

# Carolina Sandhills National Wildlife Refuge

## Road Safety Audit

July 2010



U.S. Department of Transportation  
Federal Highway Administration  
*Eastern Federal Lands Highway Division*  
*21400 Ridgetop Circle*  
*Sterling, VA 20166*

# **Road Safety Audit Report**

## **Carolina Sandhills National Wildlife Refuge**

US Route 1 and Wildlife Refuge Entrance

McBee, SC

Date of Assessment: July 20, 2010

### **Project Description**

US Rte 1 is functionally classified as a two-lane principal arterial that traverses the city of McBee in Chesterfield County in rolling terrain, and the entrance to Carolina Sandhills National Wildlife Refuge is 3-1/2 miles north of McBee. US Rte 1 is the main access for Refuge visitors. The Average Daily Traffic (ADT) is approximately 1650 vehicles per day (vpd), and the Refuge entrance average approximately 100 vehicles per day (vpd). The percentage of trucks travelling on US Rte 1 is 15% according to SCDOT, and buses are permissible. The posted speed limit is 55 miles per hour. The existing typical section is two-12' asphalt paved lanes with 1-foot paved shoulders and variable width turf shoulders. The existing typical section on the Refuge maintenance entrance and the Visitor Center / Headquarters entrance is 18-foot and 26-foot, respectively.

### **Crash History**

At the time of this report, there are no reportable crashes at US Rte 1 and the Refuge entrance, but due to the presence of heavy trucks, posted speed limit, and geometry of the entrance, there are potential for crashes to occur within the entrance.

### **Audit Team Members**

- James Asirifi FHWA / EFLHD, Highway Engineer (Safety)
- Isbel Ramos-Reyes FHWA / EFLHD, Civil Engineer (Safety / Technology)
- Dan Hinton FHWA / SC, Safety & Traffic Engineer
- Chris Brown SCDOT, RSA Coordinator
- Greg Williams SCDOT, District 4, Chesterfield Resident Construction Engineer
- Jeffrey Gilmore SCDOT, Engineering / Associate Engineer 2
- Todd Huggins SCDOT, Senior Geodetic Technician

The Audit Team convened at the Refuge conference room on the July 20<sup>th</sup> at 8:00am with a representative from the National Refuge, Mr. Jack Culpepper (Forester), who briefed the team of the problem at hand. Mr. Jack Culpepper indicated there are two entrances to the Refuge, the Maintenance Area Entrance Wildlife Drive and the Visitor Information Entrance Wildlife Drive. Due to the presence of semitrailers travelling on this high speed roadway, turning movements



into and out of the Refuge poses safety concerns. Although there are no reportable crashes at the Refuge entrance at the time of this report, the potential for crashes to occur in the future is apparent. Immediately after the briefing, James Asirifi and Isbel Ramos-Reyes led the RSA Review team to the site to assess existing traffic and safety conditions.

### Existing Condition



## **Site Visit**

The RSA Team was on-site for several hours, drove US Rte 1 within the Refuge boundary, and observed the traffic pattern. The weather was sunny, and the temperature in the high 90's. The RSA Team made the following observations and the findings were discussed during the closeout meeting presentation to the Refuge (Mr. Jack Culpepper):

- The “Carolina Sandhills National Wildlife Refuge” boundary sign is covered with vegetation. The sign is offset far from the roadway and appears to be of substandard height. Relocate and install the boundary sign to conform to MUTCD guidelines (see photo 1)
- There is no advance guide sign southbound before the “Carolina Sandhills National Wildlife Refuge Maintenance Area Wildlife Drive with Arrow” sign. This sign also obstructs sight distance looking northbound from the North Wildlife Drive Maintenance Area entrance. This sign should be set about 2’ further to the right of the travel lanes to improve sight distance (see photo 2)
- The Wildlife Drive north entrance Y-intersection Stop (R1-1) signs do not conform to MUTCD. The MUTCD require 5-feet height above edge of pavement (see photos 3&4).
- Passing is permitted along US Rte 1 at both the north and south Wildlife Drive intersections, creating unsafe conditions for motorists entering US Rte 1 (see photos 5&6).
- Significant presence of large semitrailers along US Rte 1 (see photos 7&8)
- There is no advance guide sign northbound before the “Carolina Sandhills National Wildlife Refuge Office and Visitor Information Wildlife Drive with Arrow” sign (see photo 9).
- The Stop (R1-1) sign at the Wildlife Drive South Visitor Center Entrance to US Rte 1 does not conform to MUTCD. The MUTCD require 5-feet height above edge of pavement (see photo 10)
- The culvert at the Wildlife Drive South Visitor Center Entrance protrudes within the clear zone and is not traversable. Possible treatments include flattening the slopes, moving the culvert further offset from the main travel way, adding bars / pipes to allow the vehicle wheels to safely pass over (see photo 11).



## Observations



Photo 1: The Carolina Sandhills National Wildlife Refuge entrance sign is covered with vegetation and appears to be of substandard height.



Photo 2: The Carolina Sandhills National Wildlife Refuge Maintenance Area Wildlife Drive sign does not conform to the MUTCD, and also sign restricts sight distance looking northbound.





Photo 3: Wildlife Drive north entrance Y-intersection Stop sign to US Rte 1 approaches does not conform to MUTCD



Photo 4: Wildlife Drive north entrance Y-intersection Stop sign to US Rte 1 approaches does not conform to MUTCD





Photo 5: Refuge Maintenance Entrance Area sign obstructs sight distance, looking northbound from the Wildlife Drive North Entrance. Also, passing is permitted along US Rte 1.



Photo 6: Northbound US Rte 1 showing passing at the Wildlife Drive South Entrance intersection



Photo 7: Presence of large semitrailer heading southbound along US Rte 1



Photo 8: Presence of large semitrailers heading northbound US Rte 1





Photo 9: Northbound US Rte 1 showing Carolina Sandhills National Wildlife Refuge Office/Visitor Information Wildlife Drive - no advance guide sign prior to Refuge sign



Photo 10: Southbound showing Wildlife Drive South Entrance to US Rte 1. Stop sign does not conform to MUTCD



Photo 11: Culvert at Wildlife Drive South Entrance protrudes the clear zone



## **Suggested Improvements**

At present, Carolina Sandhills National Wildlife Refuge maintains two Wildlife Drive entrances to the Refuge, the North Maintenance Area Entrance and the South Visitor Center Entrance. Although there are no reportable crashes at the Wildlife Drive intersections at US Rte 1, the potential for crashes to occur is high due to speeds and the presence of trucks. Eliminating conflict points as much as possible would reduce potential crashes at the intersections of this facility. Adding turn lanes provides separation between turning and through traffic, reduces crash potential, and improves operational efficiency.

The RSA team recommends a preferred option for safer traffic flow into the Refuge as well as alternate options that maintain entry / exit at both North and South Wildlife Drive intersections. In each of these options, the flow of visitor traffic and maintenance traffic into and out of the Refuge are shown schematically in the drawings with suggested signing and striping improvements.

### **PREFERRED OPTION      One Visitor Entrance:**

In the Preferred Option, only the south Wildlife Drive entrance is maintained for visitors. Here, all visitors coming from, or going back to, the north or south will be directed to use the south Wildlife Drive entrance only. Turning movements into and out of the north entrance will be limited to Refuge Maintenance vehicles to US Rte 1 Southbound travel only. Suggested improvements under this option include:

- Install advance guide signs “Carolina Sandhills National Wildlife Refuge, Visitor Center (ahead arrow), Maintenance Area (right arrow)” and “Carolina Sandhills National Wildlife Refuge, Next Left” as shown on diagram.
- Add a right turn lane approaching US Rte 1 southbound Wildlife Drive intersection, and a left turn lane for northbound US Rte 1 traffic approaching the south Wildlife Drive entrance as shown on diagram. Any proposed lane widening will require coordination and concurrence from SCDOT.
- Install Keep Right (R4-7) sign, No Left Turn (R3-2) signs in both directions and Do Not Enter (R5-1) signs as shown on diagram.
- Remove the existing Refuge Identification sign at the north Wildlife Drive entrance and reset at the south Wildlife Drive entrance as shown on diagram.
- Place Side Road (W2-2) sign in advance of south entrance in the northbound direction, and the Offset Side Road (W2-7) sign in advance of the north entrance in the southbound direction as shown on diagram.
- Restrict passing at the intersection of both Entrances according to MUTCD guidelines as shown on diagram.

- Install guide signs assembly to show “US Rte 1 North / Left and South / Right” as shown on diagram for exiting Refuge traffic at the south Wildlife Drive intersection.
- Upgrade stop signs at both entrances and stop bars according to MUTCD guidelines as shown on diagram.
- Install “Carolina Sandhills National Wildlife Refuge right arrow / left arrow” signs as shown on diagram along US Rte 1 at the south Wildlife Drive intersection.

#### ALTERNATE 1      Two Visitor Entrances:

In Alternate 1, both Wildlife Drive entrances into the refuge for visitors will be maintained. Some control of access is proposed on the north entrance (maintenance area). Visitors traveling from the north will still be directed to enter via the north entrance, and visitors traveling from the south will still be directed to enter via the south entrance. Turning movements into and out of the north entrance will be limited to US Rte 1 Southbound travel only. This control of access reduces vehicle conflicts at the north entrance, but will require “maintenance” vehicles exiting toward northbound US Rte 1 to exit the refuge at the south entrance (visitor center) only. The following improvements are proposed at the north and south Wildlife Drive intersections:

- Install advance guide signs “Carolina Sandhills National Wildlife Refuge Next Right / Left” as shown on diagram.
- Replace and redesign the “Carolina Sandhills National Wildlife Refuge” sign and the “Refuge Office (right arrow), Visitor Info (right arrow)” sign as shown on diagram.
- Add right turn lanes along US Rte 1 southbound approaching both Wildlife Drive intersections, and a left turn lane for northbound US Rte 1 traffic approaching the south Wildlife Drive entrance. Any proposed lane widening will require coordination and concurrence from SCDOT.
- Install Keep Right (R4-7) sign, No Left Turn (R3-2) in both directions and Do Not Enter (R5-1) signs as shown on diagram.
- Place Side Road (W2-2) sign in advance of the south entrance in the northbound direction, and the Offset Side Road (W2-7) sign in advance of the north entrance in the southbound direction as shown on diagram.
- Restrict passing at the intersection of both Entrances according to MUTCD guidelines as shown on diagram.
- Upgrade stop signs at both entrances and stop bars according to MUTCD guidelines as shown on diagram.

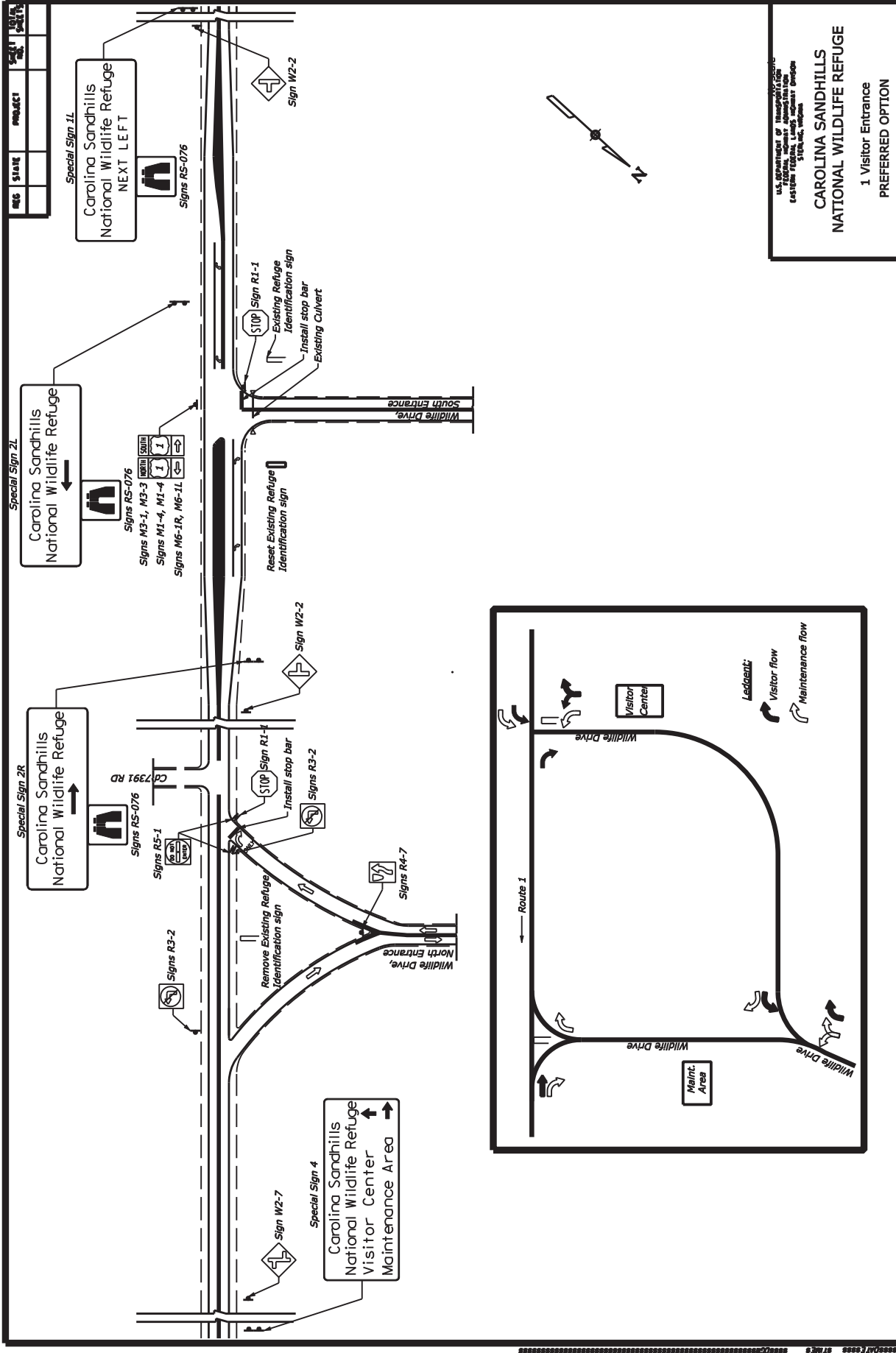


- Install guide sign assembly to show “US Route 1 North / Left and South / Right” as shown on diagram for exiting Refuge traffic at the south Wildlife Drive intersection.

## ALTERNATE 2 Two Visitor Entrances with Minor Realignment

In Alternate 2, both Wildlife Drive entrances into the refuge will be maintained. Alternate 2 is similar to Alternate 1 but the north Wildlife Drive entrance will be realigned to provide access for vehicles turning left into the refuge from US Rte 1 northbound direction. Proposed improvements include:

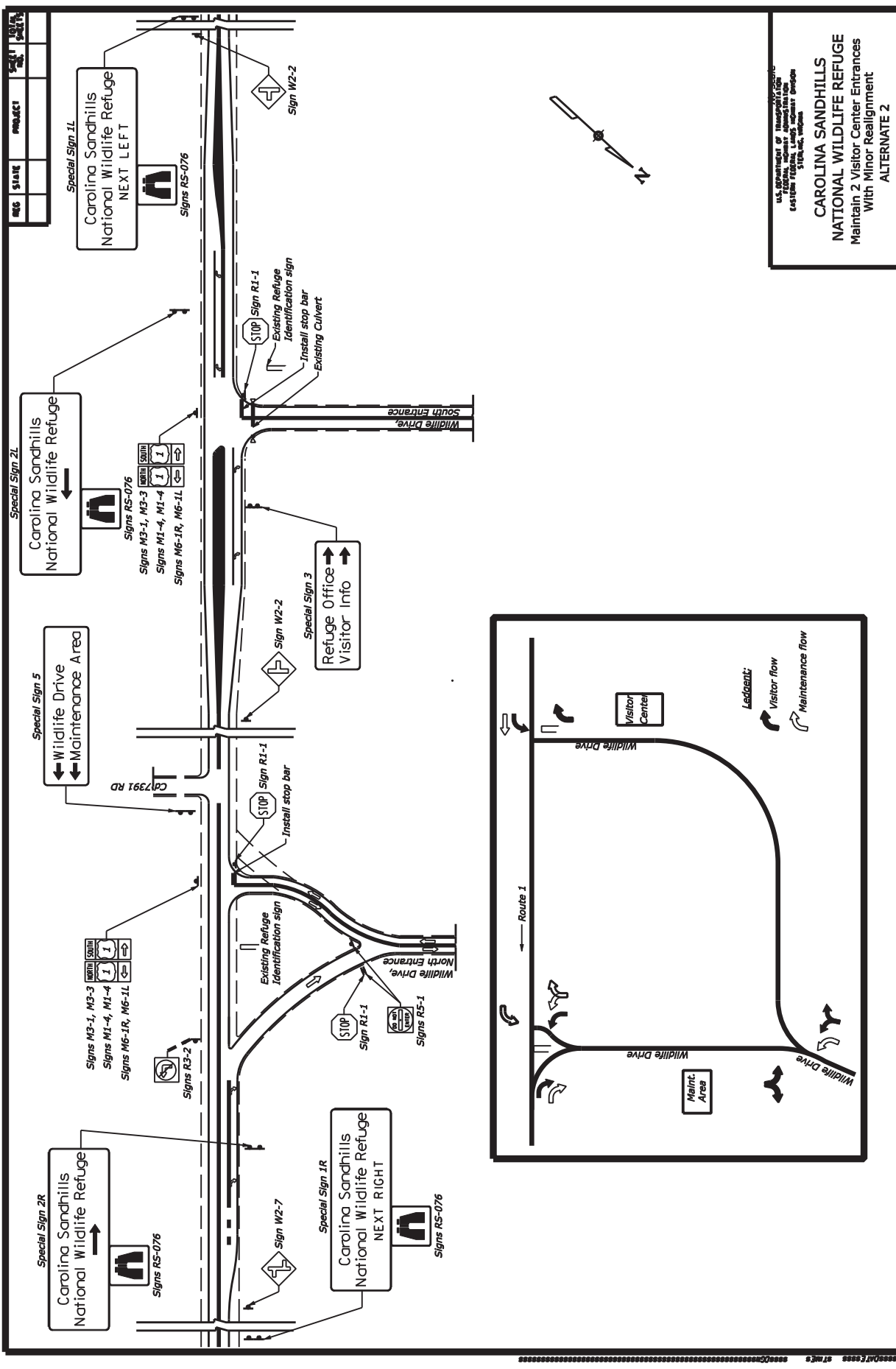
- Install advance guide signs “Carolina Sandhills National Wildlife Refuge Next Right / Next Left” as shown on diagram.
- Replace and redesign the “Carolina Sandhills National Wildlife Refuge” sign, “(left arrow) Wildlife Drive, (left arrow) Maintenance Area” sign, and the “Refuge Office (right arrow), Visitor Info (right arrow)” sign as shown on diagram.
- Add right turn lanes approaching both US Rte 1 southbound Wildlife Drive intersections, and a left turn lane for northbound US Rte 1 traffic approaching the south Wildlife Drive entrance. Any proposed lane widening will require coordination and concurrence from SCDOT.
- In realigning the north Wildlife Drive Y-intersection, install new Stop bar, Stop (R1-1), Do Not Enter (R5-1), and No Left Turn (R3-2) signs as shown in the diagram to allow entrance at both legs of the Y-intersection.
- Place Side Road (W2-2) sign in advance of south entrance in the northbound direction and the Offset Side Road (W2-7) sign in advance of the north entrance in the southbound direction as shown on diagram.
- Restrict passing at the intersection of both Entrances according to MUTCD guidelines as shown on diagram.
- Upgrade stop signs at both entrances and stop bars according to MUTCD guidelines as shown on diagram.
- Install guide sign assembly “US Rte 1 North / Left and South / Right” as shown on diagram for exiting Refuge traffic at both south and north Wildlife Drive intersections.



U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
CAROLINA SANDHILLS  
NATIONAL WILDLIFE REFUGE  
1 Visitor Entrance  
PREFERRED OPTION







U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
CAROLINA SANDHILLS NATIONAL WILDLIFE REFUGE  
SOUTH ENTRANCE, NORTH ENTRANCE  
SOUTH ENTRANCE, NORTH ENTRANCE  
SOUTH ENTRANCE, NORTH ENTRANCE

**CAROLINA SANDHILLS  
NATIONAL WILDLIFE REFUGE**  
Maintain 2 Visitor Center Entrances  
With Minor Realignment  
ALTERNATE 2