NOISE BARRIER ANALYSIS

Interstate 26 Port Access Road Interchange
Cities of North Charleston and Charleston
CHARLESTON COUNTY, SOUTH CAROLINA

Prepared For:

South Carolina Department of Transportation

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EXECUTIVE SUMMARY

The proposed Port Access Road interchange is located in the Cities of North Charleston and Charleston, Charleston County, South Carolina, in an industrial area near the old Charleston Navy Base. It is a new freeway interchange on I-26, located south of exit 217 (Meeting Street).

Specifically, the proposed interchange project construction activities will remove the existing Spruill Avenue ramps (Exit 218) and build a new full movement directional T-interchange connecting to a new Port Access Road. The new Port Access Road will connect to the Navy Base Terminal (NBT) that is currently under construction by the South Carolina State Ports Authority (SCSPA) on the west banks of the Cooper River at the old Navy Base.

The noise assessment has been prepared as a result of the I-26 Port Access Road EIS commitment made by the South Carolina Department of Transportation (SCDOT) in the Record of Decision (ROD) to provide noise abatement to the Rosemont residential area in the vicinity of Doscher Avenue, Whaley Way and Peace, Delano, Birdie Garret, Odessa, Peonie and Austin Streets in Charleston, SC. The receivers in the study area are comprised of residential homes, a church, a few retail/commercial land uses, a baseball field/picnic area (Rosemont Field), a community center (Freddie Whaley Sr. Community Center) and an adjacent outdoor recreational area near the community center.

This commitment was carried forward to the Port Access Road Interchange EA. The noise barrier analysis was prepared for use as part of the next phase of the project, assumed to be design build, following the guidelines in the SCDOT noise policy.

There were 26 receivers impacted in the project study area for the 2035 Design Year Build Alternative condition. SCDOT, along with input from Baker staff, selected the most feasible and reasonable barrier placement to create the preferred noise abatement feature.

Overall, the preferred barrier placement benefited all 26 of the impacted receivers. The predicted results also indicated that the preferred placement benefited an additional 21 receivers that were not impacted for a total number of 47 benefited receivers.

A public informational meeting was held at the Freddie Whaley Sr. Community Center on June 2, 2015. The proposed wall location, predicted sound level reduction benefits, the voting process and the probable construction schedule was presented to the attending landowners and local residents that reside in the Rosemont community. Property owners that would be benefited by the recommended noise barrier placement (both on-site and absentee landlords) were then sent letters and ballots by certified mail. Residents, including renters, received their ballots via door-to-door hand-delivery.

The public involvement voting process resulted in a positive “YES” vote in support for construction of the noise barrier design. As a result, the proposed noise abatement feature is to be carried forward into the engineering design phase.

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I. INTRODUCTION AND PROJECT DESCRIPTION

A. Introduction

The proposed Port Access Road interchange is located in the Cities of North Charleston and Charleston, Charleston County, South Carolina, in an industrial area near the old Charleston Navy Base. It is a new freeway interchange on I-26, located south of exit 217 (Meeting Street). Figure 1 shows the project location.

Specifically, the proposed interchange project construction activities will remove the existing Spruill Avenue ramps (Exit 218) and build a new full movement directional T-interchange connecting to a new Port Access Road. The new Port Access Road will connect to the Navy Base Terminal (NBT) that is currently under construction by the South Carolina State Ports Authority (SCSPA) on the west banks of the Cooper River at the old Navy Base.

The noise assessment has been prepared as a result of the I-26 Port Access Road EIS commitment made by the South Carolina Department of Transportation (SCDOT) in the Record of Decision (ROD) to provide noise abatement to the Rosemont residential area in the vicinity of Doscher Avenue, Whaley Way and Peace, Delano, Birdie Garret, Odessa, Peonie and Austin Streets in Charleston, SC. The receivers in the study area are comprised of residential homes, a church, a few retail/commercial land uses, a baseball field/picnic area (Rosemont Field), a community center (Freddie Whaley Sr. Community Center) and an adjacent outdoor recreational area near the community center.

This commitment was carried forward to the Port Access Road Interchange EA. The noise barrier analysis was prepared for use as part of the next phase of the project, assumed to be design build, following the guidelines in the SCDOT noise policy.

There were 102 noise receivers modeled and studied in the project area. (Receptor 97, not shown or analyzed in the report, was deemed to be too far away to be affected by the barrier analysis. Therefore, it was eliminated but the remaining noise sensitive sites were not renumbered.) The receivers are comprised of 95 residential land uses, one church, two retail/commercial sites, Rosemont Field (baseball), a picnic table area near Rosemont Field, the Freddie Whaley Sr. Community Center, and an adjacent outdoor recreational area near the community center.

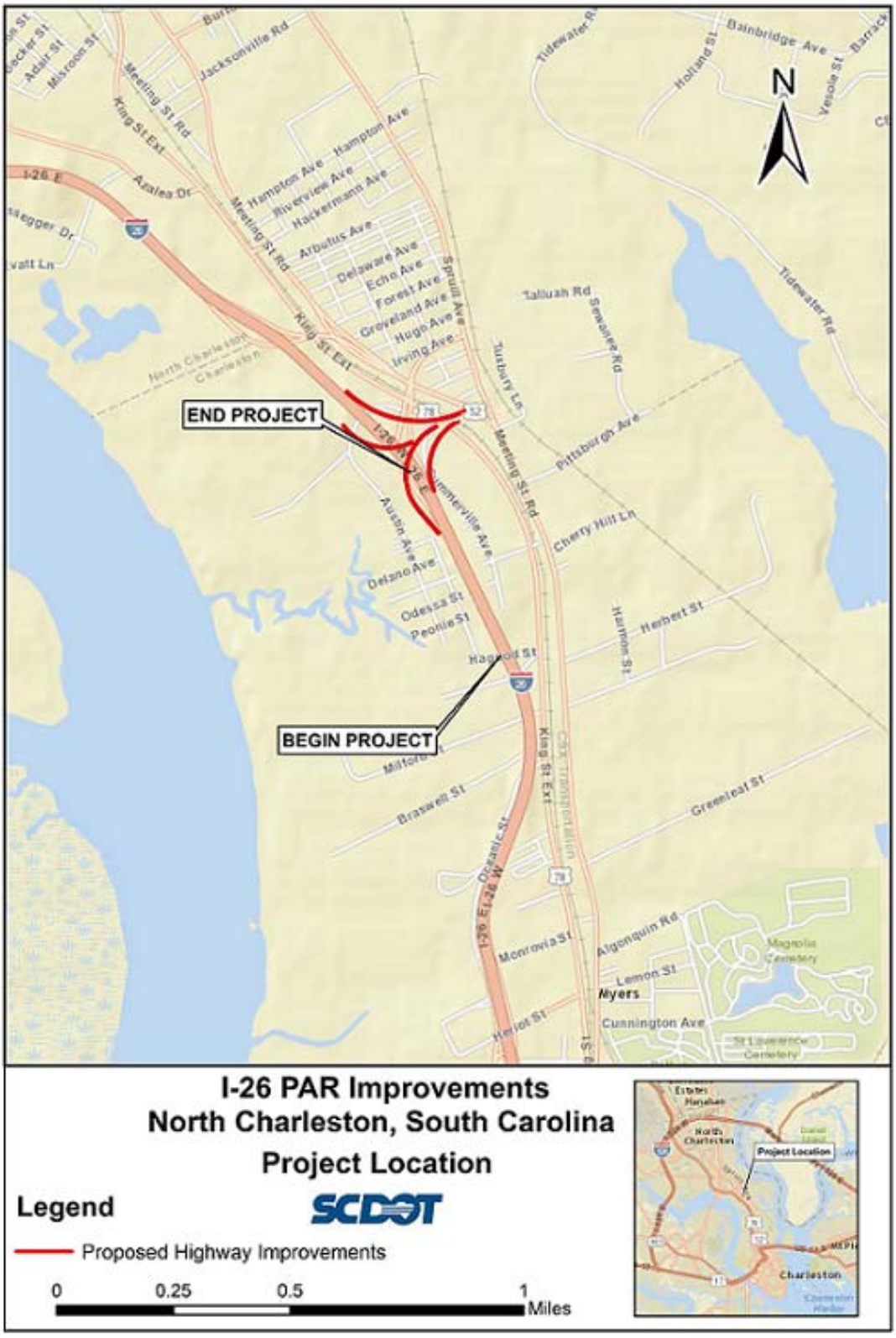

Figure 1- I-26 Port Access Interchange - Project Location

B. Purpose and Need, Existing Facility, Traffic/Roadway Conditions, and Existing Land Uses

The purpose of the proposed project is to reconstruct the existing interchange access to the Port of Charleston area. The purpose of this report is to provide potential noise barrier mitigation placements for the Rosemont community as part of the final design process.

Interstate 26 is a 6-lane Urban interstate with a posted speed of 65 miles per hour (mph). Design Hourly Volumes (DHVs) for the year 2035 are predicted to be 7,380 vehicles with a fleet mix of 96% automobiles, 2.4% medium trucks and 1.6% heavy trucks.

Much of the land use along Interstate 26 in this area is medium/heavy density residential single-family homes with commercial/retail, church and recreational land uses mixed in.

II. ANALYSIS METHODOLOGY

A. Model Used and Assumptions

The Federal Highway Administration (FHWA) Traffic Noise Model (TNM 2.5) was used to derive existing and future modeled noise levels. The environmental traffic data used was developed and approved as taken from the preliminary analysis done by CDM Smith (Appendix A). No changes were made to the traffic data. Applicable building rows, terrain lines, building structure inputs and concrete traffic barriers (jersey barriers) were added to the analysis to provide accurate sound level reduction results. The TNM inputs and outputs have been digitally provided to SCDOT (Appendix B).

B. Receptor Locations

Sensitive receivers and/or land use types were identified using aerial photography, street level views from http://maps.live.com and http://maps.google.com as well as field verification. Figure 2 (shown later in this report) depicts the location of these receivers. There are 102 noise receivers in the study area. As mentioned previously, the receivers are comprised of 95 residential land uses, one church, two retail/commercial sites, Rosemont Field (baseball), a picnic table area near Rosemont Field, the Freddie Whaley Sr. Community Center, and an adjacent outdoor recreational area near the community center.

Since the Rosemont baseball field/picnic tables and the outdoor recreational area were impacted, an equivalent receptor analysis was investigated. According to SCDOT Policy, “Active Sports Areas do not fall within the classification of non-residential uses, as a quiet environment is not important for normal activities. As such, these areas are equivalent to one impacted residence.”

C. Field Measurements

For this barrier option analysis, as per the scope of work, additional ambient noise field measurements were not taken since the 2012 analysis had already validated the model. The same model was used for this analysis with added applicable building rows, terrain lines, building structure inputs and concrete traffic barriers (jersey barriers) to provide accurate sound level reduction results.

D. Model Validation

As mentioned, the model was previously validated.

III. TRAFFIC NOISE IMPACTS

The FHWA has developed noise abatement criteria and procedures in 23 CFR Part 772, as shown in Table 1, that states that traffic noise impacts occur when either:

1) the predicted traffic noise levels approach or exceed the FHWA Noise Abatement Criteria (NAC) for the applicable activity category shown below; or,
2) the predicted traffic noise levels substantially exceed the existing noise levels by ≥15 dBA.

Table 1
23 CFR 772 (Table 1) Noise Abatement Criteria (NAC)

Activity Category	L_{eq} (h)\1,2\	L_{10} (h) \1,2\	Evaluation Location	Description of Activity Category
A	57	60	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\3\	67	70	Exterior	Residential.
C\3\	67	70	Exterior	Active sport 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	55	Interior	Auditoriums, day care 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\3\	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in 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.

SOURCE: SCDOT Traffic Noise Abatement Policy, March, 2011.

\1\ Either Leq(h) or L10(h) (but not both) may be used on a project.
\2\ The Leq(h) and L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
\3\ Includes undeveloped lands permitted for this activity category.

The modeling results for the 2015 existing condition and 2035 design year build/no barrier alternative are summarized in Table 2 and presented in Figure 2. For the noise barrier analysis, the design year no-build condition is not required. Only the existing, design year build/no barrier and design year build/with barrier scenarios (presented later) were analyzed. Furthermore, SCDOT has made a commitment to this impacted area to provide noise mitigation. Based on the SCDOT *Traffic Noise Abatement Policy*, SCDOT considers a predicted noise level within 1 dBA as "approaching" the NAC. A predicted increase of 15 dBA or more is also considered by SCDOT to substantially exceed the existing noise level.

A. Modeled Existing Year (2015) Noise Levels

There are 26 receivers that currently approach or exceed the 67 dBA NAC criteria for Category B or C. These impacted sites are comprised of 23 residential receivers (NAC B) and three recreational receivers (NAC C).

B. Modeled Design Year (Future 2035) Build Alternative Noise Levels

The sound levels are predicted to increase over the existing condition by approximately 0.3 dBA on average for Build Alternative. The sound level change over the existing condition ranges from -4.6 to 2.2 dBA. Note: there are some sites where the sound levels are predicted to decrease as a result of the new ramp placement. Nonetheless, the receivers that approached or met the impact criteria in the existing condition were still impacted in the design year condition. There were no additional impacts. There are 23 receivers predicted to approach or exceed the Category B (residential) noise criteria and three receivers for Category C (recreational), as shown in Figure 2 and Table 2.

Please note that Receivers R60 (Rosemont Pantry) and R102 (Freddie Whaley Sr. Community Center) were not officially "impacted" according to SCDOT Noise Policy since the pantry is not a residence and the community center was analyzed for interior sound levels. Nonetheless, both were predicted to receive sound level reduction benefits as a result of the mitigation analysis.

IV. FEASIBLE AND REASONABLE CONSIDERATION OF ABATEMENT

Since traffic noise impacts were predicted with the proposed project, the following section of the report considers the feasibility and reasonableness of the noise abatement. As part of this analysis, SCDOT has committed to provide noise abatement in this residential area in the form of a noise barrier. No other forms of abatement were considered (traffic management, horizontal/vertical alteration, property acquisition, noise insulation, etc.).

When considering noise abatement measures, primary consideration shall be given to exterior areas where frequent human use occurs. Since South Carolina is not part of the FHWA-approved Quiet Pavement Pilot Program, the use of quieter pavements was not considered as an abatement measure for the proposed project. In addition, the planting of vegetation or landscaping was also not considered as a potential abatement measure, since it is not an acceptable Federal-aid noise abatement measure due to the fact that only dense stands of evergreen vegetation planted 100 feet deep will reduce noise levels. In accordance with 23 CFR §772.13(c), a noise barrier was considered and evaluated as a means to reduce or eliminate the traffic noise impacts.

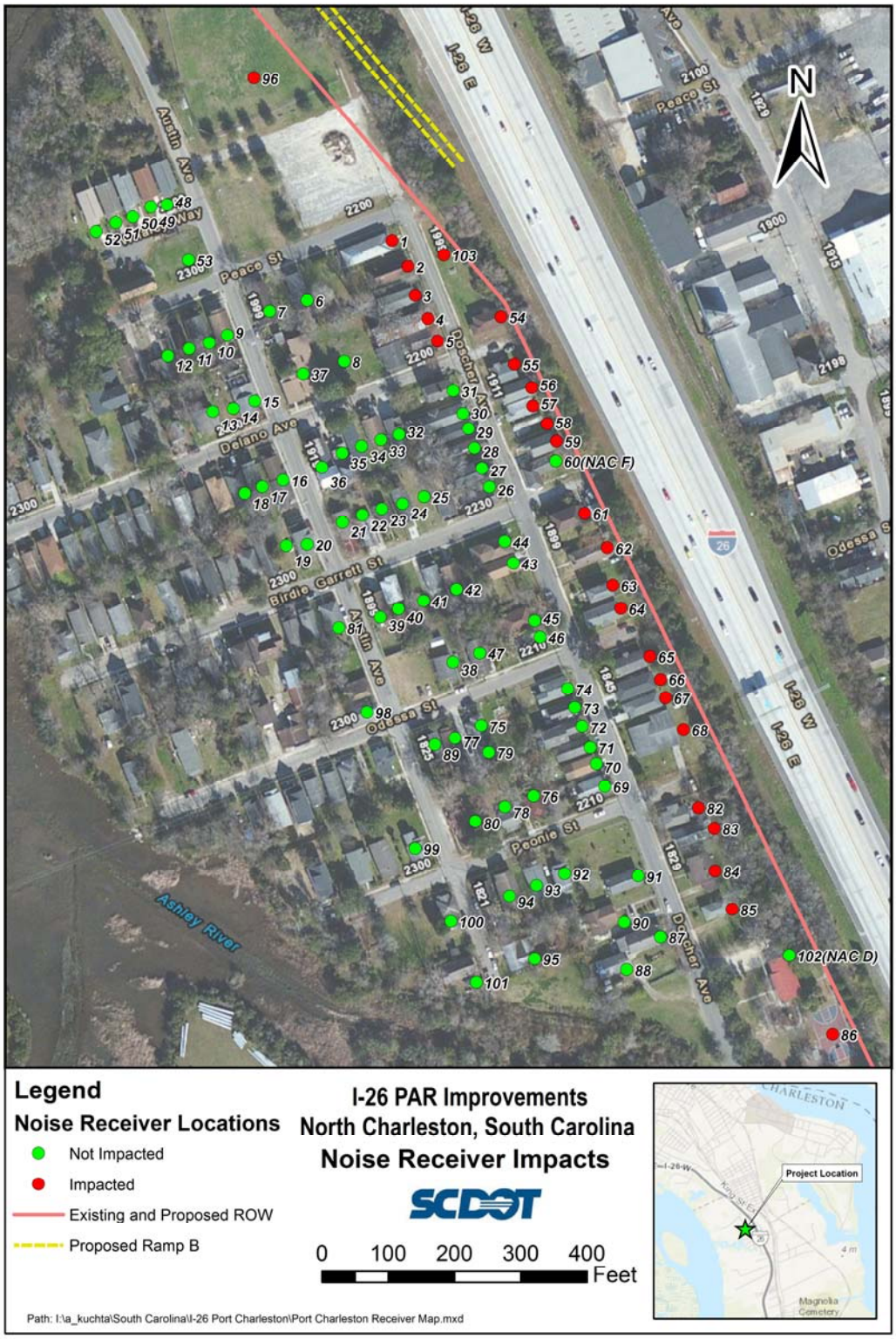

Figure 2 – Impacted Noise Receptor Locations

Table 2
I-26 Charleston PAR – Existing and Design Year Sound Levels

RECEPTOR NUMBER	EXISTING 2015	2035 BUILD	INCREASE OVER EXISTING	NAC IMPACT ?	SUBSTANTIAL INCREASE IMPACT?	NAC	NAC Criteria Level	LAND USE
1	70.2	67.5	-2.7	Y	N	B	66	Residence - Doscher Avenue
2	70.1	66.8	-3.3	Y	N	B	66	Residence - Doscher Avenue
3	69.3	66.4	-2.9	Y	N	B	66	Residence - Doscher Avenue
4	68.8	66.0	-2.8	Y	N	B	66	Residence - Doscher Avenue
5	68.3	66.0	-2.3	Y	N	B	66	Residence - Doscher Avenue
6	60.5	60.5	0.0	N	N	B	66	Residence - Peace Street
7	61.2	60.9	-0.3	N	N	B	66	Residence - Peace Street
8	56.5	57.6	1.1	N	N	B	66	Residence - Delano Street
9	60.2	60.0	-0.2	N	N	B	66	Residence - Peace Street
10	59.6	59.2	-0.4	N	N	B	66	Residence - Peace Street
11	58.9	58.6	-0.3	N	N	B	66	Residence - Peace Street
12	58.5	58.3	-0.2	N	N	B	66	Residence - Peace Street
13	57.6	57.8	0.2	N	N	B	66	Residence - Delano Street
14	57.7	58.1	0.4	N	N	B	66	Residence - Delano Street
15	57.9	58.3	0.4	N	N	B	66	Residence - Delano Street
16	57.3	57.8	0.5	N	N	B	66	Residence - Delano Street
17	56.7	57.2	0.5	N	N	B	66	Residence - Delano Street
18	56.7	57.1	0.4	N	N	B	66	Residence - Delano Street
19	56.8	57.5	0.7	N	N	B	66	Residence - Birdie Garrett Street
20	57.5	58.1	0.6	N	N	B	66	Residence - Birdie Garrett Street
21	58.0	58.3	0.3	N	N	B	66	Residence - Birdie Garrett Street
22	58.2	58.3	0.1	N	N	B	66	Residence - Birdie Garrett Street
23	58.8	58.8	0.0	N	N	B	66	Residence - Birdie Garrett Street
24	59.3	58.8	-0.5	N	N	B	66	Residence - Birdie Garrett Street
25	60.0	59.2	-	-	-	F	-	Commercial - Birdie Garrett Street
26	59.9	60.7	0.8	N	N	B	66	Residence - Doscher Avenue
27	58.1	59.2	1.1	N	N	B	66	Residence - Doscher Avenue
28	59.2	60.1	0.9	N	N	B	66	Residence - Doscher Avenue
29	59.9	60.4	0.5	N	N	B	66	Residence - Doscher Avenue
30	61.7	61.1	-0.6	N	N	B	66	Residence - Doscher Avenue
31	64.6	62.7	-1.9	N	N	B	66	Residence - Doscher Avenue
32	60.4	59.8	-0.6	N	N	B	66	Residence - Delano Street
33	59.0	58.3	-0.7	N	N	B	66	Residence - Delano Street
34	58.4	57.9	-0.5	N	N	B	66	Residence - Delano Street
35	57.8	57.8	0.0	N	N	B	66	Residence - Delano Street
36	57.7	57.9	0.2	N	N	B	66	Res/Beauty Salon - Delano Street
37	57.6	58.3	0.7	N	N	B	66	Residence - Delano Street
38	60.5	60.8	0.3	N	N	B	66	Residence - Odessa Street
39	58.8	59.3	0.5	N	N	B	66	Residence - Birdie Garrett Street
40	59.3	59.6	0.3	N	N	B	66	Residence - Birdie Garrett Street

Source: Michael Baker International

Table 2
I-26 Charleston PAR – Existing and Design Year Sound Levels

RECEPTOR NUMBER	EXISTING 2015	2035 BUILD	INCREASE OVER EXISTING	NAC IMPACT ?	SUBSTANTIAL INCREASE IMPACT?	NAC	NAC Criteria Level	LAND USE
41	60.1	60.3	0.2	N	N	B	66	Residence - Birdie Garrett Street
42	60.4	60.9	0.5	N	N	B	66	Residence - Birdie Garrett Street
43	62.9	63.2	0.3	N	N	B	66	Residence - Doscher Avenue
44	62.8	63.1	0.3	N	N	B	66	Residence - Doscher Avenue
45	60.9	61.8	0.9	N	N	B	66	Residence - Doscher Avenue
46	60.7	61.8	1.1	N	N	B	66	Residence - Doscher Avenue
47	60.2	60.9	0.7	N	N	B	66	Residence - Odessa Street
48	61.8	61.1	-0.7	N	N	B	66	Residence -Whaley Way
49	61.3	60.7	-0.6	N	N	B	66	Residence -Whaley Way
50	60.7	60.4	-0.3	N	N	B	66	Residence -Whaley Way
51	60.2	59.9	-0.3	N	N	B	66	Residence -Whaley Way
52	59.4	59.4	0.0	N	N	B	66	Residence -Whaley Way
53	61.2	60.4	-0.8	N	N	B	66	Residence -Whaley Way
54	74.3	70.2	-4.1	Y	N	B	66	Residence - Doscher Avenue
55	73.7	73.3	-0.4	Y	N	B	66	Residence - Doscher Avenue
56	74.2	74.2	0.0	Y	N	B	66	Residence - Doscher Avenue
57	73.2	73.1	-0.1	Y	N	B	66	Residence - Doscher Avenue
58	74.1	74.1	0.0	Y	N	B	66	Residence - Doscher Avenue
59	74.1	74.1	0.0	Y	N	B	66	Residence - Doscher Avenue
60	72.8	73.1	-	-	-	F	-	Commercial - Doscher Avenue
61	73.7	74.0	0.3	Y	N	B	66	Residence - Doscher Avenue
62	74.0	74.6	0.6	Y	N	B	66	Residence - Doscher Avenue
63	72.8	73.6	0.8	Y	N	B	66	Residence - Doscher Avenue
64	72.7	73.4	0.7	Y	N	B	66	Residence - Doscher Avenue
65	72.8	73.9	1.1	Y	N	B	66	Residence - Doscher Avenue
66	72.7	74.0	1.3	Y	N	B	66	Residence - Doscher Avenue
67	72.4	73.7	1.3	Y	N	B	66	Residence - Doscher Avenue
68	72.4	73.9	1.5	Y	N	B	66	Residence - Doscher Avenue
69	61.9	64.1	2.2	N	N	B	66	Residence - Doscher Avenue
70	61.0	62.7	1.7	N	N	B	66	Residence - Doscher Avenue
71	59.6	60.7	1.1	N	N	B	66	Residence - Doscher Avenue
72	57.7	58.7	1.0	N	N	B	66	Residence - Doscher Avenue
73	59.6	60.3	0.7	N	N	B	66	Residence - Doscher Avenue
74	61.9	62.3	0.4	N	N	B	66	Residence - Doscher Avenue
75	58.8	59.7	0.9	N	N	B	66	Residence - Odessa Street
76	58.8	60.4	1.6	N	N	B	66	Residence - Peonie Street
77	58.3	59.3	1.0	N	N	B	66	Residence - Odessa Street
78	58.1	59.6	1.5	N	N	B	66	Residence - Peonie Street
79	58.5	59.6	1.1	N	N	B	66	Residence - Odessa Street
80	57.5	58.7	1.2	N	N	B	66	Residence - Peonie Street

Source: Michael Baker International

Table 2
I-26 Charleston PAR – Existing and Design Year Sound Levels

RECEPTOR NUMBER	EXISTING 2015	2035 BUILD	INCREASE OVER EXISTING	NAC IMPACT ?	SUBSTANTIAL INCREASE IMPACT?	NAC	NAC Criteria Level	LAND USE
81	57.5	58.1	0.6	N	N	B	66	Residence - Birdie Garrett Street
82	70.7	72.1	1.4	Y	N	B	66	Residence - Doscher Avenue
83	70.6	72.1	1.5	Y	N	B	66	Residence - Doscher Avenue
84	69.4	70.5	1.1	Y	N	B	66	Residence - Doscher Avenue
85	68.1	69.8	1.7	Y	N	B	66	Residence - Doscher Avenue
86	67.3	68.7	1.4	Y	N	C	66	Recreation Area - Doscher Avenue
87	58.8	60.4	1.6	N	N	B	66	Residence - Doscher Avenue
88	58.0	59.4	1.4	N	N	B	66	Residence - Doscher Avenue
89	58.0	58.9	0.9	N	N	B	66	Residence - Odessa Street
90	55.6	56.7	1.1	N	N	B	66	Residence - Doscher Avenue
91	58.2	59.5	1.3	N	N	B	66	Residence - Doscher Avenue
92	59.0	60.6	1.6	N	N	B	66	Residence - Peonie Street
93	58.1	59.6	1.5	N	N	B	66	Residence - Peonie Street
94	57.4	58.8	1.4	N	N	B	66	Residence - Peonie Street
95	56.2	57.6	1.4	N	N	B	66	Residence - Austin Street
96	67.1	67.0	-0.1	Y	N	C	66	Park - Austin Avenue
98	56.8	58.0	1.2	N	N	C/B	66	Church/Residences - Odessa St.
99	56.3	57.3	1.0	N	N	B	66	Residence - Peonie Street
100	56.5	57.6	1.1	N	N	B	66	Residence - Peonie Street
101	55.3	56.3	1.0	N	N	B	66	Residence - Austin Street
102	43.9	44.5	0.6	N	N	D	51	Community Center-Doscher Avenue
103	72.5	67.9	-4.6	Y	N	C	66	Park - Doscher Avenue

Source: Michael Baker International

A. Noise Barriers

Among the most common noise barriers are earthen berms and freestanding walls. The optimum situation for use of free-standing noise barriers is when a dense concentration of impacted receivers lies directly adjacent to and parallel with the highway right-of-way. In these instances, one barrier can protect many people at a relatively low cost per impacted site. For this study, an earthen berm was ruled out since there is not enough room for proper sloping, drainage issues and trees would most likely need to be removed.

Based on the need for a barrier to be continuous and to protect a dense concentration of receivers, it is not considered reasonable to provide abatement for single impacted receivers or on non-controlled access facilities where access would impact the barrier. Interstate 26 is a controlled access facility and the installation of a noise barrier would not impact access for the dense concentration of receivers in the study area.

When considering abatement, the SCDOT Noise Policy Guidelines state that noise abatement measures must be both feasible and reasonable. The feasibility and reasonableness of a noise barrier is determined by the following factors for Feasibility and Reasonableness.

1. Feasibility:

a. Acoustic Feasibility - It is SCDOT's policy that a noise reduction of at least 5 dBA must be achieved for at least 75 percent of impacted receivers for the noise abatement measure to be acoustically feasible.

b. Engineering Feasibility - Feasibility deals with engineering considerations. The ability to achieve noise reduction may be limited by engineering considerations such as the topographical features of the area, safety, drainage, utilities, Maintenance and access. In addition, due to constructability constraints, the height of the noise abatement measure cannot exceed 25 feet.

2. Reasonableness:

There are three mandatory reasonable factors that must be met for a noise abatement measure to be considered reasonable. The three mandatory reasonable factors must collectively be achieved in order for a noise abatement measure to be deemed reasonable. Failure to achieve any one of the reasonable factors will result in the noise abatement measure being deemed not reasonable. Completion of a "Feasibility and Reasonableness Worksheet" is required for inclusion in the noise analysis report. This was completed after the public involvement voting process.

a. Viewpoints of the Property Owners and Residents of the Benefited Receivers – SCDOT shall solicit the viewpoints of all of the benefited receptors and document a decision on either desiring or not desiring the noise abatement measure. For this project, the viewpoints were solicited as part of the public involvement process through a public informational meeting and through a voting process. The public informational meeting was held at the Freddie Whaley Sr. Community Center on June 2, 2015. The proposed wall location, predicted sound level reduction benefits, the voting process and the probable construction schedule was presented to the attending landowners and local residents in the Rosemont community.

Home owner associations or local governments cannot be given authority over the desirability for abatement. The viewpoints of the abatement must be solicited from the property owners and tenants.

For non-owner occupied benefited receptors, both the property owner and the renter may vote on whether the noise abatement is desired. One owner ballot and one resident ballot shall be solicited for each benefited receptor.

The method of obtaining the votes is determined on a project-by-project basis. For this project, informational brochures and ballots were mailed to the homeowners and hand-delivered to the residential occupants that are renting the various impacted and/or benefited properties. The voting ballot explained that the noise abatement shall be constructed unless a majority (greater than 50% of the benefited receptors) of votes not desiring noise abatement is received.

The results of the voting process is presented in this report in Section V, Findings and Recommendations.

b. Cost Effectiveness - The allowable cost of the abatement will be based on $35.00 per square foot. This allowable cost is based on actual construction costs on recent SCDOT projects. This construction cost will be divided by the number of benefited receptors. If the cost per benefited receptor is less than $30,000 then the barrier is determined to be cost effective. This allowable cost will be reanalyzed every 5 years.

During the detailed noise abatement evaluation, a more project-specific construction cost may be applied at a cost per square foot basis. The estimation will take into consideration the cost of the actual noise barrier, required hydrology, additional right-of-way, and other aspects associated with the noise barrier construction.

c. *Noise Reduction Design Goal* - It is SCDOT's policy that a noise reduction of at least 8 dBA must be achieved for 80% of those receivers determined to be in the first two building rows and considered benefited. Please note that the first two building rows will only be applicable if they are within 500 feet from the edge of pavement noise source.

Several barrier scenarios were modeled that included various barrier lengths, individual panel section heights, offsets and multiple overlapping barriers. Noise barriers were also investigated on the proposed Ramp B structure.

In due course, the selected preferred barrier placement provided a benefit to <u>all</u> predicted impacted receivers. Figure 3 shows the general placement of the optimized barrier locations as well as the amount of sound level reduction at each receiver. Table 3 also shows the predicted sound reduction levels for each receiver. Both the figures and the table are shown after the barrier placement discussion text.

Preferred Optimized Barrier Placement: The preferred option includes a barrier set of two (2) sound reduction walls. The first barrier is 11-17 feet high and ~1470 feet long, located near the roadway, approximately 7 feet off the pavement (less where it transitions into the structures on either side), an estimated 4 foot below the elevation of the center of the near lane, plus a 4 foot parapet height (±) on the west (right) side of Ramp B (between Sta. 5814+00 to Sta. 5820+50) and no changes made to the existing I-26 parapet over Hagood Street.

Noise barriers were analyzed but not proposed to be on the Ramp B structure sections because the sound levels from I-26 will still be able to travel under the structure. The preliminary analysis results showed that even with a 14 foot high noise wall on the structure, the sound level reduction changes between a no barrier and a 14 foot barrier scenario on Ramp B are less than 1 dBA for the nearest receivers.

Therefore, a second noise barrier was added to account for the I-26 mainline sound levels that travel under Ramp B. This barrier is an 11-12 foot high and ~550 foot long barrier along the I-26 mainline. This barrier is placed in the center of the existing (and proposed to be abandoned) southbound on-ramp where it is on fill.

Feasibility:

Acoustic Feasibility: SCDOT noise policy states that a noise reduction of at least 5 dBA must be achieved for 75 percent of the impacted receptors. This was achieved at 26 of the 26 receptors (100%).

Engineering Feasibility: Barrier is located near to the I-26 shoulder and guiderail/concrete traffic barrier would likely be required between the road the noise barrier. The north barrier would be placed in the approximate center of the former southbound on-ramp in the area where the ramp had transitioned to the fill area from being on structure.

Reasonableness:

Noise Reduction Design Goal: SCDOT noise policy states that at least 8 dBA must be achieved for 80 percent of the benefited receivers. There were 47 benefited receivers. There were 20 receivers that achieved the 8 dBA reduction (43%).

Cost Effectiveness: The analyzed barrier was deemed to be reasonable as the estimated cost per benefited receiver (~$1,007,454 cost / 47 benefited receivers = $21, 435) was within the SCDOT $30,000 cost per benefited receiver criteria.

Public Viewpoints: The public involvement process resulted in a positive vote in favor of construction of the barrier. Specific voting results are shown in Section V, Findings and Recommendations.

Conclusion: Based on the above information, the SCDOT commitment for noise mitigation in this area and the public approval for barrier construction, this abatement feature is acceptable and proposed to be carried forward to the final design engineering phase.

Table 3
I-26 Charleston PAR – Build Alternative Sound Level Reductions (dBA)

RECEIVER NUMBER	2035 BUILD (No Barrier)	PREDICTED REDUCTION (With Barrier)
1	67.5	6
2	66.8	6
3	66.4	7
4	66.0	7
5	66.0	7
6	60.5	3
7	60.9	3
8	57.6	2
9	60.0	3
10	59.2	2
11	58.6	1
12	58.3	1
13	57.8	1
14	58.1	1
15	58.3	1
16	57.8	1
17	57.2	1
18	57.1	1
19	57.5	1
20	58.1	2
21	58.3	2
22	58.3	2
23	58.8	3
24	58.8	3
25	59.2	4
26	60.7	5
27	59.2	3
28	60.1	4
29	60.4	4
30	61.1	4
31	62.7	5
32	59.8	3
33	58.3	2
34	57.9	1
35	57.8	1
36	57.9	1
37	58.3	1
X	Blue shaded cells show receivers that were predicted to have a minimum 5 dBA reduction.	
X	Green shaded cells show receivers that were predicted to have a minimum 8 dBA reduction	
X	Red shaded cells show receivers that were predicted to be impacted for the Build Alternative.	
-	Note: As a result of the ineffectiveness of the noise barriers on structure, Barrier options 3, 4, 5 and 6 were eliminated from the analysis.	

Source: Michael Baker International, April, 2015

Table 3
I-26 Charleston PAR – Build Alternative Sound Level Reductions (dBA)

RECEIVER NUMBER	2035 BUILD (No Barrier)	PREDICTED REDUCTION (With Barrier)
38	60.8	5
39	59.3	4
40	59.6	4
41	60.3	5
42	60.9	6
43	63.2	7
44	63.1	7
45	61.8	6
46	61.8	7
47	60.9	6
48	61.1	2
49	60.7	2
50	60.4	1
51	59.9	1
52	59.4	1
53	60.4	2
54	**70.2**	9
55	**73.3**	12
56	**74.2**	12
57	**73.1**	12
58	**74.1**	12
59	**74.1**	12
60	73.1	12
61	**74.0**	12
62	**74.6**	13
63	**73.6**	12
64	**73.4**	12
65	**73.9**	12
66	**74.0**	12
67	**73.7**	12
68	**73.9**	12
69	64.1	8
70	62.7	7
71	60.7	5
72	58.7	4
73	60.3	5
74	62.3	7
X	Blue shaded cells show receivers that were predicted to have a minimum 5 dBA reduction.	
X	Green shaded cells show receivers that were predicted to have a minimum 8 dBA reduction	
X	Red shaded cells show receivers that were predicted to be impacted for the Build Alternative.	
-	Note1: R60 is an NAC F retail land use (no impact criteria). Nonetheless, the land use was benefited and was included in the reasonable and feasible calculations.	

Source: Michael Baker International, April, 2015

Table 3

I-26 Charleston PAR – Build Alternative Sound Level Reductions (dBA)

RECEIVER NUMBER	2035 BUILD (No Barrier)	PREDICTED REDUCTION (With Barrier)
75	59.7	5
76	60.4	5
77	59.3	4
78	59.6	4
79	59.6	5
80	58.7	4
81	58.1	3
82	**72.1**	11
83	**72.1**	11
84	**70.5**	10
85	**69.8**	9
86	**68.7**	5
87	60.4	3
88	59.4	2
89	58.9	4
90	56.7	2
91	59.5	4
92	60.6	5
93	59.6	4
94	58.8	4
95	57.6	2
96	**67.0**	5
98	58.0	3
99	57.3	3
100	57.6	3
101	56.3	3
102	44.5	7
103	**67.9**	7
X	Blue shaded cells show receivers that were predicted to have a minimum 5 dBA reduction.	
X	Green shaded cells show receivers that were predicted to have a minimum 8 dBA reduction	
X	Red shaded cells show receivers that were predicted to be impacted for the Build Alternative.	
-	Note2: R102 is an NAC D interior land use and was not impacted. Nonetheless, the land use was benefited and was included in the reasonable and feasible calculations.	
	Note3: R97 was too far away from the analysis area and was deleted from the study.	

Source: Michael Baker International, April, 2015

Figure 3 – Preferred Noise Barrier Placement and Results

V. FINDINGS AND RECOMMENDATIONS

Overall, the analysis results indicate that there were 26 impacted receivers predicted in the project study area for the 2035 Design Year Build Alternative condition. SCDOT, along with input from Baker staff, selected the most feasible and reasonable placement to create the preferred noise abatement feature.

The preferred preliminary barrier set placement is deemed to be feasible and reasonable (with the exception of the design goal criteria) and provides benefits (5-13 dBA reduction) to all of the 26 impacted receivers, plus residual benefits of 5 dBA reductions (or more) to 21 additional non-impacted receivers. Furthermore, an additional 27 receivers are predicted to receive a 3-4 dBA reduction (a 3 dBA change is considered perceptible to the typical person). Please note that reasonable design modifications can still be made during final design if the engineering process requires some changes.

Survey Voting Results

This section documents the process and results of the public involvement surveys conducted for the recommended noise barrier.

The preferred barrier placement was presented to the public on June 2, 2015 to inform the attending landowners and local residents of the proposed project. Property owners that would be benefited by the recommended noise barrier placement (both on-site and absentee landlords) were then sent letters and ballots by certified mail. Residents, including renters, received their ballots via door-to-door hand-delivery. These letters provided fourteen (14) calendar days from the anticipated delivery date (June 12, 2015) to provide the recipients ample time to review and respond to the survey.

The letters and ballots, sent from SCDOT, asked the respondents to indicate whether they wished to have the proposed noise barriers constructed or not. In these deliveries, the barrier location, SCDOT contact information, survey form and return envelope were provided to the recipients. The mailings gave the property owners and/or residents an understanding of the proposed project, the voting procedure, the proposed project schedule, an opportunity to provide comments, an “after-construction” graphic rendition of the proposed barrier and the survey ballot.

As per SCDOT policy, only the owners and residents of those receptor units that will be benefited by the proposed mitigation may vote on whether the proposed noise barrier should be constructed. The owner/resident of each benefited receptor unit shall be entitled to one weighted vote, regardless of the number of owners of that receptor unit unless they are the owners of a rental facility or the developer of lands. Additionally, as per SCDOT policy, the owners/residents were informed that the noise barrier shall be constructed unless a majority of votes is received to NOT have the noise barrier constructed (greater than 50% of the benefited receptors).

For this project, a total of forty-eight (48) certified letters were mailed. Several properties were owned by the same person, legal entity or land manager. As a result, each of their benefited sites was eligible to cast one vote. Approximately 34 surveys were hand delivered. (Please note that the term “approximately” is used because some properties were found to be unoccupied and another was found to only have one residence where two were shown on the lot and another site only had the foundation remaining on the property.)

SCDOT's noise policy states that the noise barrier shall be constructed unless a majority of votes are received to not have the noise barrier constructed. There were 82 ballots, therefore, a total of 42 "NO" votes was needed to not have the barrier constructed. Twenty (20) ballots were returned with a "YES" vote indicating that they wanted the proposed noise barrier. Four (4) ballots were received with a "NO" vote. Eight (8) mailed ballots were returned to SCDOT (deceased, no such owner lives here, etc.)). Since there were four (4) "NO" votes and 42 were needed, the barrier was approved by the majority of the benefited public as defined by SCDOT noise policy. Therefore, the barrier is proposed to be carried forward to the design/construction phase. Table 4 summarizes the vote count and Table 5 summarizes the various comments that were received.

Table 4
I-26 Charleston PAR – Surveyed Vote Count Results

RETURNED "YES" VOTES	RETURNED "NO" VOTES	RETURNED TO SENDER
20	4	8

Source: SCDOT, July, 2015

Table 5
I-26 Charleston PAR – Summary of Returned Public Comments

COMMENT QUANTITY	COMMENT
13	No Comment Provided
4	General comments asking that the wall be built as soon as possible and/or "thanks".
2	Comments stating that there is already a natural tree zone.
2	General comments regarding the proposed appearance of the wall.
1	General comment regarding the distance of the wall from the houses.
1	Comment stating that the little amount of noise is not bad.
1	Owner is deceased
1	General comment relating to the noise environment after I-26 was constructed, the positive growth of the area and that the air flow will be reduced if the barrier is built.

Source: SCDOT, July, 2015

As a result of the voting process, the barrier was approved and it will be carried through into the next phase of the project. A Feasibility and Reasonableness Worksheet is included for the chosen preferred barrier placement (Appendix C).

Statement of Likelihood
Based on the studies thus far accomplished, SCDOT intends to install highway traffic noise abatement measures in the form of a two (2) barrier set.

The first barrier in the set is proposed to be located at approximately Station 5820+50 to 5833+04 along the proposed Ramp B, transitioning to the I-26 mainline stationing starting at I-26 Station 5833+56 and ending at Station 5835+12 (Hagood overpass). This preliminary location is approximately 9 feet from the proposed edge of shoulder (less where it transitions into the structures on either side) and an estimated 4 feet below the elevation of the center of the near lane. The total length of this barrier is approximately 1,466 feet, ranging from 11-17 feet in height and with an approximate total of 28,784 square feet. Stationing (approximate): The barrier is currently proposed to be 15 feet high from Station 5820+50 to 5825+01, then 16 feet high from Station 5825+01 to Station 5826+02, then 17 feet high from Station 5826+02 to 5830+00, then 16 feet high from 5830+00 to 5831+96, then 15 feet high from 5831+96 to 5832+50, then 14 feet high from 5832+50 to 5833+56, then 12 feet high from 5833+56 to 5834+03, then 11 feet high from 5834+03 to 5835+12 (approximate, at/near the I-26 Hagood Bridge overpass concrete/rail traffic barrier).

The second barrier in the set is proposed to be located at approximately Station 5814+80 to 5820+30 along the I-26 mainline. The barrier is currently proposed to be placed on the approximate centerline of the existing (proposed to be former) southbound on ramp from Spruill Avenue to I-26. The total length of this barrier is approximately 550 feet, ranging from 11-12 feet in height and with an approximate total of 6,383 square feet. The barrier is currently proposed to be 11 feet high from approximately Station 5814+80 to 5816+10, about 217 feet long, then 12 feet high for approximately 333 feet in length.

Both walls are proposed to be concrete post and panel with a form liner on the highway-facing side that includes a fractured fin surface treatment.

The walls are not required to be treated with an absorptive material. The average height of the southern wall is expected to be 15.3 feet. Following the FHWA 10:1 distance to average height ratio for reflective analysis requirements, an analysis would be required for a noise-sensitive receiver within approximately 153 feet (10 x 15.3 feet). The three nearest residences on the westbound side of I-26 are 1) approximately 305 feet (and is shielded by other buildings), 2) 210 feet (visually shielded by trees), and 3) 190 feet (also visually shielded by trees). All of these residences are outside the 153 foot distance criteria. The other land uses in this area are commercial/industrial and are not subject to the noise criteria per 23 CFR 772. Note: there was a residence on the northbound side of I-26 that was approximately 290 feet from the northern wall (11.5 foot high average). However, it no longer exists.

Since the barrier was approved through the public involvement process at this time, it is forwarded into the next phase of the project. Preliminary X, Y coordinates (northings/eastings) and Z coordinates (estimated base elevations) based on current stationing are provided to the SCDOT for use in the design engineering phase (Appendix D).

These preliminary indications of likely abatement measures are based upon preliminary design for a barrier cost of $35.00 per square foot that will reduce the noise level by 5-13 dB(A) for impacted and benefited residences. If it subsequently develops during the final design engineering phase that these conditions have substantially changed, the abatement measure would be revisited to see if the sound level reductions are still valid. This process may or may not involve a re-analysis of the noise modeling, depending on the level of change, to be decided by the noise modeler in conjunction with SCDOT.

VI. CONSTRUCTION NOISE

Since the noise wall placement was chosen through the public involvement process, temporary increases in noise levels will occur during the time period that construction takes place for the noise wall and the proposed roadway. Noise levels due to construction, although temporary, can impact areas adjacent to the project. The major noise sources from construction would be the heavy equipment operated at the site. However, other construction site noise sources would include hand tools and trucks supplying and removing materials.

Typical noise levels generated by different types of construction equipment are presented in Table 6. Construction operations are typically broken down into several phases including clearing and grubbing, earthwork, erection, paving and finishing. Although these phases can overlap, each has their own noise characteristics and objective.

SCDOT's "2007 Standard Specifications for Highway Construction" includes various references to construction noise, including Sections 107.6-paragraph 3, 606.3.1.6.3-paragraph 1, 607.3.1.6.3-paragraph 1, 607.3.2.6.3-paragraph 1, and 702.4.15-paragraph 3. The SCDOT specifications cited above are generalized for nuisance noise avoidance. Detailed specifications suggested for consideration for inclusion in the proposed project's construction documents may consist of the following:

- Construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler.
- Air compressors shall meet current USEPA noise emission exhaust standards.
- Air powered equipment shall be fitted with pneumatic exhaust silencers.
- Stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of noise sensitive areas without portable noise barriers placed between the equipment and noise sensitive sites. Noise sensitive sites include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas.
- Portable noise barriers shall be constructed of plywood or tongue and groove boards with a noise absorbent treatment on the interior surface (facing the equipment).
- Powered construction equipment shall not be operated during the traditional evening and/or sleeping hours within 150 feet of a noise sensitive site, to be decided either by local ordinances and/or agreement with the SCDOT.

VII. COORDINATION WITH LOCAL OFFICIALS

SCDOT has no authority over local land use planning and development. SCDOT can only encourage local officials and developers to consider highway traffic noise in the planning, zoning and development of property neat existing and proposed highway corridors. The lack of consideration of highway traffic noise in land use planning at the local level has added to the highway traffic noise problem which will continue to grow as development continues adjacent to major highway long after these highways were proposed and/or constructed.

Typically, in order to help local officials and developers consider highway traffic noise in the vicinity of proposed Type I project, SCDOT will inform them of the predicted future noise levels and the required distance from such projects needed to ensure that noise levels remain below the NAC for each type of land use. For this analysis, however, the contour was not calculated as the proposed mitigation only addresses a densely developed residential area for which mitigation is already proposed and committed.

Table 6
Leq Noise Level (dBA) at 50 Feet for Construction Equipment

Equipment	dBA Leq @ 50 feet
Earth Moving:	
Front Loader	79
Back Hoe	85
Dozer	80
Tractor	80
Scraper	88
Grader	85
Truck	91
Paver	89
Materials Handling:	
Concrete Mixer	85
Concrete Pump	82
Crane	83
Derrick	88
Stationary:	
Pump	76
Generator	78
Compressor	81
Impact:	
Pile Driver	100
Jackhammer	88
Rock Drill	98
Other:	
Saw	78
Vibrator	76

SOURCE: Grant, Charles A. and Reagan, Jerry, A., *Highway Construction Noise: Measurement, Prediction and Mitigation.*

APPENDIX A

Traffic Data

Traffic data was taken from the preliminary noise analysis, as performed by CDM Smith. There were no changes made to the data. The traffic data is presented here, as taken from Table 1 in Appendix B from the CDM Smith report. Please note that some of the road links below may not apply specifically to this project since the detailed barrier analysis was performed specifically for the Rosemont residential area.

NOISE TECHNICAL REPORT

Port Access Road Interchange at Interstate 26

TABLE 1: Traffic to be used in TNM

Roadway Section		Total DHV	Existing DHV per lane			
Roadway Facility		**Total**	**50/50 splits**	**Cars**	**M Trucks**	**H Trucks**
S of Baker Hospital BLVD	I-26 East Bound (3 lanes)	6300	3150	1008	25	17
	I-26 West Bound (3 lanes)		3150	1008	25	17
	Existing Ramp A	580	290	278	7	5
	Existing Ramp B		290	278	7	5
	Existing Ramp C	580	290	278	7	5
	Existing Ramp D		290	278	7	5
Roadway Section		Total DHV	NoBuild DHV per lane			
N of Baker Hospital BLVD	I-26 East Bound (3 lanes)	7380	3690	1181	29	20
	I-26 West Bound (3 lanes)		3690	1181	29	20
	Existing Ramp A	700	350	336	8	6
	Existing Ramp B		350	336	8	6
	Existing Ramp C	640	320	307	8	5
	Existing Ramp D		320	307	8	5
Roadway Section		Total DHV	Build DHV per lane			
N of Baker Hospital BLVD	I-26 East Bound (3 lanes)	7380	3690	1181	29	20
	I-26 West Bound (3 lanes)		3690	1181	29	20
	Proposed Ramps A	1026	513	492	12	8
	Proposed Ramps D		513	492	12	8
	Proposed Ramps B	964	482	463	12	8
	Proposed Ramps C		482	463	12	8
	Proposed Ramps G	640	320	307	8	5
	Proposed Ramps H		320	307	8	5

- Vehicle classification traffic percentages have been identified as 96% car and 4% truck traffic. The following truck percentages will be broken down further for and the following truck percentages will be used:
  - Medium Trucks – 2.4%
  - Heavy Truck – 1.6%
- The speed of 65 mph was used for I-26 and 35 mph was used for the ramps.

APPENDIX B

TNM Data Files

(Electronically Provided to SCDOT)

APPENDIX C

Feasible and Reasonable Worksheet

SCDOT Feasibility and Reasonableness Worksheet

Date: Aug 20, 2015

Project Name	I-26 PAR Interchange Final Design Noise Analysis
Highway Traffic Noise Abatement Measure	Rosemont community, set of 2 barriers along I-26 EB

Feasibility

Number of Impacted Receivers	26	Number of Benefited Receivers	47
Percentage of Impacted Receivers that would achieve a 5 dBA reduction from the proposed noise abatement measure	100		

Is the proposed noise abatement measure acoustically feasible?
NOTE:SCDOT Policy indicates that 75% of the impacted receivers must achieve at least a 5 dBA reduction for it to be acoustically feasible.

☒ Yes ☐ No

Would any of the following issues limit the ability of the abatement measure to achieve the noise reduction goal?

Topography	☐ Yes	☒ No
Safety	☐ Yes	☒ No
Drainage	☐ Yes	☒ No
Utilities	☐ Yes	☒ No
Maintenance	☐ Yes	☒ No
Access	☐ Yes	☒ No
Exposed Height of Wall	☐ Yes	☒ No

If "Yes" was marked for any of the questions above, please explain below.

Reasonableness

According to 23 CFR 772.13(d)(2)(iv) the abatement measure must collectively achieve each of these criteria to be reasonable. Therefore if any of the three mandatory reasonable factors are not achieved, then the abatement measure is determined NOT to be reasonable. When completing the form it is not necessary to detail each of the criteria if one was determined not to be reasonable.

#1: Noise Reduction Design Goal

Number of Benefited Receivers	47	Number of Benefited Receivers that achieve at least an 8 dBA reduction	20

Percentage of Benefited Receivers in the first two building rows that would achieve at least a 8 dBA reduction from the proposed noise abatement measure. NOTE: SCDOT Policy indicates that 80% of the benefited receivers in the first two building rows must achieve at least a 8 dBA reduction for it to be reasonable. 42

Does the proposed noise abatement measure meet the noise reduction design goal? ☐ Yes ☒ No

If "Yes" is marked, continue to #2. If "No" is marked, then abatement is determined NOT to be reasonable.

#2: Cost Effectiveness

Estimated cost per square foot for noise abatement measure	35	Estimated construction cost for noise abatement measure	$1,007,454
Estimated cost per Benefited Receiver	$21,435		

Based on the SCDOT policy of $30,000 per Benefited Receiver, would the abatement measure be reasonable? NOTE: SCDOT Policy states that the preliminary noise analysis is based on $35.00 per square foot and a more project-specific construction cost should be applied at a cost per square foot basis during the detailed noise abatement evaluation. ☒ Yes ☐ No

If "Yes" is marked, continue to #3. If "No" is marked, then abatement is determined NOT to be reasonable.

#3: Viewpoints of the property owners and residents of the benefitted receivers

Number of Benefited Receivers (same as above)	47		
Number of Benefited Receivers **in support** of noise abatement measure	14	Percentage of Benefited Receivers **in support** of noise abatement measure	30
Number of Benefited Receivers **opposed** to noise abatement measure	4	Percentage of Benefited Receivers **opposed** to noise abatement measure	9
Number of Benefited Receivers **that did not respond** to solicitation on noise abatement measure	29	Percentage of Benefited Receivers **that did not respond** to solicitation on noise abatement measure	61

Based on the viewpoints of the property owners and residents of the Benefited Receivers, would the abatement measure be reasonable? NOTE: SCDOT Policy indicates that the noise abatement shall be constructed unless greater than 50% of the benefited receptors are opposed to noise abatement. ☒ Yes ☐ No

This noise barrier is proposed to be carried forward into the final design engineering phase as per SCDOT commitment in the Port Access Road EIS, then through the Port Access Road Interchange EA. The design goal criteria "No" decision is not applicable to this study as a result of the SCDOT commitment.

APPENDIX D

Preliminary Barrier Design Tables

Final Design TNM Noise Barrier Locations and Heights (Preliminary, subject to change in the engineering design phase)

Main Barrier	Station Number	Prelim. Approx.	X	Y	Base Z (ft)	Optimized Height (ft)	Top Elevation (ft)	TNM Panel Length (ft)	Panel Area (ft2)
Station	Start	5820+50	2320513.2	364585.4	19.4	15	34.40	50	750
		5821+00	2320545.0	364545.7	16.8	15	31.80	100	1500
		5822+00	2320588.0	364456.3	11	15	26.00	100	1500
		5823+00	2320634.0	364363.8	9.1	15	24.10	100	1500
		5824+00	2320679.5	364275.1	8.2	15	23.20	101	1515
		5825+01	2320722.5	364187.0	8.3	16	24.30	101	1616
		5826+02	2320767.0	364096.8	8.8	17	25.80	101	1717
		5827+03	2320812.8	364006.8	9.3	17	26.30	98	1666
		5828+01	2320858.0	363919.2	9.3	17	26.30	100	1700
		5829+01	2320903.0	363829.7	10.4	17	27.40	99	1683
		5830+00	2320947.8	363740.3	11.1	16	27.10	101	1616
		5831+01	2320993.0	363649.7	12.5	16	28.50	95	1520
		5831+96	2321036.5	363564.7	14.5	15	29.50	54	810
		5832+50	2321062.0	363519.1	17.25	14	31.25	54	756
		5833+04	2321091.2	363474.2	20	14	34.00	56	784
		5833+56	2321122.0	363427.2	22	12	34.00	47	564
		5834+03	2321144.2	363385.3	24	11	35.00	109	1199
Station	End	5835+12	2321193.5	363288.1	24	11	35.00	End Station	0
								Total Square Footage	22396
								Total Length (ft)	1466

North Barrier	Station Number	Prelim. Approx.	X	Y	Base Z (ft)	Optimized Height (ft)	Top Elevation (ft)	TNM Panel Length (ft)	Panel Area (ft2)
Station	Start	5814+80	2320258.5	365094.2	15.0	11	26.00	69	759
		5815+49	2320297.5	365037.2	13.0	11	24.00	61	671
		5816+10	2320332.0	364987.5	12.0	11	23.00	87	957
		5816+97	2320382.2	364916.6	11.0	12	23.00	87	1044
		5817+84	2320432.5	364845.8	11.0	12	23.00	79	948
		5818+63	2320468.5	364774.9	10.5	12	22.50	73	876
		5919+36	2320500.5	364709.6	10.5	12	22.50	94	1128
Station	End	5820+30	2320541.8	364625.2	10.5	12	22.50	End Station	0
								Total Square Footage	6383
								Total Length (ft)	550

Note 1: Station numbering is preliminary and approximate. Exact stationing will be developed during the Final Design

Note 2: The top elevations are to be used as the minimum height noise profile. Aesthetics, maintianing a smooth-top, final wall base elevations and other considerations may slightly change these values as individual panels are designed from station to station. Nonetheless, as long as the minimum height is maintained between these station numbers, the integrity of the predicted sound level reductions will be sustained.