

Savannah (SC 170, US 17) and Pinckney Island (US 278) National Wildlife Refuges

Road Safety Audit

Beaufort and Jasper Counties, South Carolina

March 5-6, 2008



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1. Introduction

1.1. Objectives of Study

The objective of this study was to complete a road safety audit (RSA) for Savannah and Pinckney Island National Wildlife Refuges (NWR). The Pinckney Island study area is located along US-278 in Beaufort County, South Carolina at the entrance to the refuge as shown in Figure 1.1. The Savannah NWR study area is located near the junction of US-17 and SC-170 in Jasper County, South Carolina as shown in Figure 1.2. More specifically, the Savannah NWR study area included three locations, 1) the entrance to the Savannah NWR maintenance facility, 2) the access points to the Laurel Hill Wildlife Drive, and 3) the entrance to the proposed visitor center.

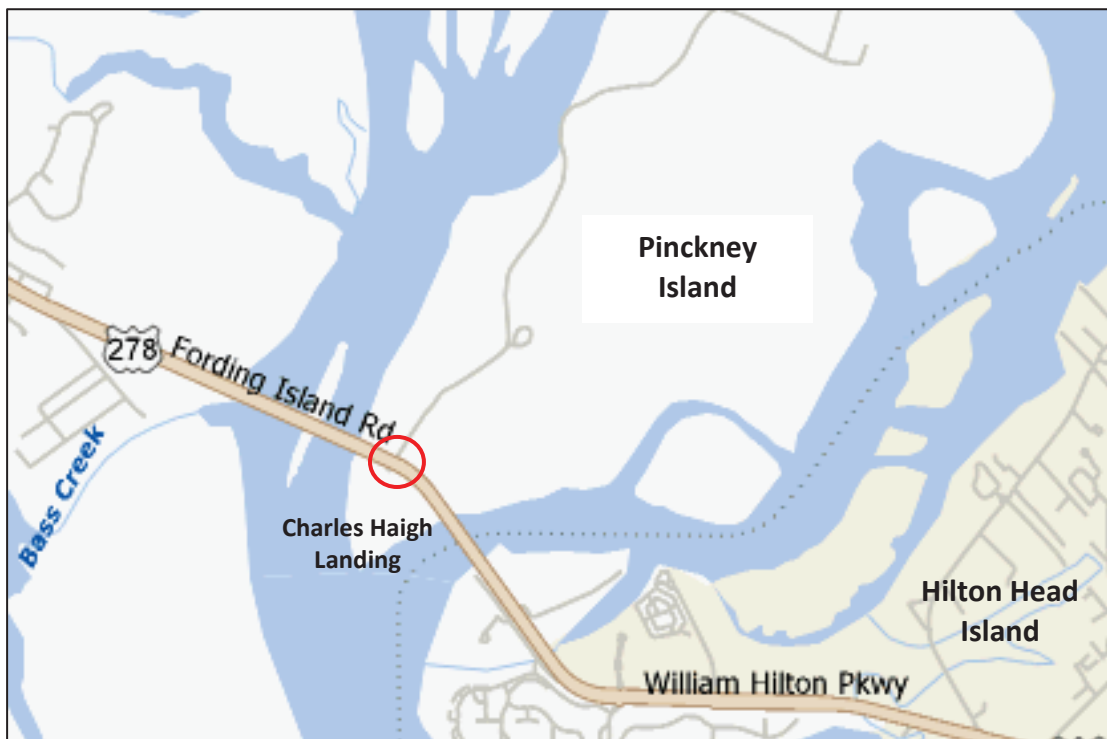


Figure 1.1 General Study Area of Pinckney Island (US-278)



Figure 1.2 General Study Area of Savannah NWR (SC-170 and US-17)

1.2. Background

The US Fish and Wildlife Service identified locations of concern on the two refuges. The purpose of this RSA is to identify safety issues at the locations of concern and develop recommendations to correct the identified safety issues.

US-278 is a four-lane principle arterial roadway in Beaufort County, South Carolina. The study area is located on Federal Lands, specifically, the entrance to the Pinckney Island National Wildlife Refuge. This road serves as a commuter route and provides the only land access to Hilton Head Island. There is a relatively large amount of pedestrian and bicycle activity in this area due to the refuge. Currently, the level of service along US-278 is F, beginning just west of Pinckney Island due to the large traffic volumes accessing Hilton Head Island. Level of service is a measure of congestion and F is the worst possible level of service, indicating grid-lock conditions. The Beaufort County Comprehensive Transportation Plan describes plans to upgrade this section of US-278 from a 4-lane to a 6-lane section as part of the planned improvements to address 2025 needs.

US-17 and SC-170 are two-lane principle arterial roadways in Jasper County, South Carolina. This study area is also located on Federal Lands, specifically, the Savannah National Wildlife Refuge. This road serves local traffic as well as large truck volumes from the nearby factories, mills, and the Savannah Port. The level of service is currently very good along US-17 and SC-170; however, it is expected that the truck volumes will increase substantially when the Jasper Port opens. There is pedestrian and bicycle activity in this area due to the refuge and the refuge would like to encourage further pedestrian and bicycle activity.

A detailed review was conducted at each location of concern. As part of the RSA, crash data were reviewed to identify common crash patterns and crash types. Four years of crash data were obtained for each location (2004 to 2007).

The RSA team consisted of 8 members, representing the consultant, Federal Highway Administration Eastern Federal Lands, South Carolina DOT, Savannah Coastal Refuges, and the Fish and Wildlife Service. The RSA was performed on March 5-6, 2008, during daytime and nighttime hours.

<u>RSA Team</u>	<u>Organization</u>
Dan Nabors	VHB, Inc.
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James Asirifi	FHWA Eastern Federal Lands
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2. Existing Conditions

2.1. Geometric Conditions

US-278 is a four-lane principle arterial roadway with a median. In the study area, there are no paved or unpaved shoulders on either side of the road; however, there is a 15 to 20 ft grass-type median with gentle slopes that provides a recovery and emergency pull-off area for motorists. Right and left turn lanes are installed in both directions as well as short acceleration lanes from the access to the boat launch and Pinckney Island Refuge. Guardrail is also installed 10 to 12 ft from the outside edge of the roadway in both directions, but there is no barrier in the median. The road has a posted speed limit of 55 mph in both directions and there are existing pavement markings designating the travel lanes, left-turn lanes, and right-turn lanes.

SC-170 is a two-lane, undivided rural principle arterial roadway. In the study area, there are 12 ft lanes and no paved shoulders with limited unpaved shoulders on either side of the road. There are no right- or left-turn lanes installed at the access points and there is also no guardrail installed along the corridor. The road has a posted speed limit of 55 mph in both directions, which is reduced to 45 mph near the exit from the Laurel Hill Wildlife Drive. There are existing pavement markings designating the centerline and edge lines.

US-17 is also a two-lane, undivided rural principle arterial roadway. In the study area, there are 12 ft lanes and no paved shoulders; however, there are relatively wide graded shoulders (10 to 20 ft) on either side of the road. The proposed access to the visitor center is located directly across from Sawgrass Lane and there are currently no right or left turn lanes installed at the access point. There is no guardrail within the study area, but utility poles are located more than 30 ft from the edge of pavement. The road has a posted speed limit of 55 mph in both directions and existing pavement markings designate the centerline and edge lines.

2.2. Traffic Data

The approximate average daily traffic (ADT) along each route in 2006 is as follows:

- US-278 = 48,900 vehicles per day
- US-17 = 5,800 vehicles per day
- SC-170 = 4,400 vehicles per day

There are notable truck volumes along US-17 and SC-170. Observations indicated that the truck traffic represents up to 50 percent of the traffic. It is expected that truck traffic will increase on US-17 and SC-170 once the Jasper Port opens.

2.3. Crash Analysis

South Carolina DOT provided traffic crash summaries for existing locations, including the US-278, SC-170, and US-17 study areas, for years 2004 to 2007. During that period there were 166 reported crashes within the US-278 study area, 5 crashes within the SC-170 study area, and 69 crashes within the US-17 study area.

A review of the collision types shows the following trends at the three study areas:

US-278 Study Area:

- 50 percent of crashes were rear-ends;
- 25 percent of crashes were run-off-road;
- 10 percent of crashes were sideswipe same direction;
- 9 percent of crashes were angle; and
- 72 percent of crashes were property damage only, which is consistent with the large number of rear-ends.

SC-170 Study Area:

- 80 percent of crashes were run-off-road;
- 20 percent of crashes were rear-end; and
- All crashes were property damage only.

US-17 Study Area:

- 43 percent of crashes were run-off-road;
- 19 percent of crashes were rear-end;
- 28 percent of crashes were angle; and
- 71 percent of crashes were property damage only; however, there were 2 fatalities in the study area.

3. Assessment Findings

3.1. Safety Benefits of Existing Roadway Features

There are several notable benefits provided by existing roadway features that are described below:

Pinckney Island NWR (US-278)

- **Turn Lanes** – Right- and left-turn lanes are installed along US-278 at the entrance to Pinckney Island NWR and boat access.

Savannah NWR (US-17)

- **Plans to Install Right-Turn Lane** – There are plans to install a right-turn lane at the entrance to the proposed visitor center on US-17.
- **Clear Zone** – The clear zone is relatively flat and free of obstructions along US-17 near the proposed visitor center.

Savannah NWR (SC-170)

- **Pavement Markings** – Pavement markings provide relatively good guidance at night and in low-light conditions along SC-170.

3.2. RSA Framework

The RSA process detailed in the *FHWA Road Safety Audit Guidelines* (Publication FHWA-SA-06-06) was utilized for conducting this RSA. A crash risk assessment was conducted for each issue, which can be used to identify a priority. This assessment is based on the expected crash frequency and severity. Expected crash frequency is qualitatively estimated on the basis of expected exposure (i.e., how many road users will likely be exposed to the identified safety issue) and probability (i.e., how likely is it that a collision will result from the identified issue). Expected crash severity is qualitatively estimated on the basis of factors such as anticipated speeds, expected collision types, and the likelihood that vulnerable road users will be exposed. These two risk elements (frequency and severity) are then combined to obtain a qualitative risk assessment on the basis of the matrix shown in Table 3.1.

TABLE 3.1 CRASH RISK ASSESSMENT

FREQUENCY RATING	SEVERITY RATING			
	<i>Minor</i>	<i>Moderate</i>	<i>Serious</i>	<i>Fatal</i>
<i>Frequent</i>	Moderate-High	High	Highest	Highest
<i>Occasional</i>	Moderate	Moderate-High	High	Highest
<i>Infrequent</i>	Low	Moderate	Moderate-High	High
<i>Rare</i>	Lowest	Low	Moderate	Moderate-High

For each safety issue identified, possible mitigation measures have been suggested. The suggestions have focused on measures that can be cost-effectively implemented.

3.3. Identified Safety Issues and Suggestions for Improvement

Despite the many safety measures to improve road safety throughout the RSA corridor, six general issues were identified and are summarized in Table 3.2. The issues are discussed in further detail in Appendix A. The RSA team members prioritized the issues based upon their perceived importance in the study area.

TABLE 3.2 SUMMARY OF RSA ISSUES AND SUGGESTIONS

SAFETY ISSUE (Number and Description)	SUGGESTIONS
1. Roadway Geometry, Risk: high	
<ul style="list-style-type: none"> Lack of turn-lanes along SC-170 and US-17 at NWR access points. 	<ul style="list-style-type: none"> Install right- and left-turn lanes at access points. <ul style="list-style-type: none"> entrance to maintenance facility entrance to wildlife drive entrance to proposed visitor center Consider shoulder bypass lanes as an alternative.
<ul style="list-style-type: none"> Lengths of the turn and acceleration lanes on US-278 are relatively short. 	<ul style="list-style-type: none"> Lengthen turn and acceleration lanes when US-278 is upgraded to 6-lane cross-section. Construct underpass to eliminate left-turns and crossing movements.
<ul style="list-style-type: none"> Horizontal and vertical curvature limits sight distance. 	<ul style="list-style-type: none"> Trim vegetation at entrance to Savannah NWR maintenance facility. Consider an Intelligent Transportation System (ITS). Install intersection warning signs along mainline. Install advance guide signs or advance street name signs along mainline.
2. Signage and Pavement Markings, Risk: moderate-high	
<ul style="list-style-type: none"> Lack of guidance within median opening at Pinckney Island. 	<ul style="list-style-type: none"> Delineate nose of median openings. <ul style="list-style-type: none"> pavement markings post-mounted delineators Consider installing STOP bars and double yellow centerlines in median openings.
<ul style="list-style-type: none"> Lack of guidance during nighttime and poor visibility conditions. <ul style="list-style-type: none"> faded pavement markings missing raised pavement markers 	<ul style="list-style-type: none"> Upgrade to retroreflective signs and pavement markings Replace missing raised pavement markers Install post-mounted delineators along corridor <ul style="list-style-type: none"> horizontal curves alignment changes
<ul style="list-style-type: none"> Lack of signing at access points. 	<ul style="list-style-type: none"> Consider installing signs to warn motorists of turning and entering vehicles. <ul style="list-style-type: none"> Laurel Hill Wildlife Drive Savannah NWR maintenance facility

SAFETY ISSUE (Number and Description)	SUGGESTIONS
<ul style="list-style-type: none"> • Passing zone on US-17 near proposed visitor center. 	<ul style="list-style-type: none"> • Consider restriping US-17 as ‘no passing’ near entrance to visitor center.
<ul style="list-style-type: none"> • Wrong color SCDOT guide sign for Savannah National Wildlife Refuge. 	<ul style="list-style-type: none"> • Replace green SCDOT sign for Savannah NWR, use brown background and white text.
3. Traffic Congestion, Risk: moderate-high	
<ul style="list-style-type: none"> • Level of service F along section of US-278. 	<ul style="list-style-type: none"> • Consider installing traffic warning system to warn motorists of slow or stopped traffic.
<ul style="list-style-type: none"> • Parking facilities are over capacity at Pinckney Island. 	<ul style="list-style-type: none"> • Consider increasing capacity of parking lot. • Underpass would maximize use of existing spaces.
<ul style="list-style-type: none"> • Nighttime events at Savannah NWR maintenance facility or Laurel Hill Wildlife Drive. 	<ul style="list-style-type: none"> • Continue policy of not holding nighttime events at maintenance facility or Laurel Hill Wildlife Drive.
4. Roadside Design, Risk: moderate	
<ul style="list-style-type: none"> • Lack of paved shoulders along US-278, US-17, and SC-170. 	<ul style="list-style-type: none"> • Consider improving shoulder width where possible, particularly on horizontal curves and at access points.
<ul style="list-style-type: none"> • Rough transition from wildlife drive exit to SC-170. 	<ul style="list-style-type: none"> • Consider improving transition between wildlife drive exit and SC-170.
<ul style="list-style-type: none"> • Pavement edge drop-offs. 	<ul style="list-style-type: none"> • Install beveled “safety edge” during resurfacing. • Improve maintenance practices to eliminate pavement edge drop-offs and stabilize shoulders.
<ul style="list-style-type: none"> • Damaged guardrail on southeast corner of entrance at Pinckney Island. 	<ul style="list-style-type: none"> • Replace section of damaged guardrail.
<ul style="list-style-type: none"> • Drop-offs on levees. 	<ul style="list-style-type: none"> • Consider installing guardrail along sections of SC-170.
<ul style="list-style-type: none"> • Narrow bridge widths along SC-170. 	<ul style="list-style-type: none"> • Widen shoulders when bridges are replaced.
5. Nighttime and Poor Visibility, Risk: moderate	
<ul style="list-style-type: none"> • Lack of nighttime guidance. <ul style="list-style-type: none"> - faded pavement markings - missing raised pavement markers - median openings on US-278 	<ul style="list-style-type: none"> • Install or replace centerline raised pavement markers. • Install high-visibility pavement markings. • Install high-intensity signs. • Delineate nose of median openings. <ul style="list-style-type: none"> - pavement markings - post-mounted delineators • Install double yellow centerline and STOP bar in median openings.
<ul style="list-style-type: none"> • Fog along US-278 and SC-170. 	<ul style="list-style-type: none"> • Consider installing fog-warning system.
6. Bicyclists, Risk: low	
<ul style="list-style-type: none"> • No designated bike lanes or adequate shoulders for bicyclists. • No safe bicycle access between refuge and boat access area at Pinckney Island. 	<ul style="list-style-type: none"> • Consider options to provide better bike access. <ul style="list-style-type: none"> - widen shoulders to 4 ft between Laurel Hill Wildlife Drive entrance and exit - reroute bicyclists along internal levees • Consider providing bike access if underpass is installed between Pinckney Island NWR and boat launch.
<ul style="list-style-type: none"> • Narrow bridge widths are safety hazard for bicyclists. 	<ul style="list-style-type: none"> • Widen shoulders when bridges are replaced.

4. Conclusions

Six safety issues have been identified in this in-service RSA. Based on a review of crash data and field observations, roadway geometry was determined to be the most critical issue for the study areas. The remaining five safety issues are ranked below roadway geometry from most to least hazardous. Suggestions for improvements have been identified and are described in this report.

Speeding was identified as a potential issue, but could not be verified during the site visit. However, if speeding is a concern a formal speed study should be conducted. Given conditions of glare and fog higher posted speeds may not always be “safe” speeds and variable speed limit signs may be considered on the heavily traveled routes (US-278).

Beyond engineering measures, road safety can be improved through education and enforcement. There is at least one opportunity to improve safety through education. There is a new visitor center proposed to be built along US-17. This will generate a large volume of visitors, including many young adults. Young drivers (i.e., those under the age of 25) are less experienced and are more likely to be involved in a crash than drivers ages 25 to 65 (Evans, 1991). Having a high-risk population in one place (i.e., a visitor center) presents an excellent opportunity for a targeted educational campaigns or informational bulletins.

The owners are invited to consider the suggested changes. To complete the RSA process, the owners may prepare a short written response to the issues and options outlined in this report.

5. References

1. Evans, L. *Traffic Safety and the Driver*. Van Nostrand Reinhold, New York, NY, 1991.
2. Foody, T.J. and W.C. Taylor. *Curve Delineation and Accidents*. Ohio Department of Highways, Bureau of Traffic, Columbus, OH, 1966.
3. Harwood, D.W., F.M. Council, E. Hauer, W.E. Hughes, and A. Vogt. *Prediction of the Expected Safety Performance of Rural Two-Lane Highways*. Federal Highway Administration, FHWA-RD-99-207, December, 2000.
1. Low Cost Safety Improvements Workshop. Federal Highway Administration, Washington, DC, 2005.
2. *Manual on Uniform Traffic Control Devices for Streets and Highways*. Federal Highway Administration, Washington, DC, 2003.
3. National Cooperative Highway Research Program. *A Guide for Addressing Unsignalized Intersection Collisions*. NCHRP Report 500 Series, Volume 5, Transportation Research Board, Washington, DC, 2003.

Appendix A: Issues and Suggestions

Issue 1: Roadway Geometry

No turn lanes on SC-170 or US-17:

Lack of turn-lanes along SC-170 and US-17 at Savannah NWR access points and proposed visitor center. There are no turn-lanes from SC-170 at the entrances to the maintenance facility and the wildlife drive. There are currently no turn lanes along US-17 at the entrance to the proposed visitor center; however, there are plans to install a right-turn lane during construction of the visitor center. These are high-speed roadways and turn lanes help to separate turning-vehicles from through traffic. This is a particular concern because there is heavy truck traffic along these routes. To compound the issue, there is a horizontal curve near the access point to the maintenance facility, which limits sight distance.

Suggestion: Install right- and left-turn lanes at access points to Savannah NWR facilities. Particularly at the maintenance facility, entrance to the wildlife drive, and entrance to the proposed visitor center. Left-turn lanes on rural roads can be expected to experience a 48% reduction in crashes when compared to a stop-controlled intersection without left-turn lanes (FHWA-SA-07-015).



View of access points to maintenance facility and Savannah NWR wildlife drive. This photo illustrates the lack of turn lanes at the access points and the horizontal curve that limits sight distance.



View of US-17 near the new visitor center. The photo shows the entrance to the new visitor center on the left and Sawgrass St. on the right. The photo illustrates that there appears to be space (not necessarily right-of-way) to provide turn lanes for the entrance and the residential street.

Short turn lanes and acceleration

lanes on US-278: While turn lanes and acceleration lanes are installed on US-278 at Pinckney Island, the length of the turn and acceleration lanes appear to be relatively short. This is a particular concern for vehicles towing boats because these vehicles require greater stopping and acceleration distances. Current limitations (i.e., bridges on either side of the entrance to Pinckney Island) restrict the possible lengthening of the turn lanes.

Suggestion: Consider lengthening turn and acceleration lanes when US-278 is upgraded from a 4-lane to 6-lane cross-section. The widening of US-278 will likely not be completed for many years due in large part to projected project costs, which are estimated at over \$155 million dollars. In the interim, one option may be to provide an underpass between the boat access and the Pinckney Island NWR. This could be done at a fraction of the cost. An underpass would eliminate left-turns and crossing movements at this location and all movements would be right-in and right-out only. The underpass could potentially be constructed under the bridge to the east of the entrances. See Appendix B for illustration of proposed underpass.



View of US-278 eastbound just prior to the entrance of Pinckney Island. There is a right- and left-turn lane from US-278, but the lengths are relatively short. The photo also shows one of the nearby bridges that restricts the length of turn lanes in the westbound direction.



View of US-278 westbound from the entrance to the Pinckney Island NWR. Photo shows the limited acceleration lane for vehicles entering US-278.



Evidence of overshooting the right turn lane may be found in the number of severed sign posts on the NW corner and guardrail strikes on the SE corner.

Access on horizontal curves: *The access to Pinckney Island NWR and the Savannah NWR maintenance facility are located on horizontal curves. The horizontal curve at Pinckney Island is compounded by vertical curvature. Horizontal and vertical curvature limits sight distance for motorists traveling along US-278 and SC-170, and also for motorists exiting the NWR facilities.*

Suggestion: Consider trimming the vegetation at the entrance to the Savannah NWR maintenance facility to improve sight distance along the horizontal curve. Advance intersection warning signs along US-278 and SC-170 may be appropriate to warn drivers on the mainline of crossing or entering vehicles (see Issue 2: Signage and Pavement Markings). Controlling vehicles speeds on the curve on SC-170 may be another option, provided a formal speed study is conducted that demonstrates speeding is an issue. Refuge staff believed this to be an issue. “Optical speed bars”, are used to reduced vehicles speeds approaching and entering the curve. The bars are spaced such that it appears to the motorist that they are going faster than they actually are and therefore they will reduce their speed to compensate



View of US-278 to the east of the entrance to Pinckney Island NWR. Photo shows the horizontal and vertical curvature that limit sight distance near the entrance.



View of the entrance to the Savannah NWR maintenance facility. Photo shows that the entrance is located near a horizontal curve, which limits the view of the entrance from SC-170.

Example of placement of optical speed bars. These will have minimal noise impacts on the refuge.



Issue 2: Signage and Pavement Markings

Insufficient pavement markings in median opening:

There was a lack of guidance within the median opening at the access to the boat launch and Pinckney Island NWR along US-278. Lack of guidance is particularly critical at night where motorists waiting in the median opening may have difficulty positioning their vehicle where it is not conflicting with through traffic.

Suggestion: Delineate nose of median openings at access points with pavement markings and post-mounted delineators. Also consider installing STOP bars and double yellow centerline in median openings to provide better guidance.



View of median opening at the entrance to Pinckney Island NWR. The photo illustrates the lack of pavement markings and delineation within the median opening. As a result, motorists are unsure where to position themselves in the median, which leads to conflicts in the median and potential sight distance obstructions.

Roadway Delineation: *Guidance measures for motorists during nighttime and poor visibility conditions are worn or missing. Specifically, the pavement markings are faded and raised pavement markers (RPMs) are missing in several sections. There is also no supplemental guidance (e.g., post-mounted delineators) in curved sections.*

Suggestions: Consider options to enhance guidance for motorists during nighttime and poor visibility conditions:

- Upgrade to retroreflective signs and pavement markings.
- Replace missing RPMs.
- Install post-mounted delineators along corridor, especially at horizontal curves. Post-mounted delineators on rural two-lane curves reduced run-off-road crashes by 15 percent (Foody and Taylor, 1966). The FHWA Low Cost Safety Improvements Workshop indicates that post-mounted delineators reduce run-off-road crashes between 25 to 58 percent.



Photo shows an example of how the pavement markings are deteriorating. The photo also shows an example of a raised pavement marker.



Photo shows the lack of guidance at night due to the faded pavement markings and lack of delineators.

Lack of signing for Access: *There is insufficient signing to warn motorists of the entrance to the Laurel Hill Wildlife Drive and Savannah NWR maintenance facility. There are no turn lanes and motorists may not be expecting vehicles to stop in the through lane to turn left at either of these locations. There may be a lack of driver expectancy of turning, accelerating, and decelerating vehicles at Pinckney Island due to the fact that the entrance to is located between a section of long bridges.*

Suggestions: Consider installing signs to warn motorists of turning and entering vehicles.

- The MUTCD shows that a W1-10 may be considered for warning of entrances to park and maintenance facility because it shows location of intersection on curve (photo to the right shows a similar sign).
- The sign described above could be supplemented with flashing beacons. Curve advance warning sign with flashing beacon can result in a 30% reduction in total crashes (FHWA-SA-07-015).
- For the maintenance facility, special warning signs may be appropriate to warn motorists on SC-170 of heavy vehicles turning into and out of the maintenance facility.
- US-278 can have a traffic signal in flash mode, provided the signal warrants are met. The signal would flash yellow on the mainline and red on the side roads during the day. The signal could be dormant at night because the park is closed.



Photo shows an example warning sign that could be used to warn motorists of the entrance to the Laurel Hill Wildlife Drive. The speed advisory plaque should be based on current roadway conditions. There is currently a 45mph curve advisory sign near the entrance to Laurel Hill.

Photo shows an example warning sign that could be used to warn motorists of the entrance to the Laurel Hill Wildlife Drive. The speed advisory plaque should be based on current roadway conditions. There is

Sign color for National Wildlife Refuge: *It was observed that there is one SCDOT sign for the Savannah National Wildlife Refuge that is the wrong color. The current sign along US-17, heading toward Port Wentworth, is green with white text. This violates driver expectancy because typical guide signs for parks and recreational areas are brown with white text.*

Suggestions: To maintain consistency and driver expectancy, the MUTCD recommends using signs with a brown background and white text for recreational areas and parks. Consider replacing the SCDOT sign for the Savannah NWR with a sign with a brown background and white text.

Issue 3: Traffic Congestion

Stop and go traffic on US-278: In the morning, commuters and visitors are traveling to Hilton Head Island and the traffic is stop-and-go in the eastbound direction. In the evening, the problem occurs in the westbound direction. Crash data reflects this condition with the high percentage of rear-end collisions along this section (50 percent). To compound the issue, this can be a heavy fog area and there is horizontal and vertical curvature along US-278. Special events in Savannah, GA may also create congestion.

Suggestion: The long-range plans to widen this section of US-278 to a six-lane facility will help to alleviate the congestion and reduce rear-end crashes. A short-range consideration may be to place BE PREPARED TO STOP (W3-4) signs in the area where traffic can be expected to stop due to congestion. A medium-range consideration may be to install a similar warning sign with flashers that activate during periods of congestion or to deploy a traffic warning system such as a variable message sign to warn motorists of slow or stopped traffic during periods of heavy congestion.



View of US-278. Photo shows the heavy traffic congestion in both directions during the morning peak period.



View of US-278 from the entrance to Pinckney Island. Photo shows a rear-end crash that occurred during the morning peak period when traffic congestion was creating stop-and-go conditions.

Parking at Pinckney Island: The RSA team observed the parking facilities at the Pinckney Island NWR during mid-day hours on a Wednesday. The parking lot was over capacity and vehicles were parked, illegally, on the grass and in other non-designated locations.

Suggestion: The Pinckney Island NWR is an unstaffed and self-regulated facility. Consider increasing the capacity of the parking lot slightly, while considering the desired maximum occupancy of the facility. In addition to improving access, the underpass mentioned in Issue 1 would also maximize parking through the use of existing spaces at the boat access.

Nighttime events at maintenance facility: Previously, there were nighttime events held at the maintenance facility. These events caused back-ups along SC-170. Due to safety issues, these nighttime events were ended.

Suggestion: Continue policy of not holding nighttime events at the maintenance facility or Laurel Hill Wildlife Drive. There may be the possibility of holding nighttime events at the new visitor center when complete.

Issue 4: Roadside Design

Narrow or no paved shoulders: There is a lack of paved shoulders along US-278, US-17, and SC-170 limiting access for bicyclists and also reduces the recovery area for errant vehicles.

Suggestion: Consider increasing shoulder width, especially on horizontal curves and near access points. Increasing shoulder width near access points provides an area for right-turning vehicles to decelerate and get out of the traffic stream. Normal resurfacing projects include a 2 ft paved shoulder, which would improve existing conditions. Adding a 2 ft shoulder can be expected to reduce run-off-road and sideswipe crashes by about 13 percent (Harwood et al., 2000) to 16 percent (FHWA-SA-07-015).



View of SC-170 eastbound. Photo shows the lack of paved and unpaved shoulders, particularly along the horizontal curve. The photo also illustrates the significant truck traffic along this route.

Rough transition from wildlife drive exit to SC-170: The exit from the wildlife drive onto SC-170 is not a smooth transition. There are several pot holes at the exit and a grade change between the shoulder and the drive. This rough transition causes motorists to traverse the area at relatively low speeds while entering a high-speed roadway.

Suggestions: Consider improving the transition from the wildlife drive exit onto SC-170. This will allow motorists to enter SC-170 at greater speeds.



View of exit from Laurel Hill Wildlife Drive to SC-170. Photo shows the rough transition from the wildlife drive onto SC-170.

Drop-offs on levees: SC-170 is built along levees within the study area. As noted previously, there are no guardrails along the roadway to prevent vehicles from running off the road. Furthermore, there are no paved shoulders and limited unpaved shoulders. Run-off road crashes were noted as a particular concern by the staff at the Savannah NWR. These crashes were not recorded with a police report because once the vehicle leaves the road, the motorist is responsible for removing the vehicle.

Suggestions: Consider installing guardrail along sections of SC-170 to reduce run-off-road crashes. Installation of guardrail along the entire section is not desirable due to the impacts on the refuge. Guardrail may be appropriate for the following sections:

- non-recoverable slopes
- a run-off-road problem indicated by crash data



View of SC-170 near the entrance to the Savannah NWR maintenance facility. Photo shows the lack of shoulders and guardrail as well as the drop-off from the roadway into the wetlands.

Pavement edge drop-offs: Pavement edge drop-offs were identified as a safety concern along sections of SC-170 and US-17. This is a particular safety concern because drivers may over-correct when they leave the roadway, which can lead to cross-over, head-on crashes or run-off-road crashes.

Suggestions: Consider using a beveled “safety edge” during resurfacing projects. Also, consider maintenance practices including shoulder stabilization to prevent pavement edge drop-offs. Shoulder stabilization is particularly important due to the large truck volumes on these roads. Correcting shoulder edge drop-offs can reduce run-off-road and head-on crashes because the beveled edge allows for a more controlled recovery at a less sharp angle.



Example of large pavement edge drop-off along SC-170 near the entrance to the Laurel Hill Wildlife Drive.



Photo shows an example of a safety edge. The beveled edge is installed at a 30 degree angle.

Damaged guardrail: The guardrail is currently damaged to the point where it will not function properly on the southeast corner of the entrance to the boat access along US-278. It is likely that this section was damaged from a vehicle that misjudged the length of the right-turn lane (see Issue 1).

Suggestions: Replace the section of damaged guardrail so that it functions properly in the event that another errant vehicle runs off the road in the same location.



View of entrance to boat launch along US-278 across from the Pinckney Island NWR. Photo shows the damaged guardrail in the southeast quadrant of the intersection.

Issue 5: Nighttime and Poor Visibility

Nighttime guidance: *There is a general lack of guidance along the US-278, US-17, and SC-170 corridors. Specifically, there is a lack of guidance (i.e., pavement markings and delineators) at median openings on US-278. Along US-17 and SC-170, the pavement markings are faded and raised pavement markers (RPMs) are missing.*

Suggestion: Consider improving the guidance along these corridors for nighttime and poor visibility conditions:

- Install or replace raised pavement markers along the centerline.
- Install high-visibility pavement markings.
- Install high-intensity signs.
- Delineate nose of median opening using pavement markings and post-mounted delineators.
- Install double yellow centerline and STOP bar in median opening.



View along study section of US-278 at night. Photo shows the lack of nighttime guidance due to the faded pavement markings and lack of raised pavement markers along the centerline.



Photo shows a relatively good example of a section with retroreflective pavement markings and high-intensity signs.

Fog: *Fog is a common occurrence along these sections of US-278 and SC-170. To compound this issue, there is heavy traffic congestion along US-278 and heavy truck traffic along SC-170. At certain times, particularly dawn and dusk, the sun can interact with the fog to produce even greater visibility issues.*

Suggestion: Consider fog-warning system to detect presence of fog and provide advisory speeds for motorists.



Photo shows the effect of fog and glare along SC-170 in the early morning hours. Roadway alignment is difficult to see as are roadway signs.

Issue 6: Bicyclists

Absence of bike lanes or bikeable

shoulders: *There are currently no designated bike lanes or adequate shoulders to provide access for bicyclists along SC-170 and US-17. The National Wildlife Refuge would like to encourage bicycling as a mode of transportation, especially within their lands. Many visitors currently drive to the beginning of the Laurel Hill Wildlife Drive, park their vehicle, and continue by bike along the 4.5 mile drive. At the end of the drive, the bicyclists must either ride along SC-170 to return to their vehicle or backtrack the 4.5 miles against traffic on the one-way wildlife drive. At Pinckney Island, there is currently no safe bicycle access between the refuge and the boat access area.*

Suggestions: Consider options to provide a better route for bicyclists using the Laurel Hill Wildlife Drive. Based on the high percentage of trucks on SC-170 and the high speeds, bikeable shoulders are not suggested. The following alternatives may be considered:

- Reroute bicyclists along improved internal levees from the end of the wildlife drive to the beginning.
- Partner with the Railway Company to develop a bicycling/hiking trail within the Railway right-of-way.

As discussed in Issue 1, an underpass would eliminate crossings on US-278. If the underpass is constructed, consider providing access for bicyclists between the boat access and the refuge at Pinckney Island. See Appendix B for illustration of proposed underpass.



View of SC-170 between the access points to the Laurel Hill Wildlife Drive. Photo shows the lack of shoulders and bicycle access between the access points to the wildlife drive. The photo also shows truck traffic on this roadway, which creates an even greater hazard for bicyclists due to their width and the wind blasts caused by high speed passing.



View of typical bridge along SC-170. Photo shows the limited shoulder area along the bridge that does not provide adequate separation for bicyclists and pedestrians. One suggestion is that when bridges are replaced, widen shoulders per SCDOT standards to provide adequate separation between vehicles and bicyclists.

Appendix B: Illustration of Proposed Underpass at Pinckney Island



Photo shows existing access points to Pinckney Island NWR and Charles Haigh Landing. Visitors traveling from one to the other must cross US-278 (William Hilton Parkway), which has been identified as a major safety concern. There is the potential to construct an underpass to provide a safe route between the two locations without crossing US-278. With the construction of an underpass, the entrances to the two facilities could also restrict left-turns, which would also enhance safety. There is an existing access road from the parking lot of Haigh Landing toward Hilton Head Island, which would provide access to the proposed underpass. The proposed location of the underpass is shown by the red line in the photo.