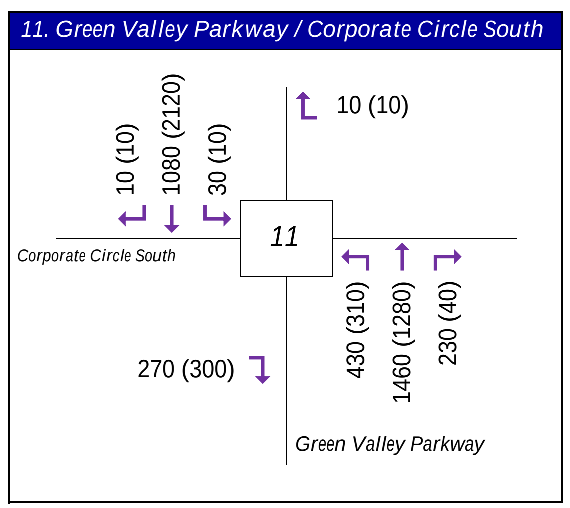


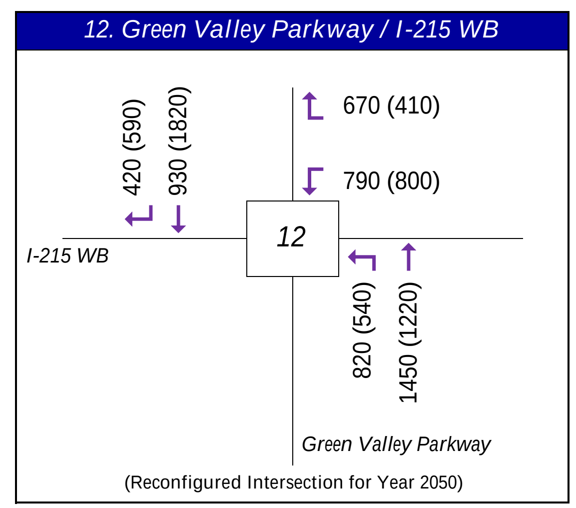


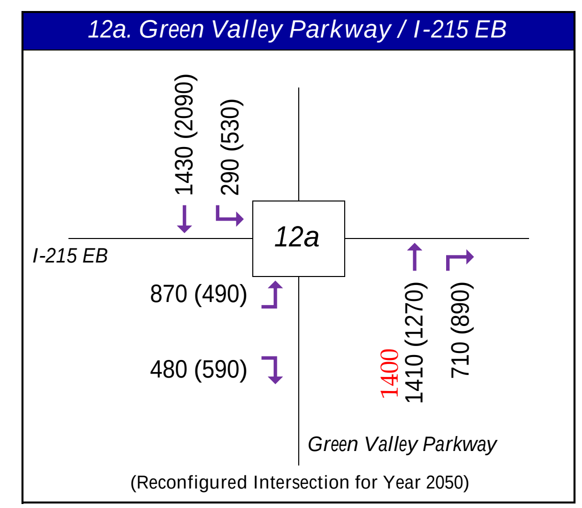


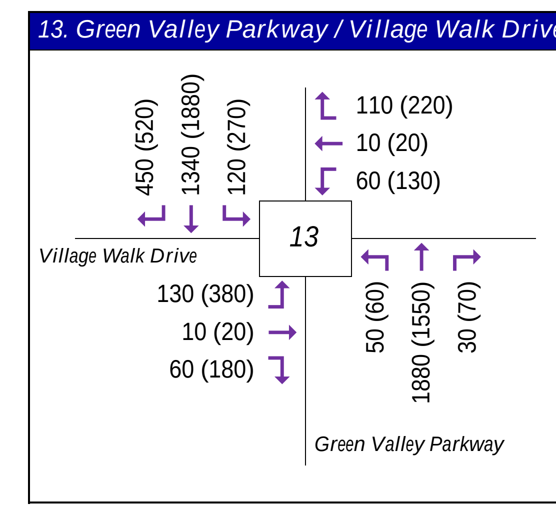








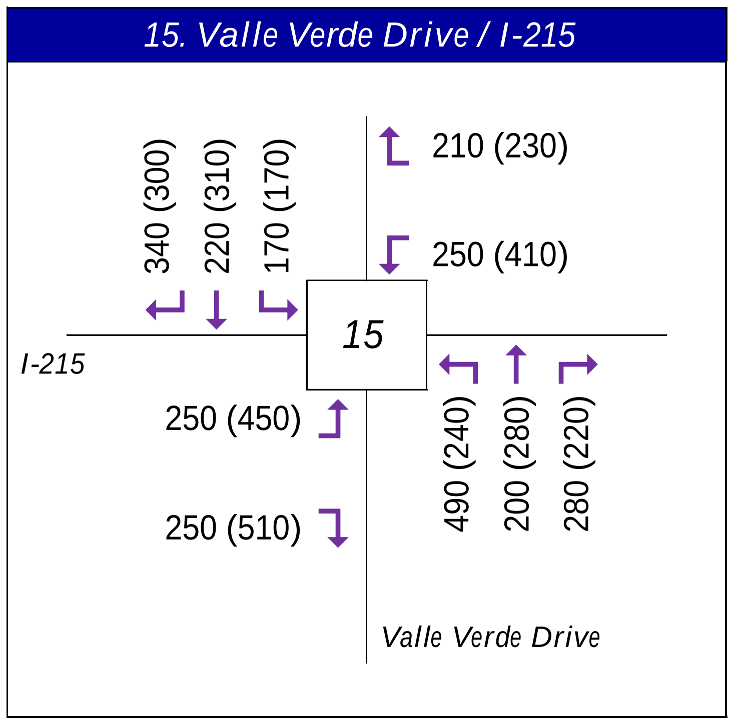


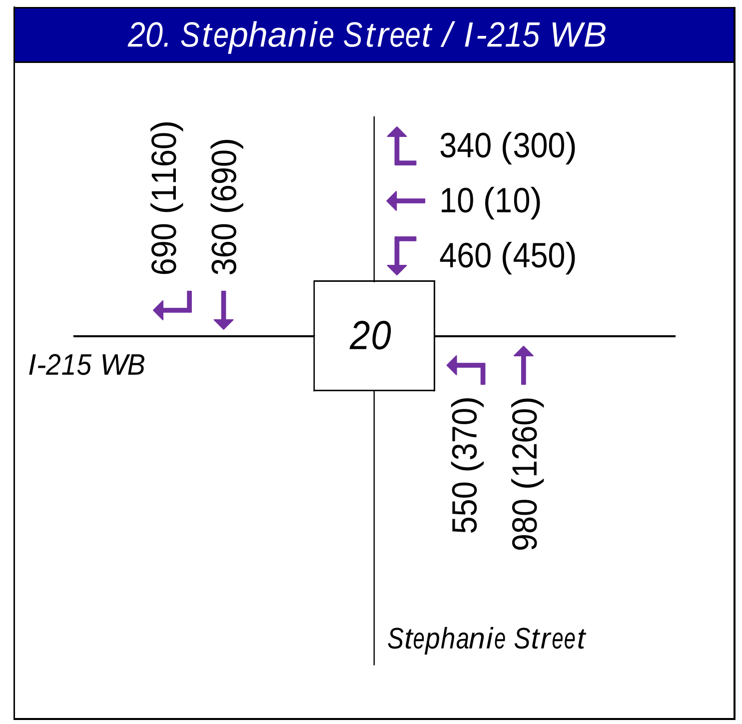


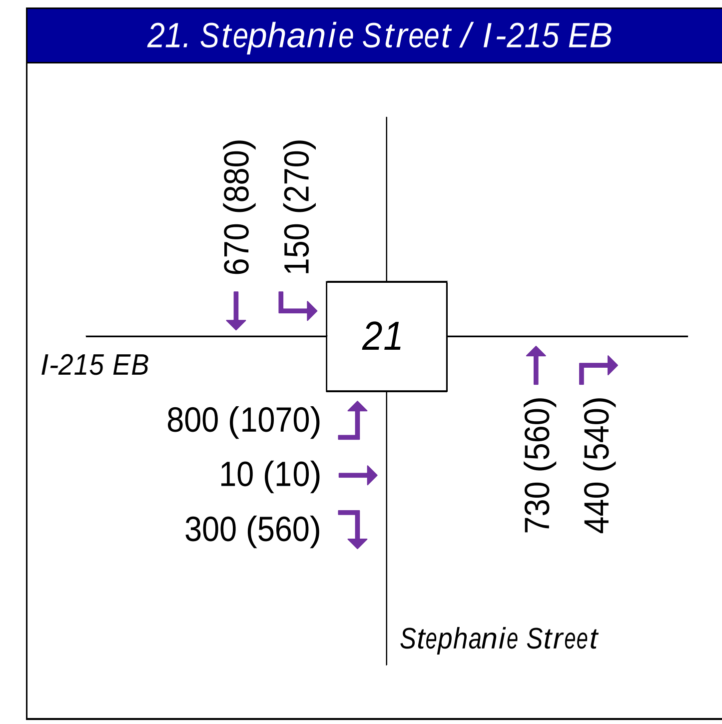
Static Assigned Volumes from the Aimsun Next model are shown as-is. A minimum nominal volume of 10 vph is shown when the volumes in the model are lower.
xx (xx): AM (PM) Peak Hour Volumes; AM Peak Hour = 7:30 AM to 8:30 AM; PM Peak Hour = 4:30 PM to 5:30 PM. Volumes may not be balanced between adjacent intersections due to rounding.

Year 2021

AM and PM Peak Hour Volumes



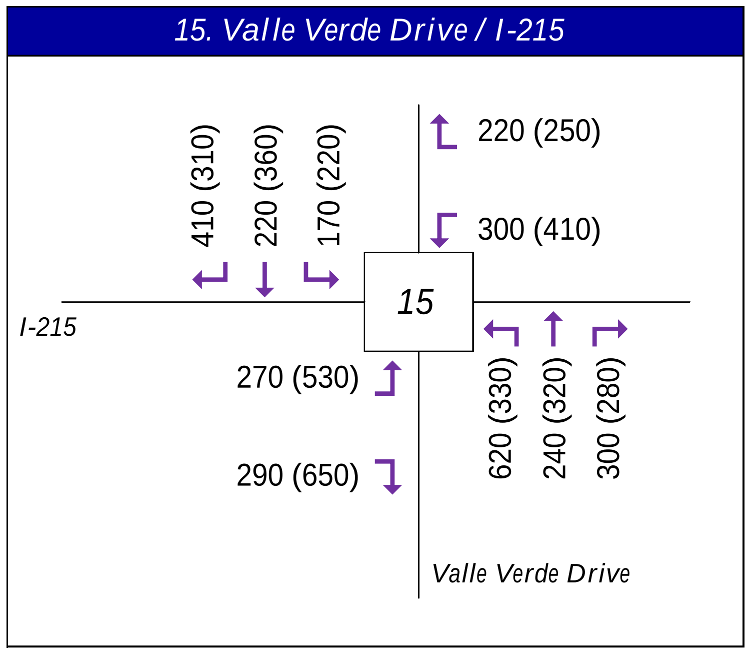


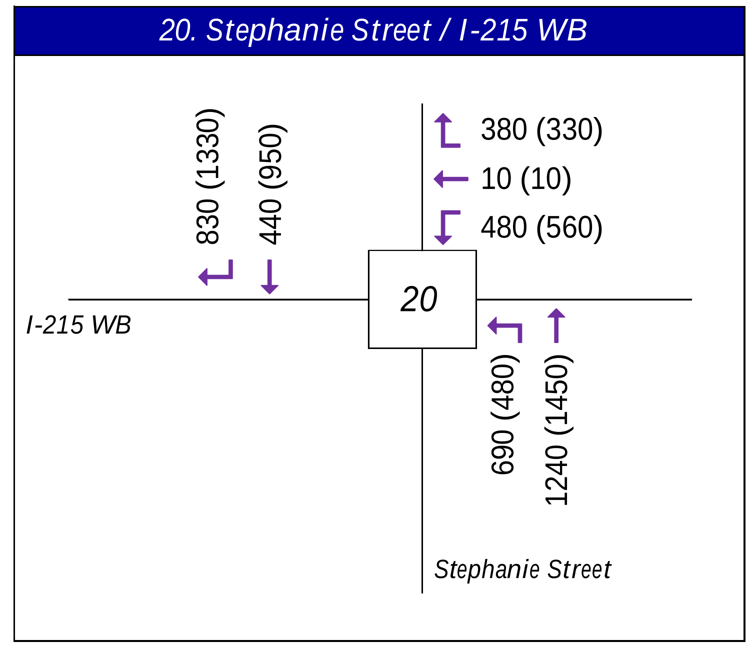


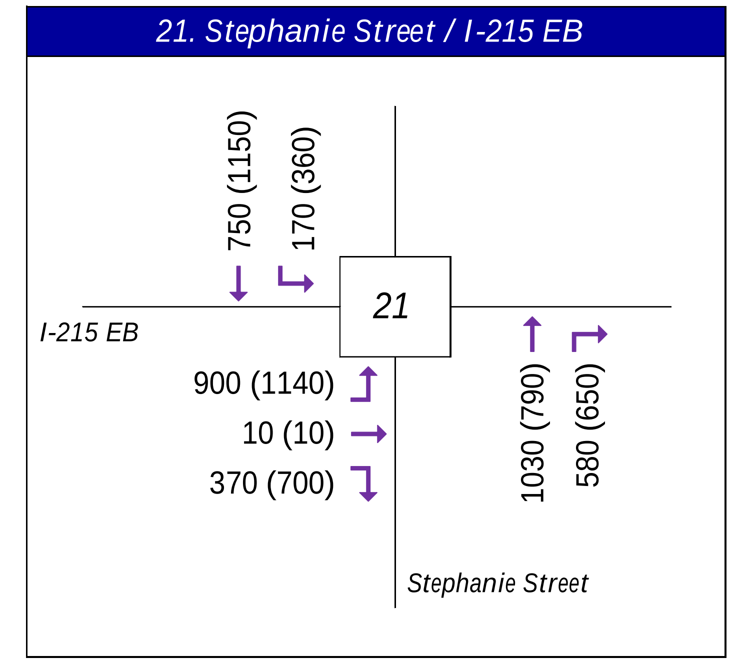
Static Assigned Volumes from the Aimsun Next model are shown as-is. A minimum nominal volume of 10 vph is shown when the volumes in the model are lower.
xx (xx): AM (PM) Peak Hour Volumes; AM Peak Hour = 7:30 AM to 8:30 AM; PM Peak Hour = 4:30 PM to 5:30 PM. Volumes may not be balanced between adjacent intersections due to rounding.
These intersections are included within the modeling limits primarily to process the traffic to the study facilities in a more realistic manner. Therefore, volumes shown are order-of-magnitude forecast volumes.

Year 2050 No-Action Alternative

AM and PM Peak Hour Volumes



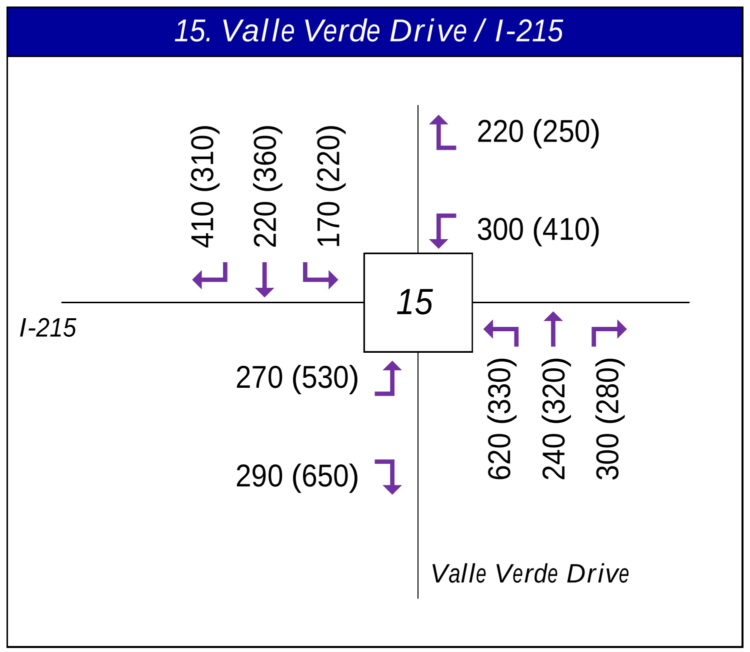


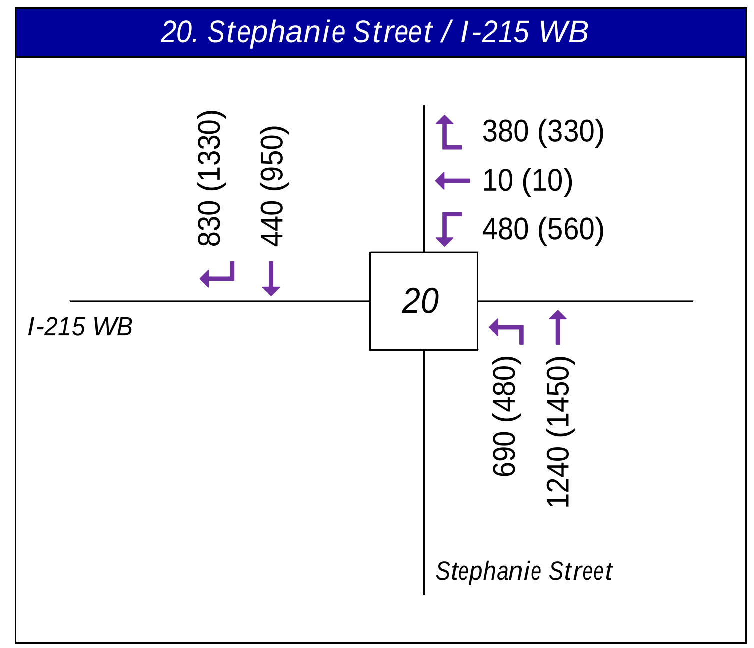


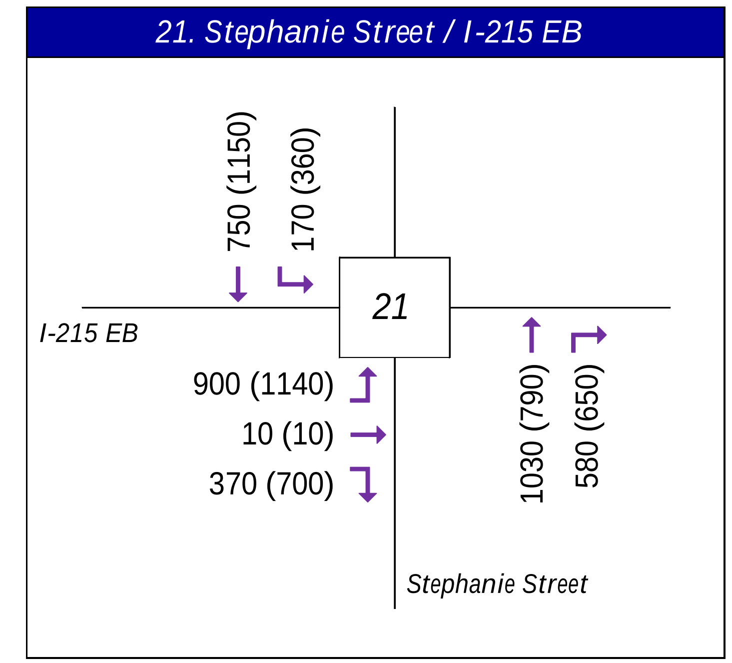
Static Assigned Volumes from the Aimsun Next model are shown as-is. A minimum nominal volume of 10 vph is shown when the volumes in the model are lower.
xx (xx): AM (PM) Peak Hour Volumes; AM Peak Hour = 7:30 AM to 8:30 AM; PM Peak Hour = 4:30 PM to 5:30 PM. Volumes may not be balanced between adjacent intersections due to rounding.
These intersections are included within the modeling limits primarily to process the traffic to the study facilities in a more realistic manner. Therefore, volumes shown are order-of-magnitude forecast volumes.

Year 2050 Build Alternative

AM and PM Peak Hour Volumes







Static Assigned Volumes from the Aimsun Next model are shown as-is. A minimum nominal volume of 10 vph is shown when the volumes in the model are lower.
xx (xx): AM (PM) Peak Hour Volumes; AM Peak Hour = 7:30 AM to 8:30 AM; PM Peak Hour = 4:30 PM to 5:30 PM. Volumes may not be balanced between adjacent intersections due to rounding.
These intersections are included within the modeling limits primarily to process the traffic to the study facilities in a more realistic manner. Therefore, volumes shown are order-of-magnitude forecast volumes.

Attachment E
FHWA Noise/TNM Certificates

Certificate of Continuing Education

This is to certify that

Patrick Joseph

has satisfactorily completed 32 hours of training on

FHWA TRAFFIC NOISE MODEL 2.5

conducted by

Bowlby & Associates, Inc.

Franklin, TN
June 24-27, 2014

William Bowlby, Ph.D., P.E.
Bowlby & Associates, Inc.

Darlene Reiter, Ph.D., P.E.
Bowlby & Associates, Inc.

Certificate of Continuing Education

This is to certify that

Lauren Munoz

has satisfactorily completed 29 hours of training on

FHWA TRAFFIC NOISE MODEL 2.5

And 7.5 hours of training on

TRAFFIC NOISE FUNDAMENTALS

conducted by

Bowlby & Associates, Inc.

Brentwood, Tennessee
April 1-5, 2019

William Bowlby, Ph.D., P.E.
Bowlby & Associates, Inc.

Darlene Reiter, Ph.D., P.E.
Bowlby & Associates, Inc.

U.S. Department
Of Transportation
Federal Highway
Administration

National Highway Institute

Certificate of Training

NATIONAL HIGHWAY INSTITUTE
Training Solutions for Transportation Excellence

Robin Sterry

has participated in

FHWA-NHI 142051
Highway Traffic Noise

hosted by

Washington Department of Transportation

Date: **August 7- 9, 2007**

Location: **Seattle, WA**

Hours of Instruction: **18**

Instructor

Local Coordinator

Instructor

Joseph S. Toole, Associate Administrator
Office of Professional and Corporate Development

U.S. Department of Transportation
Federal Highway Administration

Certificate of Training

NATIONAL HIGHWAY INSTITUTE

Certifies that *Robin K. S. Howell*

has satisfactorily completed 28 hours of training in

FUNDAMENTALS AND ABATEMENT OF HIGHWAY TRAFFIC NOISE

conducted by

THE NATIONAL HIGHWAY INSTITUTE AND THE OFFICE OF ENVIRONMENTAL POLICY

March 8 - 11, 1988	Austin, Texas
Date	Location
Robert E. Farris	Robert E. Armstrong / Mark H Wenz
Deputy Federal Highway Administrator	Instructor
George M. Shrieves	Frederick D. Moe
Director National Highway Institute	Coordinator