MID-CURRITUCK BRIDGE STUDY

ALTERNATIVES SCREENING REPORT

WBS Element: 34470.1.TA1
STIP NO. R-2576
CURRITUCK COUNTY
DARE COUNTY

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Alternatives Screening Report

This Alternatives Screening Report discusses the process used by the North Carolina Turnpike Authority (NCTA) and the Federal Highway Administration (FHWA) to select alternatives for detailed study in the Mid-Currituck Bridge Draft Environmental Impact Statement (DEIS).

This report is divided into the following sections:

- A description and discussion of the No-Build Alternative, beginning on page 1;
- A description and screening of project concept alternatives, beginning on page 2, including:
  - Existing-Road Improvement (ER) Alternatives;
  - Mid-Currituck Bridge (MCB) Alternatives;
  - Several low capital investment and operational alternatives; and
  - Ferry (F) Alternatives;
- A description and screening of Mid-Currituck Bridge corridor location alternatives, beginning on page 51;
- Identification of the detailed study alternatives to be evaluated in detail in the DEIS, beginning on page 66; and
- A description of refinements developed for the bridge corridors selected for detailed study in the DEIS; beginning on page 69.

1.0 No-Build Alternative

The No-Build Alternative assumes that the proposed project would not be implemented. Reasonably foreseeable improvements contained in North Carolina Department of Transportation's (NCDOT) *2009 to 2015 State Transportation Improvement Program* (STIP) are expected to occur independent of the alternatives being assessed for the proposed project. The planned improvements listed in the STIP for development within or near the project area that are included in the No-Build Alternative are:

- **Project No. R-2544** —Widen US 64 to multi-lanes east of the Alligator River to US 264;

- **Project No. R-2545**—Widen US 64 to multi-lanes east of Columbia to east of the Alligator River;
- **Project No. R-2574** —Widen US 158 to multi-lanes from NC 168 to east of NC 34 at Belcross in Camden County; and
- **Project No. R-4429** —Upgrade NC 168 to north of SR 1232 and SR 1213 to SR 1216.

Figure 1 shows the locations of these STIP projects.

2.0 Project Concept Screening

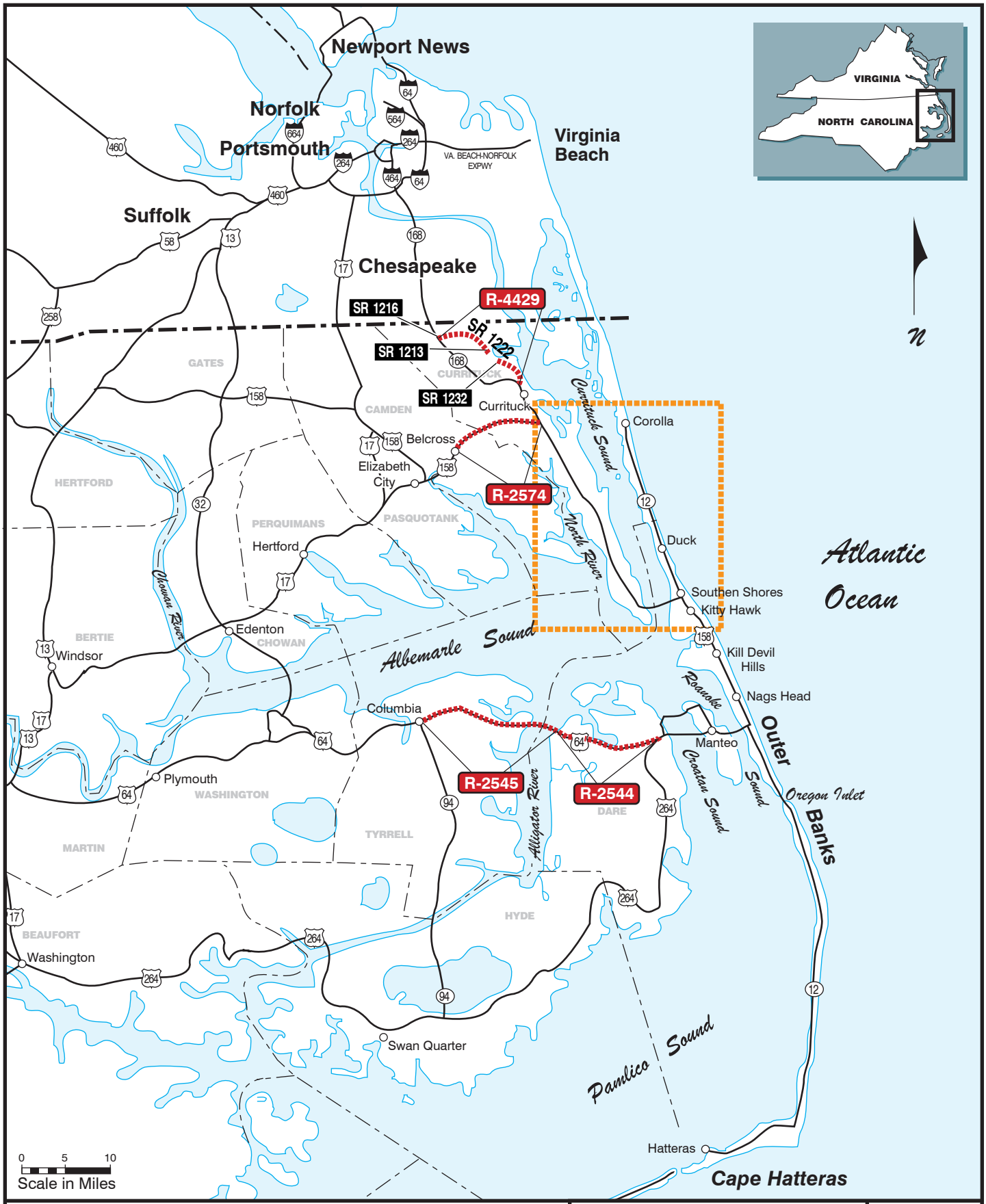
This section discusses the development and screening of project concepts. The screening focused primarily on two sets of alternatives: alternatives that improve existing roads without building a new bridge (ER1 and ER2) and alternatives that involve constructing a new Mid-Currituck Bridge in combination with improvements to existing roads (MCB1, MCB2, MCB3, and MCB4). The concept screening process also involved analysis of several other alternatives, including: shifting rental start times; transportation systems management (TSM); bus transit; and ferry service.

This section describes how each project concept alternative was developed, analyzes whether that alternative is reasonable, and indicates whether it will be carried forward in the DEIS as a Detailed Study Alternative. The project concept alternatives were analyzed based on a range of factors, including ability to meet purpose and need, economic feasibility, and potential for community and natural resource impacts.

2.1 Road and Bridge Alternatives

The current study, which was initiated by FHWA and NCTA in 2006, is a continuation of a previous study that was initiated by FHWA and NCDOT in 1995. That previous study produced a substantial body of data, analysis, and commentary, much of which focused on the choice between building a new bridge and improving existing roads.

Given the backdrop of the previous study, the alternatives screening process focused initially on developing and evaluating a range of two existing-road improvement alternatives and four Mid-Currituck Bridge alternatives. As described in the sections that follow, three of those alternatives (ER2, MCB2, and MCB4) were selected as detailed study alternatives for the DEIS.



LEGEND

- STIP Project Locations
- Mid-Currituck Bridge Project Area

STIP Projects in the No-Build Alternative

Figure 1

2.1.1 Development of Road and Bridge Alternatives

2.1.1.1 Existing-Road Improvement (ER) Alternatives

Two alternatives were developed to examine the reasonableness of improving existing NC 12 and US 158 without building a new Mid-Currituck Bridge. These alternatives were ER1 and ER2, with the initials ER standing for "existing road." Figure 2 shows the locations of the improvements associated with each alternative. ER1 was developed in an attempt to achieve a desirable level of service (LOS) D throughout the project area road network for the summer weekday. ER2 was developed to achieve maximum transportation benefits using the existing roadways, while minimizing impacts to communities. The basic features of these two alternatives are:

- **ER1**
  - Adding a third outbound lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;
  - Widening US 158 to eight lanes between the Wright Memorial Bridge and the NC 12 intersection; and
  - Widening NC 12 to four lanes between US 158 and Corolla.
- **ER2**
  - Adding a third outbound lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;
  - Widening US 158 to eight lanes between the Wright Memorial Bridge and the NC 12 intersection; and
  - Widening NC 12 to three lanes between US 158 and the Dare-Currituck County Line and to four lanes between the Dare-Currituck County Line and Corolla.

ER1 and ER2 differ only in that ER1 widens NC 12 to four lanes in Dare County, and ER2 widens NC 12 to three lanes in Dare County. The sections that follow describe the assumptions made in determining the characteristics of these alternatives.

Assumptions—Number of Lanes

Other combinations of improvements to NC 12 and US 158 are possible other than those described for ER1 and ER2. Other combinations might include: widening US 158 to six lanes in Currituck County, not widening portions of NC 12 while widening others, and widening US 158 to only six lanes in Dare County. Widening US 158 in Currituck

LEGEND

- Eight Lanes
- Six Lanes
- Four Lanes
- Three Lanes
- Third Outbound Lane or Contraflow Lane

Highway Improvement Alternatives ER1 and ER2

Figure

2

County was not considered because congestion is not forecast to occur on US 158 in Currituck County on summer weekdays in 2035, but only the summer weekend. Improvements to NC 12 and US 158 were considered when summer weekday peak hour volumes in 2035 operated at a congested LOS E or F.

The summer weekday peak period was the design hourly volume used to determine how many lanes to include in potential road and bridge improvement alternatives. The design hour is a peak traffic hour with a traffic volume that represents a reasonable value for guiding design decisions. It is selected such that hourly volumes over the course of a year are not congested with the exception of the highest peak periods. Serving high peak volumes that occur only periodically over the course of the year is considered an inefficient use of highway construction funds. The summer weekday peak hour was found to be appropriate for the Mid-Currituck Bridge alternatives development based on design hourly volume guidance found in the American Association of State Highway Officials' (AASHTO) policy manual, *A Policy on Geometric Design of Highways and Streets* (2004). The design hourly volume is given in units of vehicles per hour. Impact minimization and project area transportation plans also were considered in developing the preliminary alternatives.

Without a Mid-Currituck Sound Bridge, eight lanes on US 158 east of the Wright Memorial Bridge and four lanes on NC 12 are needed to achieve LOS D on the summer weekday. These two improvements are included in ER1. Instead of a standard eight-lane typical section on US 158 east of the Wright Memorial Bridge, a 6- to 8-lane super-street typical section also could be used. The unique characteristic of a super-street is configuration of the intersections. Side street traffic wishing to turn left or go straight must turn right onto the divided highway where it can make a U-turn through the median a short distance away from the intersection. After making the U-turn, drivers can then either go straight (having now accomplished the equivalent of an intended left turn) or make a right turn at their original intersection (having now accomplished the equivalent of an intention to drive straight through the intersection).

ER2 assumes eight lanes on US 158 east of the Wright Memorial Bridge and four lanes on NC 12 in Currituck County. On NC 12 in Dare County, ER2 assumes three lanes because the 60-foot right-of-way through most of Dare County on NC 12 is too narrow to accommodate a four lane road, and the purchase of an additional 40 feet of right-of-way width needed to accommodate four lanes would result in substantial displacement of homes and businesses along NC 12. Again, instead of a standard eight-lane typical section on US 158 east of the Wright Memorial Bridge, a 6- to 8-lane super-street typical section also could be used.

Retaining two lanes on NC 12 with intersection improvements was not included in an ER alternative because opportunities to improve NC 12 operations without additional lanes are limited. Left-turn lanes or left-overs (left turns allowed from NC 12 to a local street but not the reverse movement) could be added at major intersections (those that

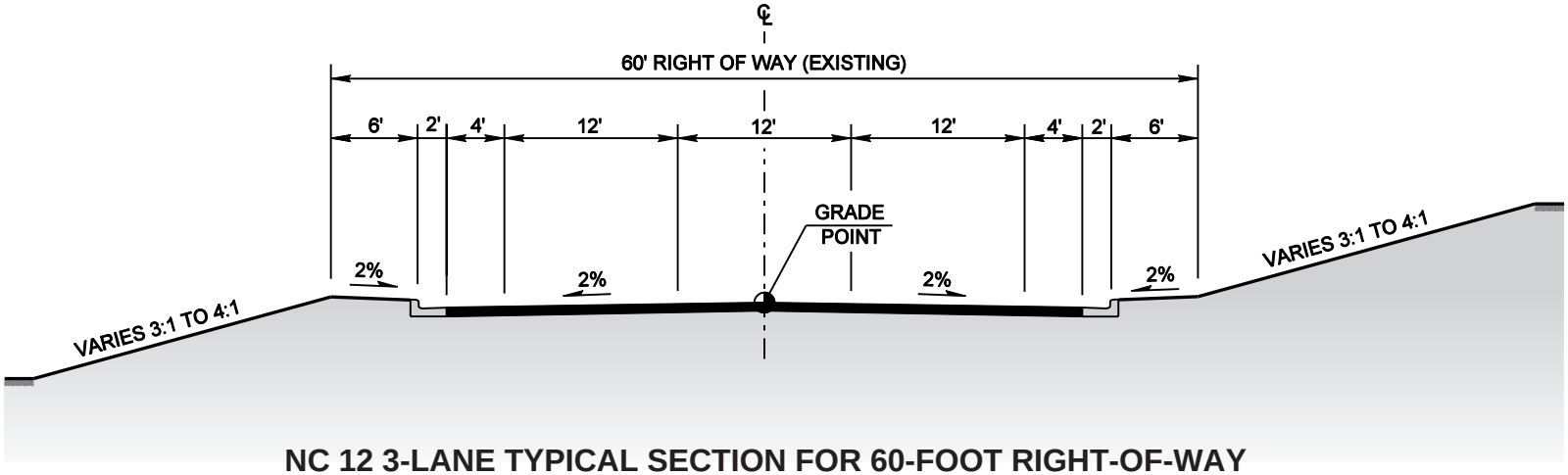
service numerous homes), particularly in Dare County, where streets and driveways intersect NC 12 at frequent intervals. Thus, the interruption of traffic flow associated with turning, particularly left turns when turning vehicles wait in the travel lane for on-coming traffic to clear before turning, would continue even with improvements at major intersections. Frequent provisions for left turns would create essentially a three-lane road, particularly with the numerous intersections on NC 12 in Dare County.

Assumptions—Road Width

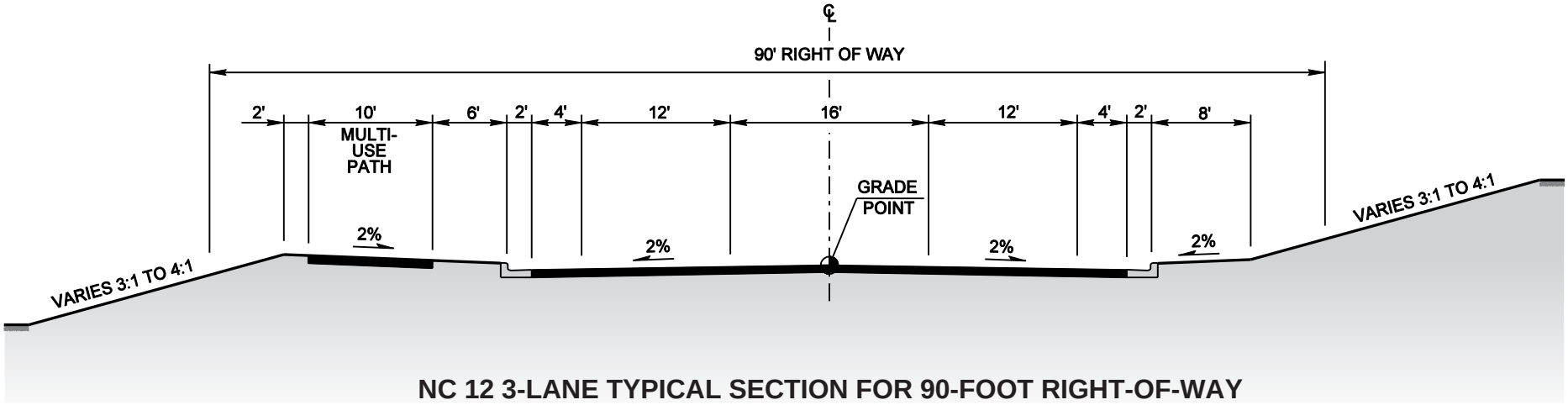
Conceptual designs were developed for ER1 and ER2 for use in assessing their potential for environmental impact and estimating their cost. Each design was based in part on a typical section defining lanes and median widths, curb and shoulder characteristics, and the width of a multi-use path for bicycles and pedestrians and its relationship to the roadway lanes. The three typical sections used with the ER1 and ER2 conceptual designs are shown in Figure 3, Figure 4, and Figure 5.

Typical sections for the conceptual designs were developed for three and four lanes on NC 12 and eight lanes on US 158 between the Wright Memorial Bridge and NC 12. The intent was to minimize the potential impact to adjoining land uses by confining improvements to the existing right-of-way where possible. The typical sections were reviewed and approved for use in meetings with representatives of NCDOT on January 10, 2006, January 18, 2006 (which also included a representative of FHWA), and February 1, 2006. The typical sections do not contain substandard design features. Typical sections may be reevaluated and modified during detailed studies.

The four-lane typical section developed for NC 12 will fit within a 100-foot right-of-way (with only minor re-grading at some locations outside the right-of-way). It includes a 17.5-foot median. The available right-of-way is 100-feet wide in much of Currituck County. Two typical sections could be considered, one with bike lanes adjacent to travel lanes and one with a multi-use path. Since a multi-use path is common along NC 12, the latter typical section was assumed. A narrower four-lane cross section (with a reduced four foot concrete center island, a five foot sidewalk, and turning restrictions) was assumed at the Sanderling Inn, where resort facilities (parking lot and recreational facilities) are close to the edge of the existing right-of-way on both sides of NC 12. Displacing a portion of the Sanderling Inn operation would be difficult to replace and a narrower section could operate successfully for a short distance (0.25 mile). This approach was not considered univerally because the 17.5-foot median width is the minimum necessary to provide for a left turn lane at intersections. The preferred minimum distance between median breaks for full intersections is 1,200 feet. The minimum distance between two intersections to accommodate a left turn lane, then to narrow the median to four feet, then bring the median back out to 17.5 feet, and finally accommodate the left turn lane at the next intersection is approximately 1,200 feet. Thus, if one attempted to narrow the median throughout a four lane NC 12, its lanes would be constantly moving in and out with the median, which is not an acceptable

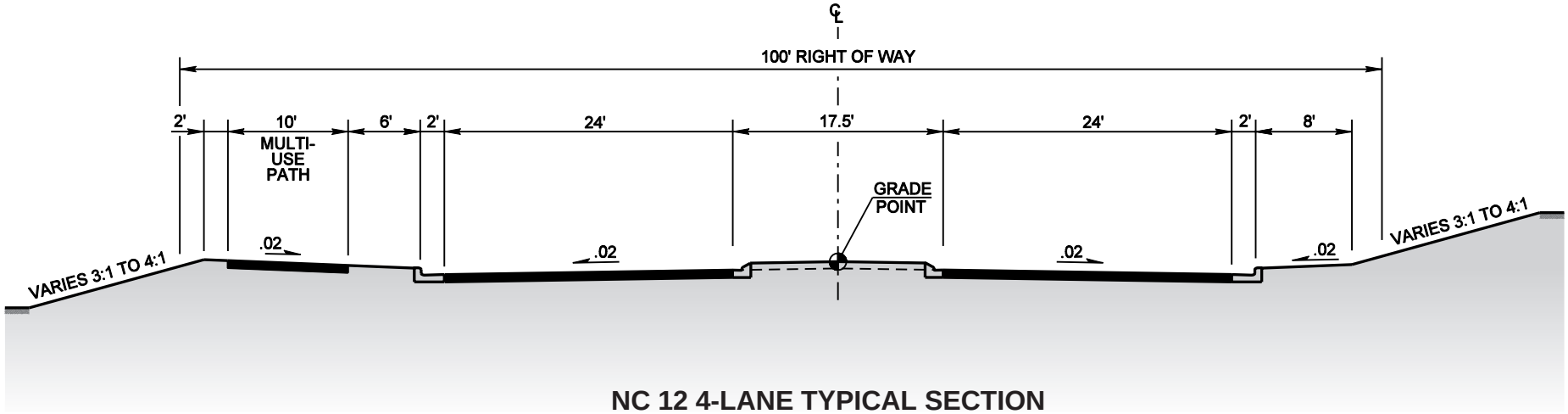


NC 12 3-LANE TYPICAL SECTION FOR 60-FOOT RIGHT-OF-WAY

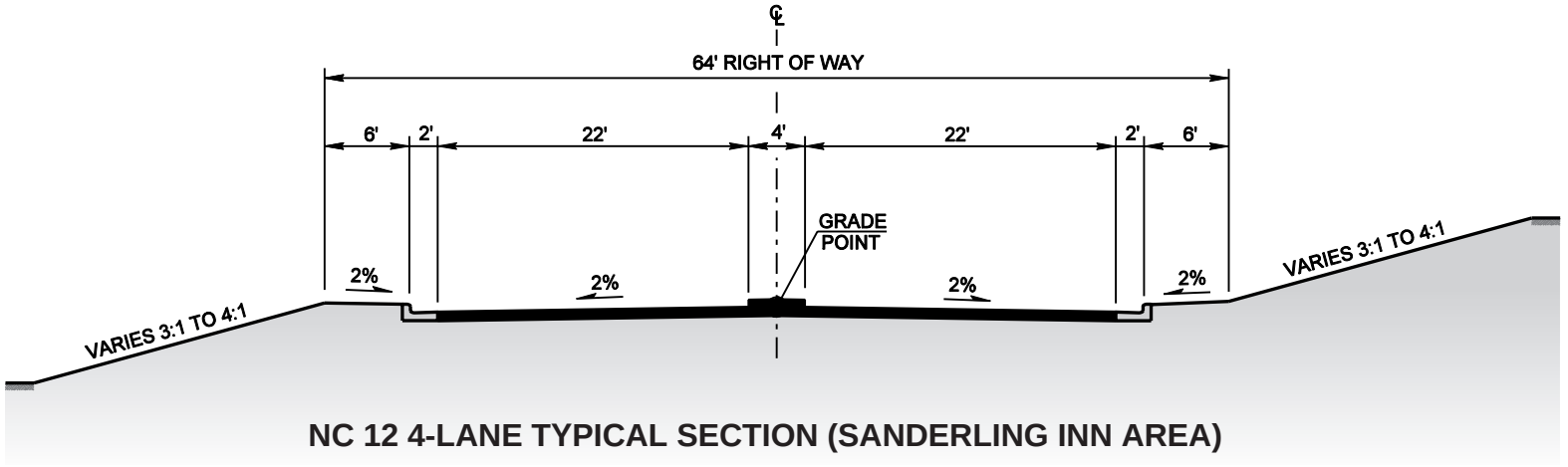


NC 12 3-LANE TYPICAL SECTION FOR 90-FOOT RIGHT-OF-WAY

	NC 12 Three-Lane Typical Roadway Sections	**Figure** 3



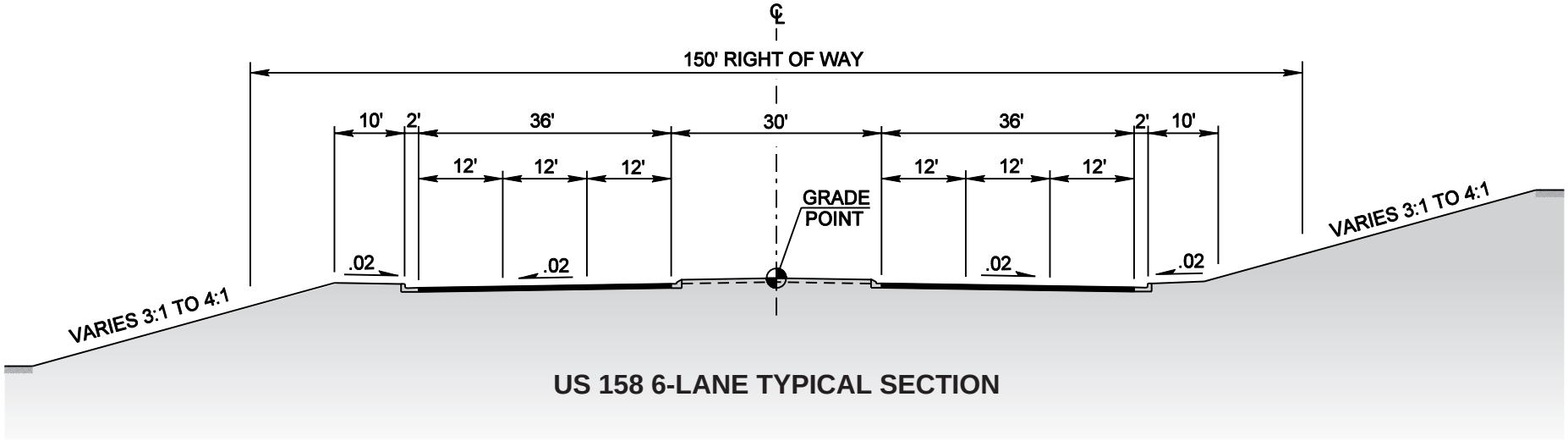
NC 12 4-LANE TYPICAL SECTION



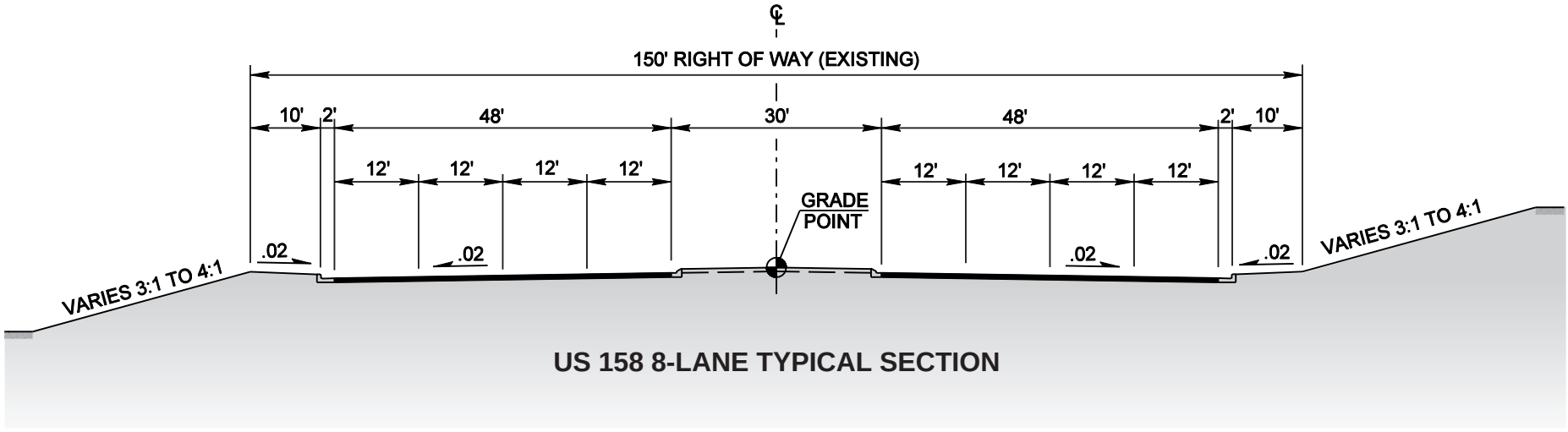
NC 12 4-LANE TYPICAL SECTION (SANDERLING INN AREA)

	NC 12 Four-Lane Typical Roadway Sections	**Figure** 4

Wright Memorial Bridge to NC 12



US 158 6-LANE TYPICAL SECTION



US 158 8-LANE TYPICAL SECTION

	US 158 Six and Eight-Lane Typical Roadway Sections	**Figure** 5

design. In addition, spacing median breaks at distances longer than 1,200 feet would not be acceptable because the purpose of NC 12 is to provide convenient access to subdivisions along its length.

Two three-lane typical sections with a continuous left turn lane were developed for NC 12. One would fit within the 60-foot right-of-way that predominates along NC 12 and would include 4-foot striped bike lanes like presently occur in downtown Duck. The third lane would serve as a continuous left turn lane available to both directions of travel. The other typical section would fit within the 90-foot right-of-way in the southern part of Southern Shores. It would include a multi-use path, as currently appears in the southern part of Southern Shores.

The typical section of the eight-lane improvement on US 158 in Dare County was developed such that it would fit within the existing US 158 right-of-way (150 feet) except for some grading. The eight-lane improvement includes a 30-foot median. A super-street cross section was considered, but not recommended during the conceptual alternatives studies. It was felt at that time that the introduction of a short section of super-street could be confusing to US 158 travelers. It also was felt that a super-street could be designed to fit within the existing right-of-way. Therefore, the decision could be re-visited as late as project implementation without substantial additional impact.

Assumptions—Widening and Intersection Improvement Locations

As described above, the typical sections were developed to minimize the need for additional right-of-way along NC 12 and US 158. However, in Dare County, NC 12 generally has a 60-foot right-of-way (90-feet of right-of-way exists at the south end of NC 12 in Southern Shores). The typical section developed for four lanes requires a 100-foot right-of-way, the minimum needed to meet NCDOT design criteria for four-lane roads. Thus, additional right-of-way would be required in Dare County with four lanes, with associated impacts to the development lining NC 12. It was found that, because of the small lot sizes along NC 12, displacement would be best minimized by generally widening to one side of the existing NC 12 right-of-way. Lot sizes are generally near the minimum allowed by current zoning. Symmetrical widening (some widening on both sides of NC 12) would leave substandard lot sizes on both sides of the road. This would necessitate the purchase of the full property and associated improvements on both sides of NC 12 rather than on only one side. Thus, the four-lane widening of NC 12 in Dare County generally assumes that the needed additional right-of-way would be purchased from one side of NC 12 or the other. The study team sought to use the side of the road where displacement losses would be least. In Duck's commercial area, use of land from the town's public park (west side of NC 12) was avoided.

The four-lane conceptual designs include a median with breaks at approximately 1,200-foot intervals, varying somewhat depending on the spacing of existing intersections. The median's limiting of left turns to major intersections would greatly reduce traffic interferences associated with drivers stopping in the travel lanes to make left turns. For

the three-lane design, limits on turning to and from NC 12 at some closely spaced intersections was assumed, generally in the form of limiting turns on some local streets to right turns in and right turns out and, where alternate access is available, intersection closures to reduce the number of points where drivers would slow to make turns. These changes would add to the additional road capacity provided by the continuous left turn lane of the three-lane alternative.

For the four-lane NC 12, curves too tight to meet current NCDOT standards for a four-lane road were reconfigured in the conceptual designs to meet current minimum curve standards. Curves were not altered with the three-lane road.

Finally, it was assumed that intersection improvements would be made at signalized intersections along the widened roadways as needed to achieve a level of service appropriate for the travel benefits associated with the additional lanes.

Assumptions—US 158 Hurricane Evacuation Improvements

US 158 in Currituck and Dare counties, from NC 168 to NC 12, was found to be the road in the project area that would control future hurricane clearance times. Without improvements in the outbound capacity of this portion of US 158, future hurricane evacuation clearance times would not decrease, even if NC 12 were widened, or a Mid-Currituck Bridge were built. For hurricane clearance, US 158 would be a bottleneck. Hurricane clearance is the total number of hours from the time the first evacuee leaves their origin in the affected area until the last evacuee reaches shelter or a point of safety. That point of safety is assumed to be I-95, which passes north and south through east-central North Carolina.

Thus, ER1 and ER2 also were assumed to include either a third outbound lane on US 158 between NC 168 and the Wright Memorial Bridge, where no other improvements were being considered, or that county and state emergency management personnel would operate the continuous left turn lane currently along US 158 as a third outbound lane, or so called contra-flow lane. At the Knapp Bridge across the Intracoastal Waterway there is no fifth center lane. In that case, the center southbound lane would be used as a third outbound lane. Alternatives ER1 and ER2 include widening US 158 between the Wright Memorial Bridge and NC 12, which also would facilitate hurricane evacuation.

Assumptions – No Tolling on Existing Roads

The existing-road improvement alternatives all assume that existing roads (US 158 and NC 12) would not be tolled. This assumption was made for two reasons. First, NCTA lacks authority under North Carolina law to toll existing roads, except in relation to a single proposed project in the Raleigh area (N.C. Gen. Stat. 136-89.187). Second, it is impractical to toll roads that have multiple uncontrolled access points, as is the case with NC 12 and US 158 in the project area. Given these two considerations, any improvement

alternative that includes only widening existing roads would need to be funded entirely with traditional (non-toll) revenue sources.

2.1.1.2 Mid-Currituck Bridge (MCB) Alternatives

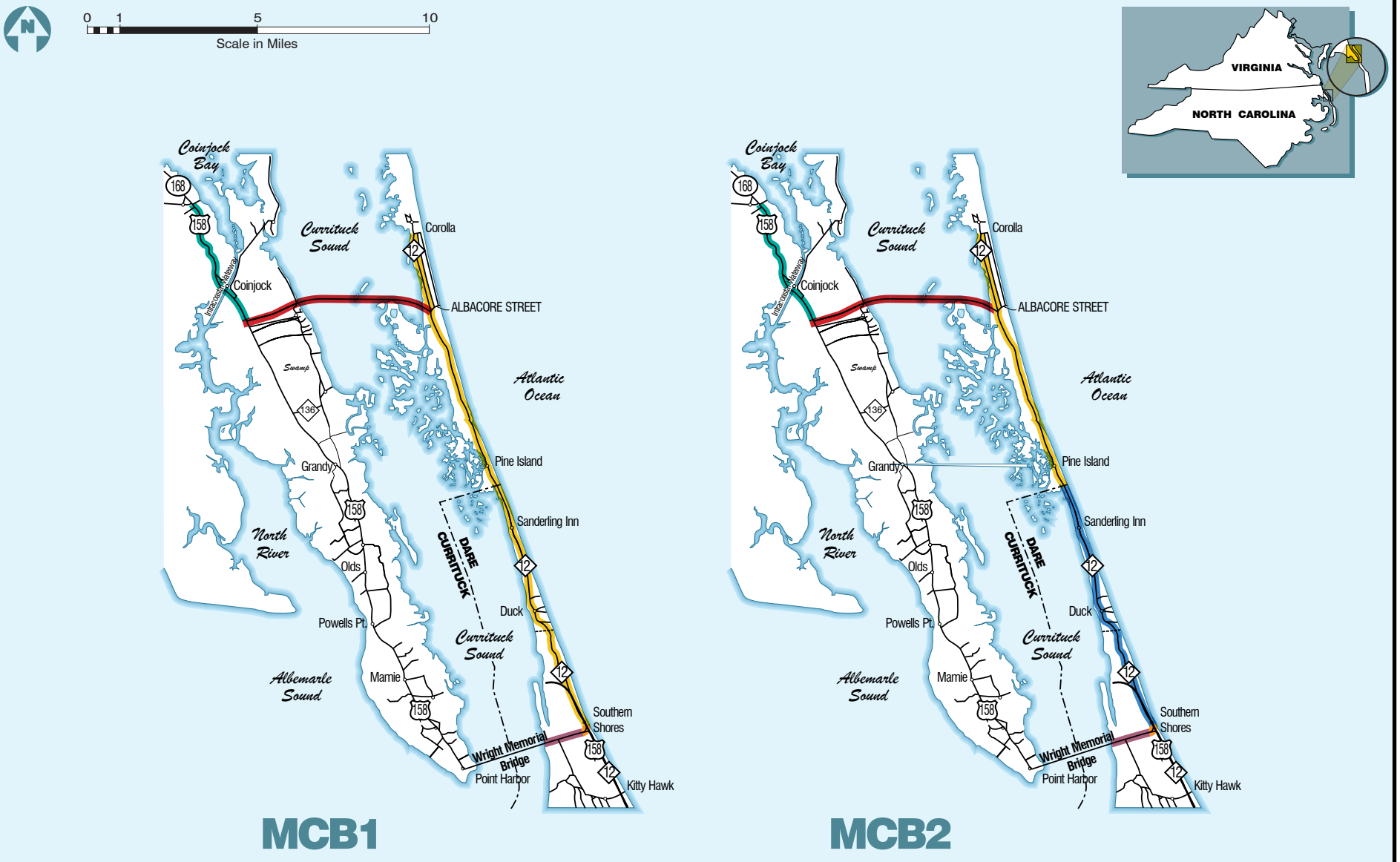
Four alternatives involving construction of a bridge over Currituck Sound were considered. These alternatives are MCB1, MCB2, MCB3, and MCB4, with the initials MCB standing for "Mid-Currituck Bridge." Figure 6 and Figure 7 show the MCB alternatives and their related highway improvements.

MCB1 and MCB2 consider the potential additional travel benefits of combining a Mid-Currituck Bridge with substantial NC 12 and US 158 improvements. Thus, MCB1 and MCB2 include the road improvements similar to ER1 and ER2, respectively, plus a Mid-Currituck Bridge.

MCB3 and MCB4 were considered in order to identify the extent to which network congestion and travel time could be improved, as well as other associated benefits, if only a Mid-Currituck Bridge were built. This is the project as defined in the NCDOT *2009 to 2015 State Transportation Improvement Program* (STIP) and county and state transportation improvement plans. Limited existing road improvements were added to MCB3 and MCB4 to ensure that southbound traffic stopped at traffic signals on NC 12 would not queue back onto the bridge on the summer weekend. These improvements also would ensure that the purpose of substantially reducing hurricane clearance time was met. These two alternatives differ in terms of the extent of their hurricane evacuation improvements.

The basic features of the four Mid-Currituck Bridge alternatives are:

- **MCB1**
  - Constructing a two-lane toll bridge across the Currituck Sound in Currituck County;
  - Adding a third outbound lane on US 158 between NC 168 and Aydlett Road (SR 1140) as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;
  - Widening US 158 to six lanes between the Wright Memorial Bridge and Jupiter Trail/Wal-Mart entrance and eight lanes from Jupiter Trail/Wal-Mart entrance to the NC 12 area; and
  - Widening NC 12 to four lanes between US 158 and Corolla.
- **MCB2**
  - Constructing a two-lane toll bridge across the Currituck Sound in Currituck County;



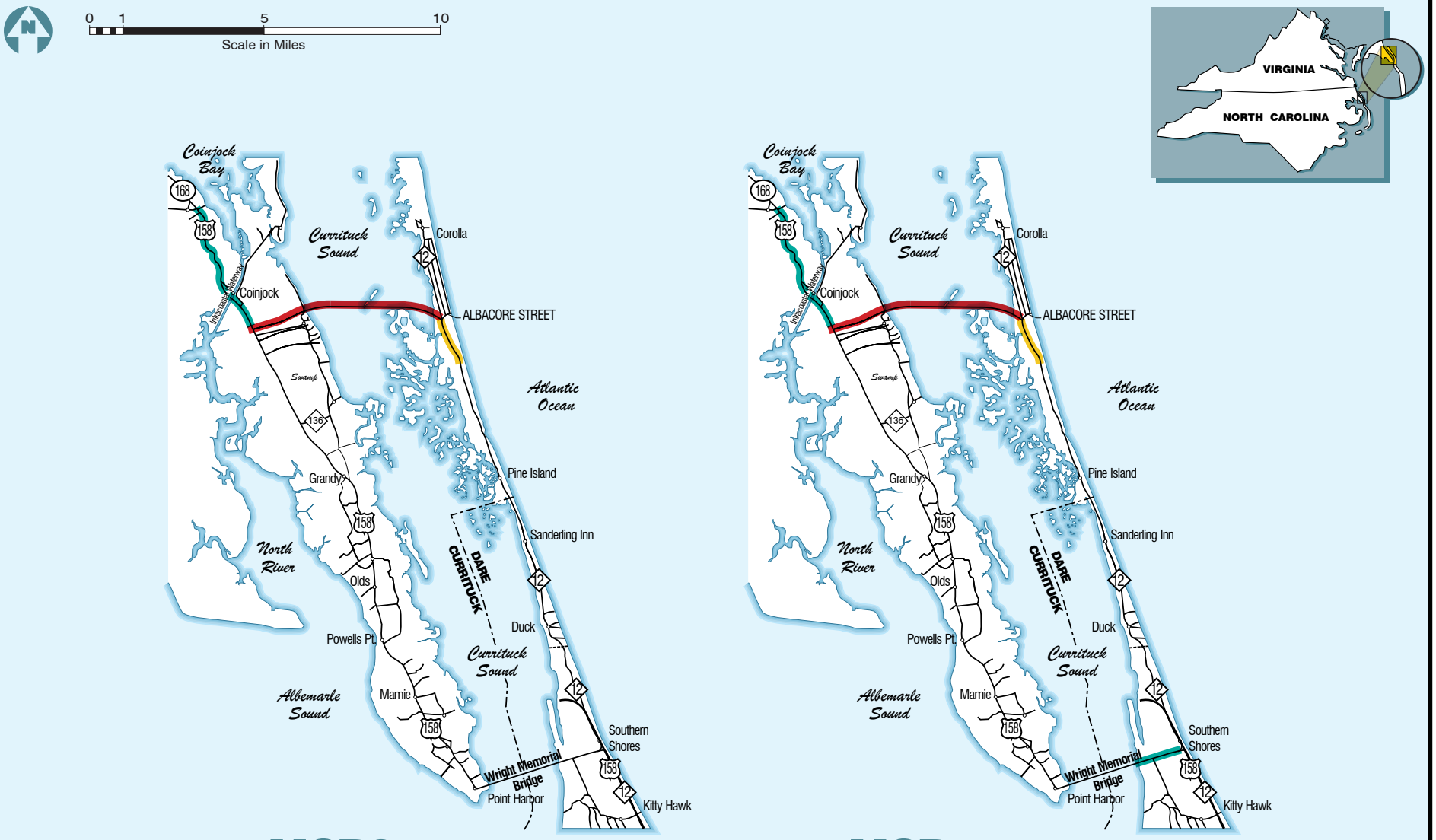
LEGEND

- Eight Lanes
- Six Lanes
- Four Lanes
- Three Lanes
- Mid-Currituck Bridge
- Third Outbound Lane or Contraflow Lane

Bridge Alternatives MCB1 and MCB2

Figure

6



LEGEND

- Eight Lanes
- Six Lanes
- Four Lanes
- Three Lanes
- Mid-Currituck Bridge
- Third Outbound Lane or Contraflow Lane

Bridge Alternatives MCB3 and MCB4

Figure

7

- Adding a third outbound lane on US 158 between NC 168 and Aydlett Road (SR 1140) as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;

- Widening US 158 to six lanes between the Wright Memorial Bridge and Jupiter Trail/Wal-Mart entrance and eight lanes from Jupiter Trail/Wal-Mart entrance to the NC 12 area; and

- Widening NC 12 to three lanes between US 158 and the Dare-Currituck County Line and to four lanes between the Dare-Currituck County Line and Corolla.

- **MCB3**

  - Constructing a two-lane toll bridge across the Currituck Sound in Currituck County;

  - Adding a third outbound lane on US 158 between NC 168 and Aydlett Road (SR 1140) as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane; and

  - Widening NC 12 to four lanes for approximately two to four miles south of the intersection with a Mid-Currituck Bridge.

- **MCB4**

  - All components of MCB3 plus a third outbound lane on US 158 between the Wright Memorial Bridge and NC 12 (or using the center turn lane as a third outbound evacuation lane) as an additional hurricane evacuation improvement.

Alternative bridge locations were not evaluated in the screening of project concepts because the travel benefits would be the same for different bridge locations. Alternative bridge locations are considered in Section 3.0 of this report.

Conceptual designs for MCB1 to MCB4 were developed for use in assessing their potential for environmental impact and estimating their cost. The sections that follow describe the assumptions made in determining the characteristics of these alternatives.

Assumptions—Capacity at Interface Between the Bridge and US 158 and NC 12

Although the design hourly volume for this project in 2035 is for the summer weekday, it was determined that the bridge's interchange with US 158, toll plazas, and intersection with NC 12 should operate at LOS D on the summer weekend as well. This assumption was made because lengthy delay and associated queuing of vehicles (travelers completely stopped waiting for their turn to move) at these three key points could substantially increase travel time and lower speed on the bridge, as well as adversely affect travel on US 158 during this heaviest of travel periods in the project area.

AASHTO indicates that LOS D or better is achieved at a signalized intersection when delay is 40 seconds or less. LOS E occurs when delay is between 40.1 and 60 seconds, and LOS F occurs when the delay time exceeds 60 seconds. Queuing occurs when vehicles arrive at an intersection at a rate faster than they can pass through an intersection.

Use of a signalized intersection between a Mid-Currituck Bridge and US 158 was considered; however, delay on the summer weekend in 2035 would be 168 to 222 seconds or 2.8 to 3.7 times the 60 seconds where LOS F begins. Average summer weekend travel demand for the Mid-Currituck Bridge would be 1,050 vehicles in the peak hour for vehicles turning from southbound US 158 to the bridge. An intersection with dual left turn lanes can process approximately 300 vehicles per hour. These conditions would result in traffic queues from a US 158 intersection north for two miles or more in this single hour. Over the course of the summer weekend peak travel period on US 158, even longer queues could be expected as demand continues to exceed capacity. Similar queues would also occur for outbound traffic on US 158. Thus, an interchange, rather than a signalized intersection, with US 158 is assumed with the Mid-Currituck Bridge.

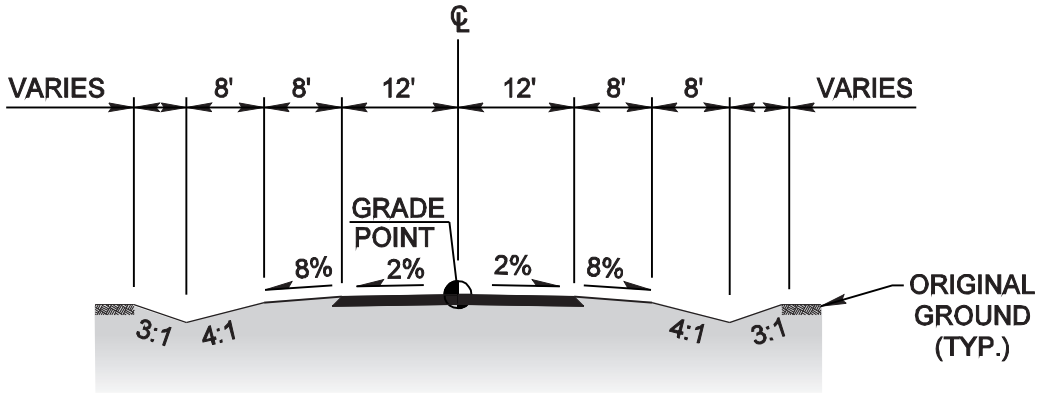
To achieve LOS D in terms of delay at the toll plazas, four plazas were assumed in each direction of travel, one with solely electronic toll collection where drivers would not need to stop to pay their toll and three with both manual toll collection (by an attendant) and electronic toll collection. In the eastbound direction, this number presumes an interchange with US 158. Some manual toll collection is considered essential because not all visitors to the Outer Banks are expected to come from states with electronic toll collection programs or agreements with the NCTA for toll collection based on identification of license plates.

With MCB3 and MCB4, which do not include extensive four-laning on NC 12 in Currituck County, it is assumed that NC 12 would be widened to four lanes between the bridge terminus and the Currituck Clubhouse Drive (an expected future signalized intersection) area to ensure that southbound traffic on NC 12 would not queue back onto the Mid-Currituck Bridge. The length of this widening would be approximately 2 to 4 miles depending on the location of the intersection between the bridge and NC 12. Without widening NC 12, eastbound queues from Currituck Clubhouse Drive would extend to the bridge's intersection with NC 12 and then onto the bridge for as up to 1.5 miles.

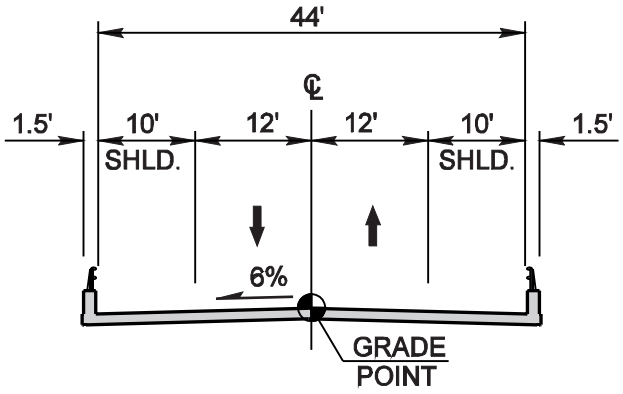
The traffic numbers considered in making these decisions were 2035 forecasts that assumed a toll was charged.

Assumptions—Number of Lanes on Bridge

All of the MCB alternatives assume a two-lane Mid-Currituck Bridge. The typical section for such a bridge is shown in Figure 8. Early in the alternatives screening study,



BRIDGE APPROACH ROAD TYPICAL SECTION



MID-CURRITUCK BRIDGE AND APPROACH BRIDGE TYPICAL SECTION

	Mid Currituck Bridge as a Two-Lane Bridge	**Figure** 8

a four-lane bridge was assumed as a potential worst-case scenario when considering potential environmental impacts of the bridge. Early traffic forecasts, which did not incorporate the potential traffic diversion that would occur as a result of a toll being charged, indicated that four lanes would be needed to achieve LOS D on the bridge on the summer weekday (the design hourly volume)

The decision to evaluate a two-lane bridge, rather than a four-lane or a three-lane bridge, was based on LOS, travel time, safety, and cost. Although the design hourly volume for the project is the average peak summer weekday, the benefits to summer weekend travel also were considered, as they are for other alternatives evaluations discussed in this report. Key factors in the decision to evaluate a two-lane bridge instead of a three- or four-lane bridge are shown in Table 1. The traffic numbers used in considering LOS, speed, and travel time across the bridge were 2035 forecasts that assumed a toll was charged.

Table 1. Bridge Lane Comparison

Number of Lanes	Summer Weekday (Peak Travel Direction)			Summer Weekend (Peak Travel Direction)			Conceptual Cost (millions of dollars)
	LOS	Speed (mph)	Travel Time (minutes)	LOS	Speed (mph)	Travel Time (minutes)	
2-lane	D	48	10.1	E	43	11.1	$491
3-lane with lane control signals (LCS)	NA	NA	NA	B	49	9.6	$545
3-lane with movable barrier	NA	NA	NA	B	52	9.2	$574
4- lane (1 bridge)	A	55	8.7	B	54	8.9	$613
4-lane (2 bridges)	A	55	8.7	B	54	8.9	$709

NA=Not applicable.

The findings when comparing a two- and a four-lane bridge were:

- A two-lane bridge would provide a desirable LOS D on the average summer weekday in 2035. On the average summer weekend, LOS E would occur, but travel time across the bridge would be reduced by only 1.0 minute between the summer weekday and the summer weekend.
- A four-lane bridge would result in LOS B on the summer weekend in 2035 with a travel time 2.2 minutes less than with a two-lane bridge.

- A four-lane bridge would cost approximately $100 to $200 million more than a two-lane bridge.

The reductions in travel time (1.4 minutes on the summer weekday and 2.2 minutes on the summer weekend) across a four-lane bridge were determined not to be worth the substantial additional cost.

A three-lane bridge also was considered as a possible means of improving average summer weekend travel times at a lower cost. In the case of a three-lane bridge, the third center lane would be reversible so that on the summer weekend, two lanes of travel always could be provided in the peak direction. On the average summer weekday, reversing the center lane would not be needed because an adequate LOS D is achieved with two lanes and because there is no prevailing peak direction in the traffic flow.

Two approaches to reversing the third lane on the summer weekend were considered:

1. Use of overhead lane control signals to designate direction of travel. This approach proved to be unacceptable because of:

    a. The lack of familiarity of tourists with the meaning of lane control signals and a safe response to what they indicate, which would create a risk for head-on collisions

    b. Their safe operation could necessitate lowering the bridge speed limit to 35 mph, less than the 43 mph (see Table 1) that could be achieved with a two-lane bridge.

2. Use of a moveable barrier to designate the direction of travel for the third lane, eliminating the opportunity for travelers moving in opposite directions to enter the same lane. This eliminates the safety concern associated with the first option. This approach also proved to be unacceptable because of:

    a. The impracticality of purchasing equipment ($12 million), training staff, and operating equipment for only 26 summer weekend days per year;

    b. Rubbernecking related to presence of the equipment while moving the barrier could reduce speeds during the mid-day transition;

    c. The mid-day transition period where travel demand would be generally equal in each direction of travel would be one hour, and both directions of travel would be operating at LOS E;

    d. Travel time saving in the peak direction would be only 1.9 minutes; and

    e. There would be an approximate additional capital cost of $80 million, as well as the cost to operate, maintain, and store the associated barrier moving equipment.

It was decided that the reductions in travel time across a three-lane bridge on the average summer weekend were not substantial enough to warrant the risk, challenges, and cost associated with a three-lane bridge.

Assumptions—Existing Road Improvements

The MCB alternatives vary in terms of their assumptions about improvements to existing roads. MCB1 and MCB2 include more extensive existing-road improvements than MCB3 and MCB4.

MCB1 assumes the ER1 lane improvements to NC 12 and US 158, except that US 158 is assumed to be widened to six lanes instead of eight lanes between the Wright Memorial Bridge and Jupiter Trail/Wal-Mart Center driveway (1,700 feet west of NC 12). The Mid-Currituck Bridge would divert enough US 158 traffic from this area that a six-lane road generally would be sufficient to maintain LOS D on the summer weekday. A super-street also could be used.

MCB2 assumes the ER2 lane improvements, except that like MCB1, MCB2 assumes six lanes on US 158 between the Wright Memorial Bridge between the Wright Memorial Bridge and Jupiter Trail/Wal-Mart Center driveway. A super-street also could be used.

Like the eight-lane US 158 typical section considered with ER1 and ER2, the six-lane typical section (see Figure 5) for US 158 would fit within the existing 150-foot right-of-way and include a 30-foot median. The other road width and intersection location assumptions used for ER1 and ER2 also were used for MCB1 and MCB2, respectively.

MCB3 and MCB4 would involve building the bridge while making only those improvements to NC 12 and US 158 that are needed to meet the hurricane clearance need and to minimize the potential for congestion on a two-lane NC 12 from queuing back onto the bridge. Therefore, MCB3 and MCB4 assume NC 12 is widened to four lanes between the Currituck Clubhouse Drive area and the Mid-Currituck Bridge, as described above under "Assumptions—Capacity at Interface Between the Bridge and US 158 and NC 12," as well as the hurricane evacuation improvements described below.

Finally, for all four MCB alternatives it was assumed that intersection improvements would be made at signalized intersections along the widened roadways, as needed, in order to achieve a level of service appropriate for the travel benefits associated with the additional lanes.

Assumptions—US 158 Hurricane Evacuation Improvements

As indicated in Section 2.1.1.1, under "Assumptions—US 158 Hurricane Evacuation Improvements," US 158 was found to be the road in the project area that would control future hurricane clearance times. Without improvements to outbound US 158, clearance times would not change, even with a Mid-Currituck Bridge. The bridge, however, would divert some evacuating traffic from US 158. With some traffic leaving the Outer

Banks via a Mid-Currituck Bridge, fewer improvements on US 158 would be needed to improve hurricane clearance times.

Thus, MCB1, MCB2, and MCB3 assume a third outbound lane for emergency use or using the center turn lane as a third outbound emergency lane only between the Mid-Currituck Bridge and NC 168. MCB1 and MCB2 include widening US 158 between the Wright Memorial Bridge and NC 12, which would benefit clearance times. MCB3 does not include this improvement. MCB4 seeks to further reduce clearance times over MCB3 by adding a third outbound lane between the Wright Memorial Bridge and NC 12 or using the center turn lane as a third emergency lane.

Assumptions – Tolling

All of the MCB alternatives assume that, if constructed, the Mid-Currituck Bridge would be a toll bridge. This assumption was based on several considerations. First, there is no other funding source for construction of the bridge; thus without tolls, the project could not go forward. Second, a *Preliminary Traffic and Revenue Study* prepared for the project (Wilbur Smith Associates, January 2007) concluded that tolls can cover a substantial portion of the project cost. Finally, the North Carolina General Assembly has specifically designated the Mid-Currituck Bridge as a toll bridge on the North Carolina Intrastate System, and has specifically authorized NCTA to develop this bridge as a toll facility. Based on all of these considerations, this report assumes that any bridge across Currituck Sound would be operated as a toll bridge.

2.1.2 Evaluation of Road and Bridge Alternatives

The six Preliminary Alternatives (ER1, ER2, MCB1, MCB2, MCB3, and MCB4) were evaluated based on their ability to meet purpose and need, improve system efficiency, as well as economic feasibility, social impacts, and natural resource impacts. The assessment of economic feasibility included both total cost and the availability of financing to cover that cost. The factors used to compare the six alternatives are described in Section 2.1.2.1 below.

As noted above, a four-lane bridge was initially assumed in the alternatives screening and provided the basis for the earliest discussions of the merits of the alternatives with environmental resource and regulatory agencies. In late 2007, when NCTA determined that a two-lane bridge would provide an adequate level of traffic service, the comparisons were revised to reflect that decision. Therefore, all data in this report regarding benefits, costs, and impacts reflect a two-lane bridge.

2.1.2.1 Evaluation Criteria

The following factors were used to screen the six Preliminary Alternatives:

- Ability to meet purpose and need and the level of benefit offered in relation to those purposes;

- Improve system efficiency;
- Economic feasibility (cost and funding capacity); and
- Potential impacts on natural resources and communities.

Ability to Meet Purpose and Need and Level of Benefit

NCTA has identified three purposes in the purpose and need statement with corresponding measures of success, as follows:

1. To substantially improve traffic flow on the project area's thoroughfares. Thoroughfares in the project area are US 158 (from NC 168 to NC 12) and NC 12 (from US 158 to its endpoint in Currituck County).

   As described in the *Statement of Purpose and Need*, the ability of alternatives to achieve this purpose is measured in terms of:

   - The percent reduction in annual millions of vehicle-miles traveled under congested condition (at LOS E and F, at LOS F, and at a poor LOS F) on the project area's thoroughfares in 2035 (LOS E and F are considered congested);
   - The percent reduction in miles of NC 12 and US 158 operating at LOS F on the summer weekday and summer weekend in 2035; and
   - The percent reduction in miles of NC 12 and US 158 operating at a poor LOS F on the summer weekday and summer weekend in 2035.

   LOS A to F are defined in Section 1.8.3 of the *Statement of Purpose and Need*. The traffic engineering literature does not define a poor LOS F but only LOS A to F. However, the LOS analysis for this project identified a 2035 peak period travel demand on some roads that would be much higher than the capacity of those roads (see Figure 1-8 of the *Statement of Purpose and Need*). For example, on US 158 east of the Wright Memorial Bridge and on NC 12 in Southern Shores summer weekend travel demand in 2035 would be 62 to 117 percent more than the capacity of the road (ratio of traffic volume to road capacity of 1.62 to 2.17 with LOS F beginnning at 1.0). Thus, for assessing the relative benefits of the alternatives, it was important to create the distinction of a poor LOS F. It is assumed that a poor LOS F occurs when the ratio of traffic volume to capacity is 1.3 or greater (peak period travel demand is 30 percent higher than the capacity of the road). This number was selected keeping in mind that traffic does not tend to have perfectly even flow. Thus, below a volume-capacity ratio of 1.3 there exists opportunities for breaks in the traffic flow for use by drivers turning from driveways and unsignalized intersections. In addition, some drivers can experience moments of better than LOS F flow in the course of a peak hour even though, on the whole, the peak hour LOS is F. Once the ratio of volume to capacity reaches 1.3, flow variation would likely disappear, and a continuous

unbroken stream of traffic would be experienced by people on NC 12 and US 158. Thus, it would be extremely difficult for people to turn out of driveways and unsignalized intersections.

2. To substantially reduce travel time for persons traveling between the Currituck County mainland and the Currituck County Outer Banks.

   The ability of alternatives to achieve this purpose is measured in terms of the percent reduction in summer travel time (weekday and weekend) in 2035 between Aydlett Road on the Currituck County mainland and Albacore Street on the Currituck Outer Banks via the Wright Memorial Bridge. The travel time in 2035 associated with the direct link a Mid-Currituck Bridge would create between the mainland and the Outer Banks also is considered.

3. To substantially reduce hurricane clearance time for residents and visitors who use NC 168 and US 158 during a coastal evacuation.

   The ability of alternatives to achieve this purpose is measured in terms the potential reduction in hurricane clearance time in 2035 from the No-Build Alternative, as compared to North Carolina's legislated standard of an 18-hour clearance time (NC Gen. Stat. § 136-102.7, "Hurricane Evacuation Standard").

An improvement is considered substantial as opposed to minor if the improvement is great enough to be largely noticeable to typical users of the transportation system and if the improvement offers some benefit across much of the network as opposed to offering only a few localized benefits. Alternatives that provide only minor or no improvement, as opposed to substantial, would not achieve these purposes.

Improve System Efficiency

A desireable benefit of the proposed project would be to improve system efficiency. The extent to which this benefit is achieved is measured in two ways. First, it is measured in terms of the potential reduction in annual million vehicle-miles traveled on the thoroughfare network. Second, it is measured in terms of its compatibility with the goal of the North Carolina State General Assembly and NCDOT to ensure an efficient transportation system in North Carolina. This goal is reflected in the North Carolina Strategic Highway Corridor (SHC) System and the North Carolina Intrastate System, both of which include as an integral part of that effciency goal the construction of a Mid-Currituck Bridge as a new transportation link between the Currituck County mainland and the Currituck County Outer Banks.

Economic Feasibility (Cost and Funding Capacity)

This screening factor considers the capital cost of and the available capital funding for the road and bridge alternatives.

Available capital funding considers potential total revenue from bond financing and potential Transportation Infrastructure Finance and Innovation Act (TIFIA) financing. It also considers the potential capital funding shortfall and the potential ability of a public/private partnership to cover shortfalls. A public/private partnership could cover shortfalls by financing and operating the project for a longer time than is possible with bond financing.

In 2008, the North Carolina General Assembly appropriated $15 million per year for repayment of bonds or payment of debt service not covered by toll revenues, which also could contribute to covering shortfalls that might be associated with toll bridge financing costs.

For several reasons, available capital funding also considers that US 158 and NC 12 cannot be tolled. First, it is not practical to collect tolls on roads with multiple uncontrolled access points. Second, state law requires that if a road is tolled that "an existing, alternate, comparable nontoll route corresponding to each Turnpike Project constructed" be available (NC Gen. Stat. §.136-89.197). Thus, NCTA has no authority to toll US 158 and NC12. Finally, available capital funding considers that no construction funds derived from highway user taxes and fees are allocated to this project in the 2009-2015 STIP. The STIP identifies this project as one funded by "others," i.e. NCTA.

The President's Council on Environmental Quality (CEQ), in its March 1981 guidance document "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," indicates that in determining the scope of alternatives to be considered in a National Environmental Policy Act (NEPA) document, the emphasis is on what is "reasonable." The guidance indicates that "reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense."

The only alternatives that are practical or feasible from an economic standpoint are those that can be funded with the available funding sources listed above.

Potential Impacts on Natural Resources and Communities

Impact potential considers displacement, rural/beach community fragmentation, habitat fragmentation, wetlands filled/bridged and high quality resources filled/bridged. Most, but not all, of the wetlands in the project area also are high quality resources. High quality resources in the project area are generally lands listed as Significant Natural Heritage Areas by the North Carolina Natural Heritage Program.

Initial analyses looked at a broad range of potential impact types using conceptual designs for the alternatives and available Geographic Information Systems (GIS) data, including:

- Major utility conflicts;

- Railroad crossings;
- Displacements;
  - Residences
  - Businesses
  - Cemeteries
  - Recorded historic sites
- Rural community fragmentation on mainland;
- Beach community fragmentation on Outer Banks;
- Greenway crossings;
- Low income or minority populations;
- Potential Section 4(f) impacts;
- Hazardous materials sites affected;
- Known federally-listed species habitat
- 100-year floodplain impacts;
- Habitat fragmentation;
- Wetland impacts;
- Coastal Area Management Act (CAMA) wetland impacts;
- Stream impacts;
- Potential riparian buffer impacts;
- Water supply critical areas; and
- High quality resources.

The focus of the analysis turned to the measures listed in the first paragraph either because the road and bridge alternatives would not affect the resource/issue in the longer list or the potential for impact was identical for all alternatives.

2.1.2.2 Evaluation

The results of the screening analysis for the ER and MCB alternatives are presented in Table 2. The cost and impact numbers presented in Table 2 assume an average of the cost or impact of the six bridge corridor alternatives examined in Section 3.1. Key conclusions from this analysis are summarized below for each alternative.

ER1

Ability to Meet Purpose and Need. ER1 was developed to achieve LOS D operations on the summer weekday. In addition, ER1 would eliminate poor LOS F operations in the project area on the summer weekday and summer weekend. Total annual congested vehicle-miles would drop 55 percent. In addition, travel times to and from the Currituck County Outer Banks would be reduced by 48 percent (compared to the No-Build Alternative). Hurricane evacuation times would be substantially reduced—by 50 to 81 percent of the amount needed to achieve the 18-hour evacuation standard. Thus, the three elements of the purpose and need would be met.

Table 2. Evaluation of Existing Road (ER) and Mid-Currituck Bridge (MCB) Alternatives

	Highway Improvement Alternatives					
	ER1	**ER2**	**MCB1**	**MCB2**	**MCB3**	**MCB4**
Components						
Bridge	NA	NA	2-lane bridge	2-lane bridge	2-lane bridge	2-lane bridge
US 158 (Wright Memorial Bridge to NC 12)	8 lanes	8 lanes	6 lanes (8 lanes in NC 12 area)	6 lanes (8 lanes in NC 12 area)	5 lanes	5 lanes
NC 12 (Dare County north of US 158)	4 lanes	3 lanes	4 lanes	3 lanes	2 lanes	2 lanes
NC 12 (Currituck County)	4 lanes	4 lanes	4 lanes	4 lanes	2 lanes (4 near bridge)	2 lanes (4 near bridge)
Location of US 158 Contraflow or Third Outbound Lane for Hurricane Evacuation	Wright Memorial Bridge to NC 168 (24.5 miles)	Wright Memorial Bridge to NC 168 (24.5 miles)	Mid-Currituck Bridge to NC 168 (5 miles)			Same as MCB3 plus Wright Memorial Bridge to NC 12 (1.5 miles)
Economic Feasibility						
Capital Cost (in millions (April 2008 dollars)						
• Two-Lane Mid-Currituck Bridge (average of six potential corridors)	NA	NA	$385	$385	$385	$385
• NC 12	$550	$207	$550	$207	$72	$72
• US 158 in Dare County	$41	$41	$27	$27	$0	$7
• US 158 in Currituck County (third outbound lane)	$67	$67	$16	$16	$16	$16
TOTAL CAPITAL COST	$658	$315	$978	$635	$473	$480
Available Capital Funding (in millions)						
Potential Financing (Toll Revenue Bond and Transportation Infrastructure Finance and Innovation Act [TIFIA] Financing)	$0	$0	$412	$412	$412	$412
Potential Capital Funding Shortfall (Surplus) (total cost minus availablefinancing)	$658	$315	$566	$223	$61	$68

Table 2 (continued). Evaluation of Existing Road (ER) and Mid-Currituck Bridge (MCB) Alternatives

	Highway Improvement Alternatives					
	ER1	ER2	MCB1	MCB2	MCB3	MCB4
Potential for Public-Private Partnership or General Assembly debt service funds to cover shortfall	No	No	No	No	Yes	Yes
Travel Benefits[1]						
2035 Traffic Flow Benefits						
Percent Reduction in Congested Annual Millions of VMT						
• At LOS E or F	55%	22%	66%	52%	39%	39%
• At LOS F	51%	27%	91%	91%	71%	71%
• At a poor LOS F	100%	44%	100%	100%	69%	69%
Percent Reduction in Miles of Road Operating at LOS F						
• Summer Weekday (SWD)	100%	60%	100%	100%	61%	61%
• Summer Weekend (SWE)	37%	10%	89%	89%	73%	73%
• Weighted Average of SWD & SWE	66%	33%	94%	94%	68%	68%
Percent Reduction in Miles of Road Operating at a Poor LOS F						
• Summer Weekday (SWD)	100%	35%	100%	100%	86%	86%
• Summer Weekend (SWE)	100%	25%	100%	100%	75%	75%
• Weighted Average of SWD & SWE	100%	32%	100%	100%	82%	82%
2035 Travel Time Benefits (Aydlett Rd to Albacore St)						
Percent Reduction in Summer Travel Time via Wright Memorial Bridge (weighted average of SWD & SWE)	48%	19%	53%	44%	31%	31%
Percent Reduction in Summer Travel Time via Currituck Sound Crossing (weighted average of SWD & SWE)	NA	NA	93%	93%	93%	93%

Table 2 (continued). Evaluation of Existing Road (ER) and Mid-Currituck Bridge (MCB) Alternatives

	Highway Improvement Alternatives					
	ER1	**ER2**	**MCB1**	**MCB2**	**MCB3**	**MCB4**
2035 Hurricane Evacuation Benefit						
Clearance Time With US 158 Outbound Contraflow Lane in Currituck County	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs
• Percent of a Reduction from 36.3 hours to 18 hours	49%	49%	49%	49%	49%	49%
• Amount Above 18-hour Goal	8.9 hrs	8.9 hrs	8.9 hrs	8.9 hrs	8.9 hrs	8.9 hrs
Clearance Time With US 158 Third Outbound Lane in Currituck County	21.8 hrs	21.8 hrs	21.8 hrs	21.8 hrs	26.6 hrs	21.8 hrs
• Percent of a Reduction from 36.3 hours to 18 hours	79%	79%	79%	79%	53%	79%
• Amount Above 18-hour Goal	3.8 hrs	3.8 hrs	3.8 hrs	3.8 hrs	8.6 hrs	3.8 hrs
System Efficiency Improvement						
Percent Reduction in Total Annual Millions of Vehicle Miles Traveled (VMT)	0%	0%	13%	13%	13%	13%
Consistent with Strategic Highway Corridor Vision Plan	No	No	Yes[2]	Yes[2]	Yes	Yes
Consistent with Intrastate System Designations	No	No	Yes[2]	Yes[2]	Yes	Yes
Impact Potential						
Displacement						
• Mid-Currituck Bridge (average of C1 to C6)	0	0	5	5	5	5
• NC 12	195	15	195	15	5	5
• US 158 in Dare County	0	0	0	0	0	0
• US 158 in Currituck County (third outbound lane)	32	32	1	1	1	1
TOTAL DISPLACEMENT	227	47	201	21	11	11

Table 2 (concluded). Evaluation of Existing Road (ER) and Mid-Currituck Bridge (MCB) Alternatives

	Highway Improvement Alternatives					
	ER1	**ER2**	**MCB1**	**MCB2**	**MCB3**	**MCB4**
Rural/Beach Community Fragmentation	Four through lanes crossed by beach users, shoppers, or hotel guests in Dare County.	New turn lane crossed by beach users or hotel guests in Dare County.	Same as ER1 plus Mid-Currituck Bridge passes through Aydlett (C3 and C4 through center) and C1, C3, and C5 pass through middle of new subdivision.	New turn lane crossed by beach users or hotel guests in Dare County, plus Mid-Currituck Bridge passes through Aydlett (C3 and C4 through center) and C1, C3, and C5 pass through middle of new subdivision.	Mid-Currituck Bridge passes through Aydlett (C3 and C4 through center) and C1, C3, and C5 pass through middle of new subdivision.	Mid-Currituck Bridge passes through Aydlett (C3 and C4 through center) and C1, C3, and C5 pass through middle of new subdivision.
Habitat Fragmentation	None	None	Associated with Mid-Currituck Bridge crossing of Maple Swamp and loss of swamp forest and hardwood forest; C1 to C4 in vicinity of an existing forest edge; C5 and C6 create a new edge and also use bay forest.			
Wetland Filled/Bridged (Acres)						
• Mid-Currituck Bridge on Mainland (average of C1 to C6, see Table 5 for acres by corridor)	0.0/0.0	0.0/0.0	14.2/6.5	14.2/6.5	14.2/6.5	14.2/6.5
• Mid-Currituck Bridge on Outer Banks (average of C1 to C6, see Table 5 for acres by corridor)	0.0/0.0	0.0/0.0	0.0/2.0	0.0/2.0	0.0/2.0	0.0/2.0
• NC 12	10.9/0.0	10.4/0.0	10.9/0.0	10.4/0.0	6.3/0.0	6.3/0.0
• US 158 in Dare County	4.2/0.0	4.2/0.0	3.4/0.0	3.4/0.0	0.0/0.0	0.0/0.0
• US 158 in Currituck County (third outbound lane)	12.4/0.0	12.4/0.0	10.8/0.0	10.8/0.0	10.8/0.0	10.8/0.0
TOTAL WETLANDS FILLED/BRIDGED	27.5/0.0	27.0/0.0	39.3/8.5	38.3/8.5	30.8/8.5	30.8/8.5
High Quality Resources Filled/Bridged (Acres)						
• Mid-Currituck Bridge (average of C1 to C6, see Table 5 for acres by corridor)	0.0/0.0	0.0/0.0	4.8/6.6	4.8/6.6	4.8/6.6	4.8/6.6
• NC 12	17.8/0.0	16.8/0.0	17.8/0.0	16.8/0.0	0.0/0.0	0.0/0.0
• US 158 in Dare County	0.2/0.0	0.2/0.0	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0
• US 158 in Currituck County (third outbound lane)	1.4/0.0	1.4/0.0	1.4/0.0	1.4/0.0	1.4/0.0	1.4/0.0
TOTAL HIGH QUALITY RESOURCES FILLED/BRIDGED	19.4/0.0	18.4/0.0	24.0/6.6	23.0/6.6	6.2/6.6	6.2/6.6

[1] The absolute numbers associated with the percents shown are included in Table 9 in the Appendix. Several charts showing these findings in a graphical form also are included in the Appendix.

[2] Consistent because it includes a Mid-Currituck Bridge; however, these plans do not call for the improvement of NC 12, which is a component of these alternatives.

Improve System Efficiency. This alternative would not improve system efficiency. Although traffic would operate at an improved level of service, ER1 would not reduce the annual million vehicle-miles traveled in the project area. Also, it would not provide a new transportation link across Currituck Sound as specified in the North Carolina Strategic Highway Corridor and Intrastate System plans.

Economic Feasibility. The capital cost of this alternative is $658 million. The current NCDOT STIP defines the proposed project as funded by others, i.e. NCTA. No STIP funds are allocated for this project. ER1 could not be financed by tolls because NCTA lacks authority to toll existing roads in association with this project, and it is impractical to toll roads that have multiple uncontrolled access points. The high cost of this alternative plus the inability to pay for it with available revenue sources makes this alternative impractical from an economic standpoint.

Potential Impacts on Natural Resources. ER1 would not involve a new bridge and therefore would not cross Maple Swamp, which is both a wetland and a high quality natural resource. ER1 also would avoid the other environmental impacts associated with crossing Currituck Sound. ER1 would have impacts on the natural environment from widening existing NC 12 and US 158. This alternative would involve filling 27.5 acres of wetlands and 19.4 acres of high-quality natural resources.

Potential Impacts on Communities. ER1 would involve widening NC 12 to four lanes in Dare County on the Outer Banks. There is extensive residential development along this section of NC 12, and many of the properties are close to the roadway. As a result, ER1 would result in 227 displacements (including 56 businesses), more than 10 times the potential for displacement under any other alternative (except MCB1, which involves the same widening of NC12). The bulk of this displacement would be associated with widening NC 12 to four lanes in Dare County where an additional 40 feet of right-of-way would need to be purchased for much of this area. Also in Dare County, NC 12 is frequently crossed by beach users, shoppers, and hotel guests, which would be more challenging with a four lane road.

Conclusion. While ER1 would offer a high level of congestion relief, it was not chosen for detailed study in the DEIS. The main reasons for eliminating this alternative are: (1) it does not improve system efficiency; (2) it has a high number of displacements; and (3) it would cause community fragmentation. NCTA also does not consider this alternative to be economically feasible.

ER2

Ability to Meet Purpose and Need. ER2 was developed to balance transportation needs with community impacts. Consequently, ER2 would provide some of the transportation benefits of ER1, but to a much lesser extent. Where ER1 would completely eliminate poor LOS F conditions (i.e., severe congestion), ER2 would reduce them by 44 percent but would leave extensive periods of severe congestion. Where ER1 would reduce

travel times to and from the Currituck County Outer Banks by 48 percent, ER2 would reduce those travel times by 19 percent. Finally, ER2 would provide equivalent benefits as ER1 in hurricane clearance time reduction since the hurricane-related improvement on US 158 are the same for the two alternatives. Thus, all three elements of the purpose and need would be met with ER2.

Improve System Efficiency. ER2 also would not improve system efficiency. Although traffic would operate at an improved level of service, ER2 would not reduce the annual million vehicle-miles traveled in the project area. Also, it would not provide a transportation link across Currituck Sound as specified in the North Carolina Strategic Highway Corridor and Intrastate System plans.

Economic Feasibility. The capital cost of this alternative is $315 million. Like ER1, ER2 could not be financed by tolls because NCTA lacks authority to toll existing roads in association with this project, and it is impractical to toll roads that have multiple uncontrolled access points. The inability to pay for this alternative with available revenue sources makes it impractical from an economic standpoint.

Potential Impacts on Natural Resources. ER2 also would not involve a new bridge and, therefore, would not cross Maple Swamp, which is both a wetland and a high quality natural resource. ER2, like ER1, would avoid the other environmental impacts associated with crossing Currituck Sound. ER2 would have impacts on the natural environment from widening existing NC12 and US 158. This alternative would involve filling 27.0 acres of wetlands and 18.4 acres of high-quality natural resources.

Potential Impacts on Communities. ER2 would involve widening NC 12 to three lanes, primarily within existing right-of-way, in Dare County on the Outer Banks. As a result, ER2 would avoid much of the displacement associated with ER1. ER2 would, however, result in 47 displacements.

Conclusion. ER2 would avoid the high number of displacements associated with ER1but, like ER1, it would not be economically feasible. It also would not improve system efficiency and offers a low level of benefit in terms of reducing congestion and travel time. However, several federal and state environmental resource and regulatory agencies working with NCTA feel that ER2 should be assessed in the DEIS and contrasted with Mid-Currituck Bridge alternatives because this alternative is the least expensive and appears to have the least potential for environmental impact of all the alternatives. Additionally, the agencies believe that a non-bridge alternative should be evaluated in the DEIS to fully assess direct and indirect impacts and to have a full range of feasible and comparable alternatives. Therefore, ER2 was chosen as a detailed study alternative.

MCB1

Ability to Meet Purpose and Need. MCB1 would provide the greatest transportation benefits of any alternative. It would eliminate poor LOS F operations in the project area and LOS F operations on the summer weekday. It would reduce travel times to and from the Currituck County Outer Banks by 53 percent (for the "U-shaped" trip from Aydlett Road to Albacore Street across the Wright Memorial Bridge). Travel times for bridge users would be reduced by up to 93 percent. It would reduce hurricane evacuation times by the same amount as ER1 and ER2, but would accomplish this objective with only 5 miles of hurricane evacuation-related improvement on US 158 (Mid-Currituck Bridge to NC 168) rather than the 25 miles (Wright Memorial Bridge to NC 168) associated with ER1 and ER2. Thus, all three elements of the purpose and need would be met with MCB1.

Improve System Efficiency. Unlike ER1 and ER2, this alternative would provide a new link in the transportation system, which would provide a more direct route to and from the Currituck County Outer Banks, in accordance with state plans. The increased efficiency of the network is reflected in a 13 percent reduction in millions of vehicle-miles traveled in 2035.

Economic Feasibility. The capital cost of this alternative is $978 million, which is the highest of the six alternatives. The bridge component of the project likely could be funded by tolls. To ensure the functionality of the bridge, toll revenues might fund some limited improvements to existing roads where they connect with the bridge. Available revenue sources, however, would not be sufficient to cover the cost of all existing-road improvements. The high cost of this alternative, combined with the lack of an available revenue source for the extensive existing-road improvements, makes this alternative impractical from an economic standpoint.

Potential Impacts on Natural Resources. MCB1 would involve a new bridge across Currituck Sound, as well as a crossing of Maple Swamp, which is both a wetland and a high quality natural resource. MCB1 also would have impacts on the natural environment because of widening existing NC12 and US 158. As a result, this alternative has the highest impacts on the natural environment of any ER or MCB alternative. It would involve the filling of 39.3 acres and bridging 8.5 acres of wetlands, and would involving filling 24 acres and bridging 6.6 acres of high-quality natural resources.

Potential Impacts on Communities. MCB1, like ER1, would involve widening NC 12 to four lanes in Dare County on the Outer Banks. Thus, MCB1 would result in 201 displacements, which is nearly the same number of displacements as ER1. MCB1 would have fewer displacements than ER1 only because ER1 would involve more extensive hurricane clearance improvements (25 miles rather than 5 miles) on the Currituck County mainland. Also, similar to ER1 in Dare County, NC 12 is frequently crossed by beach users, shoppers, and hotel guests, which would be more challenging with a four

lane road. In addition, the bridge component would pass through the community of Aydlett on the mainland.

Conclusion. While MCB1 would meet the purpose and need, it was not chosen for detailed study in the DEIS. The main reasons for eliminating this alternative are: (1) it has a high number of displacements and (2) it would cause community fragmentation. NCTA also does not consider this alternative to be economically feasible.

MCB2

Ability to Meet Purpose and Need. MCB2 is the same as MCB1 except that NC 12 is widened only to three lanes in Dare County. With three lanes on NC 12 in Dare County, the travel benefits would be less, but still substantial. Like MCB1, MCB2 would meet all three elements of the purpose and need.

Improve System Efficiency. MCB2 also would provide a new link in the transportation system, which would provide a more direct route to and from the Currituck County Outer Banks, in accordance with state plans. The increased efficiency of the network is reflected in a 13 percent reduction in millions of vehicle-miles traveled in 2035.

Economic Feasibility. The capital cost of this alternative is $635 million. Like MCB1, the bridge component of the project likely could be funded by tolls. Again, available revenue sources would not be sufficient to cover the cost of all of the existing-road improvements. NCTA believes that the high cost of this alternative, combined with the lack of an available revenue source for the existing-road components, makes this alternative impractical from an economic standpoint.

Potential Impacts on Natural Resources. The natural resource impacts for MCB1 and MCB2 would be virtually identical, although MCB2 would be slightly less.

Potential Impacts to Communities. MCB2 would involve widening NC 12 to three lanes in Dare County on the Outer Banks, rather than the four-lane widening as with MCB1. As a result, MCB2 would avoid much of the displacement associated with MCB1. MCB2 also would avoid many of the displacements associated with ER2, because ER2 would involve more extensive hurricane clearance improvements (25 miles rather than 5 miles) on the Currituck County mainland. MCB2 would result in 21 displacements. Like MCB1, the bridge component would pass through the community of Aydlett on the mainland.

Conclusions. MCB2 would meet the purpose and need and would not involve severe displacement impacts like MCB1. However, environmental resource and regulatory agencies working with NCTA feel that this alternative should be assessed in the DEIS, because it offers the best reduction in congestion and improvement in travel time possible, while avoiding the severe displacements associated with ER1 and MCB1.

Therefore, MCB2 was chosen as a detailed study alternative, although NCTA does not consider this alternative to be economically feasible.

MCB3

Ability to Meet Purpose and Need. MCB3 would involve a Mid-Currituck Bridge and limited improvements to US 158 and NC 12. Without the widening of much of NC 12 and US 158 between the Wright Memorial Bridge and NC 12, the travel benefits would be less than MCB1 and MCB2, but still notable. For example, there would be a 39 percent reduction in congested travel compared to the 66 percent and 52 percent reductions associated with MCB1 and MCB2, respectively. Travel time via the Wright Memorial Bridge would decrease 31 percent compared to the 53 percent and 44 percent reductions associated with MCB1 and MCB2, respectively. The travel time benefit of using the bridge would be identical (up to a 93 percent reduction over the current route) to MCB1 and MCB2. MCB3 would provide a smaller improvement in hurricane clearance times assuming the provision of a third outbound lane at 26.6 hours. The clearance time with a contraflow lane would be 27.4 hours, identical to MCB1 and MCB2. The difference from MCB1 and MCB2 in the case of the third outbound lane option results because there are no improvements in MCB3 along US 158 east of the Wright Memorial Bridge. Such an improvement is included in MCB4. MCB3 and MCB4 are identical except for the lack of this single improvement. The lack of this improvement with MCB3 was the reason for it not being carried forward as a detailed study alternative. While less than MCB1 and MCB2, MCB3 would have substantial benefits: it would reduce congestion, reduce travel times, and improve hurricane evacuation. Therefore, MCB3 would meet the three elements of the purpose and need.

Improve System Efficiency. MCB3 also would provide a new link in the transportation system, which would provide a more direct route to and from the Currituck County Outer Banks, in accordance with state plans. The increased efficiency of the network is reflected in a 13 percent reduction in millions of vehicle-miles traveled in 2035.

Economic Feasibility. A combination of toll revenue bonds and TIFIA financing (which is also supported by toll revenues) would cover most of the cost of this alternative. It is expected within the context of a public-private partnership and/or NC General Assembly debt service funds that the entire project could be funded.

Potential Impacts on Natural Resources. The natural resource impacts for MCB3 would be less than those for MCB1 and MCB2, since fewer roadway improvements would be built.

Potential Impacts to Communities. MCB3 would result in 11 displacements—the lowest of the six alternatives. Similar to MCB1 and MCB2, the bridge component would pass through the community of Aydlett on the mainland.

Conclusions. MCB3 meets the purpose and need, improves system effciency, is economically feasible, and does not involve high numbers of social or natural resource impacts, such as the displacement levels associated with ER1 and MCB1. While MCB3's benefits are lower than MCB1 or MCB2, it can serve as a substantial step in reducing congestion in the project area. The other improvements associated with MCB1 and/or MCB 2 could be made when funding is available. MCB3, however, would not allow for the best possible hurricane clearance time reduction possible. Therefore, MCB3 was not chosen for detailed study in the DEIS in favor of MCB4 (see the next section) because MCB4 would offer the same benefits as MCB3, as well as achieve the best possible hurricane clearance time reduction.

MCB4

Ability to Meet Purpose and Need. MCB4 would offer the same benefits of MCB3, plus the additional benefit of being able to achieve a hurricane clearance time of 21.8 hours through the inclusion of a third outbound lane on US 158 between the Wright Memorial Bridge and NC 12.

Improve System Efficiency. MCB4 also would provide a new link in the transportation system, which would provide a more direct route to and from the Currituck County Outer Banks, in accordance with state plans. The increased efficiency of the network would be the same as for the other MCB alternatives.

Economic Feasibility. Similar to MCB3, a combination of toll revenue bonds and TIFIA financing would cover most of the cost of this alternative. It is expected within the context of a public-private partnership and/or NC General Assembly debt service funds that the entire project could be funded.

Potential Impacts on Natural Resources. The natural resource impacts for MCB4 would be the same as MCB3. The additional US 158 improvements included in MCB4 would not involve additional impacts on wetlands or high-quality natural resources.

Potential Impacts to Communities. Like MCB3, MCB4 would result in 11 displacements—the lowest of any ER or the other MCB alternatives. As with the other MCB alternatives, the bridge component would pass through the community of Aydlett on the mainland.

Conclusions. MCB4 meets the purpose and need, improves system effciency, is economically feasible, and does not involve high numbers of social or natural resource impacts, such as the displacement levels associated with ER1 and MCB1. MCB4 will be carried forward for detailed study in the DEIS.

2.1.2.3 Summary of Evaluation Findings

ER2, MCB2, and MCB4 were selected for detailed evaluation in the DEIS. Table 3 summarizes the reasons for not selecting ER1, MCB1, and MCB3 as detailed study alternatives.

Table 3. Summary of Reasons for Not Selecting Alternatives for Detailed Study

ER1	MCB1	MCB3
High Number of displacements		
Community fragmentation		
Would not improve system efficiency		
		Lower hurricane evacuation benefit than MCB4

After identifying ER2, MCB2, and MCB4 as alternatives for evaluation in detail in the DEIS, NCTA refined the conceptual design drawings for the Mid-Currituck Bridge component of MCB2 and MCB4 to further avoid and minimize natural resource impacts. These engineering refinements to MCB2 and MCB4 are discussed in Section 5.0.

2.2 Additional Alternatives Considered and Eliminated

In addition to considering the ER (existing-road) and MCB (Mid-Currituck Bridge) alternatives, NCTA also considered a range of other potential project concepts to determine whether they should be carried forward for detailed study. These alternatives include: (1) shifting rental times; (2) transportation systems management; (3) bus transit; and (4) a ferry service across Currituck Sound as an alternative to a Mid-Currituck Bridge.

This section discusses each of these alternatives. For each alternative, the report describes the concept, presents evaluation findings, and explains why the concept was not carried forward for detailed study. The travel benefits associated with each of these alternatives are presented in Table 4.

2.2.1 Shifting Rental Times

2.2.1.1 Description of Alternative

The project area includes a substantial number of vacation rental properties that commonly rent by the week, with their peak use being in the summer (June to August). The distribution of rental unit check-ins and check-outs in the project area is 70 percent on Saturday, 25 percent on Sunday, and 5 percent on Friday. It is on the summer

Table 4. Travel Benefits of Other Alternatives Considered

	Shift Rental Times	TSM	Bus Transit	Ferry Alternatives			
				F1	F2	F3	F4
2035 Traffic Flow Benefits							
Reduction in Congested Annual Millions of VMT							
• At LOS E or F	1%	5%	0%	56%	30%	15%	15%
• At LOS F	5%	9%	0%	52%	31%	20%	20%
• At a poor LOS F	14%	1%	0%	100%	100%	22%	22%
Reduction in Miles of Road Operating at LOS F							
• Summer Weekday (SWD)	0%	8%	0%	100%	60%	38%	38%
• Summer Weekend (SWE)	5%	0%	0%	34%	8%	5%	5%
• Weighted Average of SWD & SWE	3%	3%	0%	64%	31%	20%	20%
Reduction in Miles of Road Operating at a poor LOS F							
• Summer Weekday (SWD)	0%	0%	0%	100%	100%	0%	0%
• Summer Weekend (SWE)	28%	0%	0%	100%	100%	28%	28%
• Weighted Average of SWD & SWE	10%	0%	0%	100%	100%	10%	10%
2035 Travel Time Benefit Aydlett Road to Albacore Street							
Percent Reduction in Summer Travel Time via Wright Memorial Bridge (weighted average of SWD & SWE)	1%	11%	0%	50%	26%	11%	11%
Percent Reduction in Summer Travel Time via Currituck Sound Crossing (weighted average of SWD & SWE)	NA	NA	NA	59%	59%	59%	59%
2035 Hurricane Evacuation Benefit							
Clearance Time with US 158 Outbound Contraflow Lane	No contraflow lane	27.4 hrs	No contraflow lane	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs
• Percent of a Reduction from 36.3 hours to 18 hours	0%	50%	0%	49%	49%	49%	49%
• Amount Above 18-hour Goal	18.3 hrs	8.9 hrs	18.3 hrs	8.9 hrs	8.9 hrs	8.9 hrs	8.9 hrs
Clearance Time with US 158 Third Outbound Lane	No third outbound lane	No third outbound lane	No third outbound lane	21.8 hrs	21.8 hrs	26.6 hrs	21.8 hrs
• Percent of a Reduction from 36.3 hours to 18 hours	0%	0%	0%	79%	79%	53%	79%
• Amount Above 18-hour Goal	18.3 hrs	18.3 hrs	18.3 hrs	3.8 hrs	3.8 hrs	8.6 hrs	3.8 hrs

[1] The absolute numbers associated with the percents shown are included in Table 9 in the Appendix.

weekend during rental unit check-out and check-in that the highest traffic volumes in the project area occur. The Shift Rental Times Alternative assumes that shifting arrival times and check-ins to an even distribution amongst Friday, Saturday, and Sunday would improve the project area traffic flow. NCTA has no authority to compel implementation of the Shift Rental Times Alternatives, nor does any other state agency.

2.2.1.2 Analysis and Conclusions

The Shift Rental Times Alternative would—if implemented—result in some reduction in congestion on NC 12 and US 158 during summer weekends, but it would provide no benefits during other times, including summer weekdays. Overall, the reduction in total congestion (LOS E and F) would not be substantial (1 percent). This alternative also would result in a reduction in summer travel time (1 percent) that would not be substantial and would not provide any reduction in hurricane clearance times (see Table 4). Therefore, this alternative would not meet the project's purpose and need. In light of this finding and the difficulty of implementing this alternative, the Shift Rental Times Alternative is not a reasonable alternative. Therefore, it will not be carried forward for detailed study in the DEIS.

2.2.2 Transportation Systems Management (TSM)

2.2.2.1 Description of Alternative

TSM alternatives are defined as alternatives that seek to maximize the efficiency of the existing transportation system without a major capital investment. For purposes of this report, the TSM Alternative includes:

- Optimizing signal timing on US 158 and NC 12 in the project area to improve traffic flow through signalized intersections;
- Improving major intersections on NC 12 (those that service numerous homes) with left turn lanes and/or traffic signals; and
- Restricting side-road access on some other intersections, generally in the form of right in-right out only turning from local streets and, where alternate access is available, intersection closures to reduce the number of points where drivers would slow to make turns.

In addition, this alternative includes provisions for reversing lanes on US 158 from NC 168 in Currituck County to NC 12 in Dare County during a hurricane evacuation. This is an approach to facilitating hurricane evacuation that focuses on maximizing the efficiency of the current road system.

2.2.2.2 Analysis and Conclusions

The TSM Alternative could not be implemented by NCTA, because it would not involve a toll facility, but it could be implemented by NCDOT or local governments. If implemented, the TSM Alternative would provide congestion relief (see Table 4) that would not be substantial, with a 5 percent reduction in overall congestion (LOS E and F), a 3 percent reduction in the miles of road operating at LOS F, and no reduction in the miles of road operating at a poor LOS F. Its contraflow lane would substantially reduce hurricane clearance times and travel time. Since the TSM Alternative would not meet the project's traffic flow improvement purpose and its associated need, it is not a

reasonable alternative. Therefore, the TSM Alternative will not be carried forward for detailed study in the DEIS.

2.2.3 Bus Transit

2.2.3.1 Description of Alternative

This alternative would introduce bus transit into the project area with the objective of reducing the number of private vehicles traveling throughout the project area. Specific design and operational characteristics of the Bus Transit Alternative were not developed pending a finding on whether or not the potential benefits of transit made it an option worth pursuing in further detail.

In considering the Bus Transit Alternative, the following was taken into account:

- Existing bus transit service is minimal, and no plans for public transit exist within the project area.
- FHWA guidance (Technical Advisory T 6640.8A) indicates that customarily transit is "considered as a potential alternative on proposed major highway projects in urbanized areas over 200,000 population." This project is not in such an urbanized area.
- There is no single concentrated destination where most trips go, such as a central business district in an urban area. Rather, people go to and from many scattered destinations.
- Transit service in resort areas usually involves transit circulating in an area of concentrated activity, such as an area of high-rise hotels and night clubs, which the project area does not have and neither does the Outer Banks as a whole.
- In urban areas with a single concentrated destination only about 10 percent of trips use transit.

There are two types of trips that a transit service could attempt to serve in order to make a contribution to reducing congestion:

1. Summer Weekend Trips. On the summer weekend, it is the tourist trips arriving in the area and departing the area to return home. It is highly unlikely that these trips could be captured by transit, for the following reasons:
   - Visitors to the project area currently come by automobile carrying personal items needed for up to a week-long stay. They often bring children.
   - In order to capture these travelers, they would have to be willing to spend the time to load their luggage and other personal items into a bus, ride a bus with multiple stops along the way, walk with their luggage from the bus to the real

estate office to check-in, board another bus with luggage to get into the general vicinity of their final destination (buses could not stop at every beach home), and finally walk with their luggage to their beach home or other destination. This clearly would be time consuming and inconvenient.

- No benefits of transit exist that would offset the time and inconvenience defined above to make transit attractive.

2. Summer Weekday Trips. On the summer weekday, the predominant type of trip is people moving between low density and dispersed origins and destinations. As noted previously, even in urban areas with land use patterns that facilitate transit, one cannot expect to capture more than 10 percent of the trips. For example, in the Raleigh-Durham Metropolitan area, 2 to 3 percent of the work trips are on transit. Thus, it is expected that the number of summer weekday trips that could be captured would be less than 10 percent. In addition, most people use transit because it will save them time, parking at their destination is unavailable or expensive, incentives are offered by employers, or they do not own or have access to an automobile. Only travel time would apply in the Outer Banks, and bus transit service on the Outer Banks would operate on the same congested roads as other traffic.

In order to develop an estimate of the percent of trips that could be attracted to transit, the study team compared the travel time on NC 12 from the US 158/NC 12 intersection to Albacore Street in Currituck County (16.8 miles) on a bus under uncongested conditions to the time to drive from US 158 to Albacore Street with the No-Build Alternative. The analysis included estimates for the amount of time required for passengers to walk to the bus (7.5 minutes), wait for the bus (15 minutes, assuming 30-minute headways), ride the bus with the bus stopping every one-half mile for one minute to take on passengers, and walk to their destination (7.5 minutes). It was assumed that if the bus under uncongested conditions takes longer to make this trip than an automobile under worst-case congested conditions (No-Build Alternative), then it could be concluded that transit would offer no benefit. On the other hand, if the uncongested bus travel time is less than the congested automobile travel time, it could be assumed that the Bus Transit Alternative could take some automobiles off of the roadway network until the two travel times for this trip are equal.

Based on the methodology above, it was found that bus travel times under uncongested conditions were greater (94 minutes) than automobile travel times on summer weekdays under congested conditions (55 to 65 minutes depending on the direction of travel). Thus, it is likely that bus transit would be little used if provided. However, some use might occur, so it was assumed that 1 percent of trips on NC 12 would use bus transit if provided. This assumption of 1 percent transit usage provided the basis for estimating the benefits of the Bus Transit Alternative (see Table 4).

2.2.3.2 Analysis and Conclusions

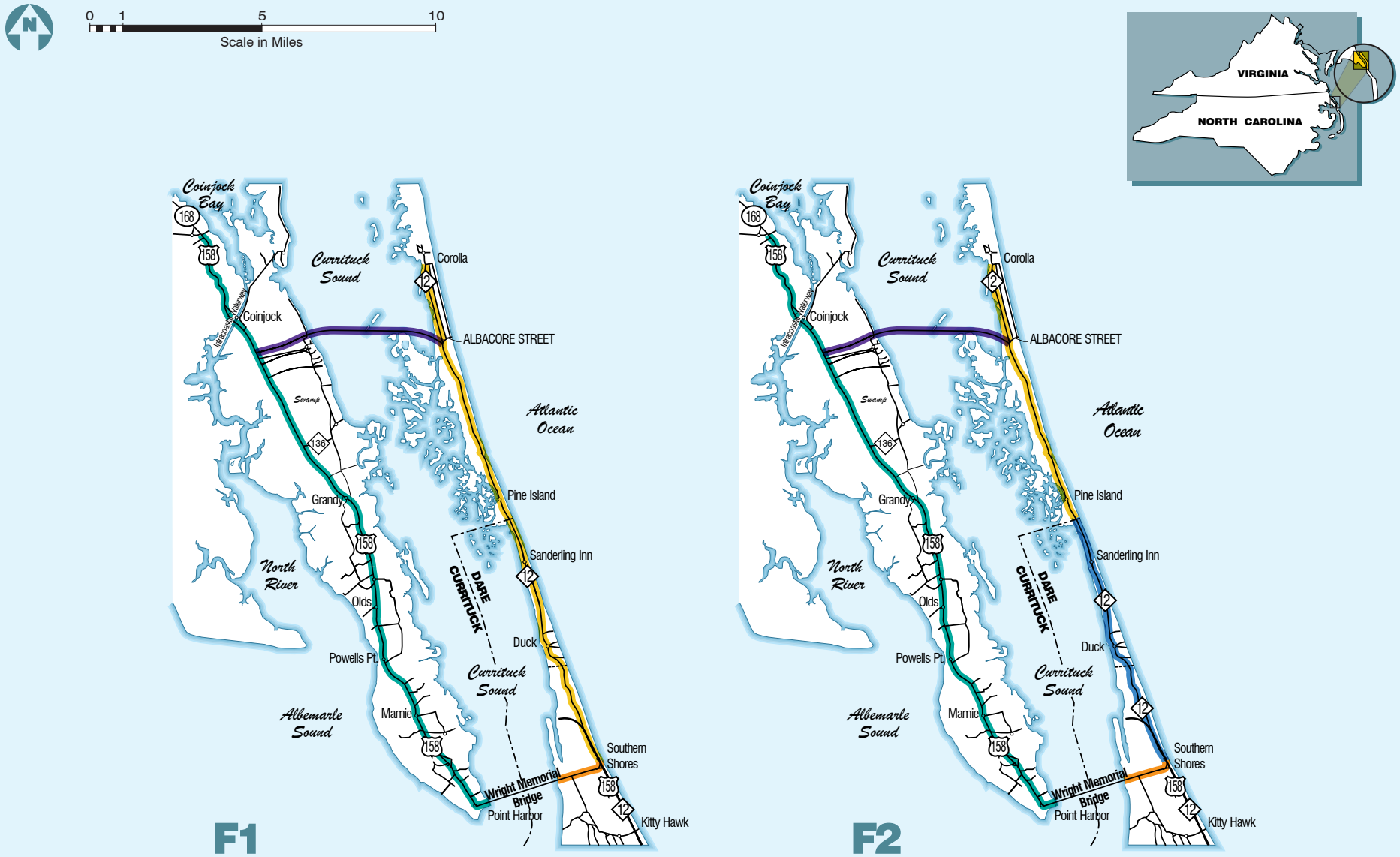
The Bus Transit Alternative could not be implemented by NCTA because it would not involve a toll facility, but it could be implemented by another agency or local government. If implemented, the Bus Transit Alternative would provide no congestion relief and no reduction in travel times to the Currituck County Outer Banks from the mainland (see Table 4). It makes provision only for trips on the Outer Banks. Thus, it would offer no hurricane clearance time benefit for those leaving the area during an evacuation. Therefore, the Bus Transit Alternative would not meet the purpose and need and is not a reasonable alternative. Therefore, it will not be carried forward for detailed study in the DEIS.

2.2.4 Ferry Alternatives

2.2.4.1 Description of Alternatives

Four ferry alternatives are assessed, F1, F2, F3, and F4, with the F standing for "ferry." A ferry was considered as a possible alternative to a Mid-Currituck Bridge. Thus, each alternative assumes that a ferry is used in place of a bridge. The non-ferry components of F1 and F2 are the same as ER1 and ER2, creating a ferry equivalent of MCB1 and MCB2, respectively. F3 and F4 are the ferry plus improvements to US 158 needed to reduce hurricane clearance times, creating a ferry equivalent to MCB3 and MCB4, respectively. Figure 9 and Figure 10 show the ferry routes and each of the related highway improvements. The basic features of the ferry alternatives are:

- **F1**
  - Providing a ferry service across Currituck Sound;
  - Adding a third outbound lane on US 158 from NC 168 to the Wright Memorial Bridge as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;
  - Widening US 158 to eight lanes between the Wright Memorial Bridge and the NC 12 intersection; and
  - Widening NC 12 to four lanes between the US 158 and Corolla.
- **F2**
  - Providing a ferry service across Currituck Sound;
  - Adding a third outbound lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;

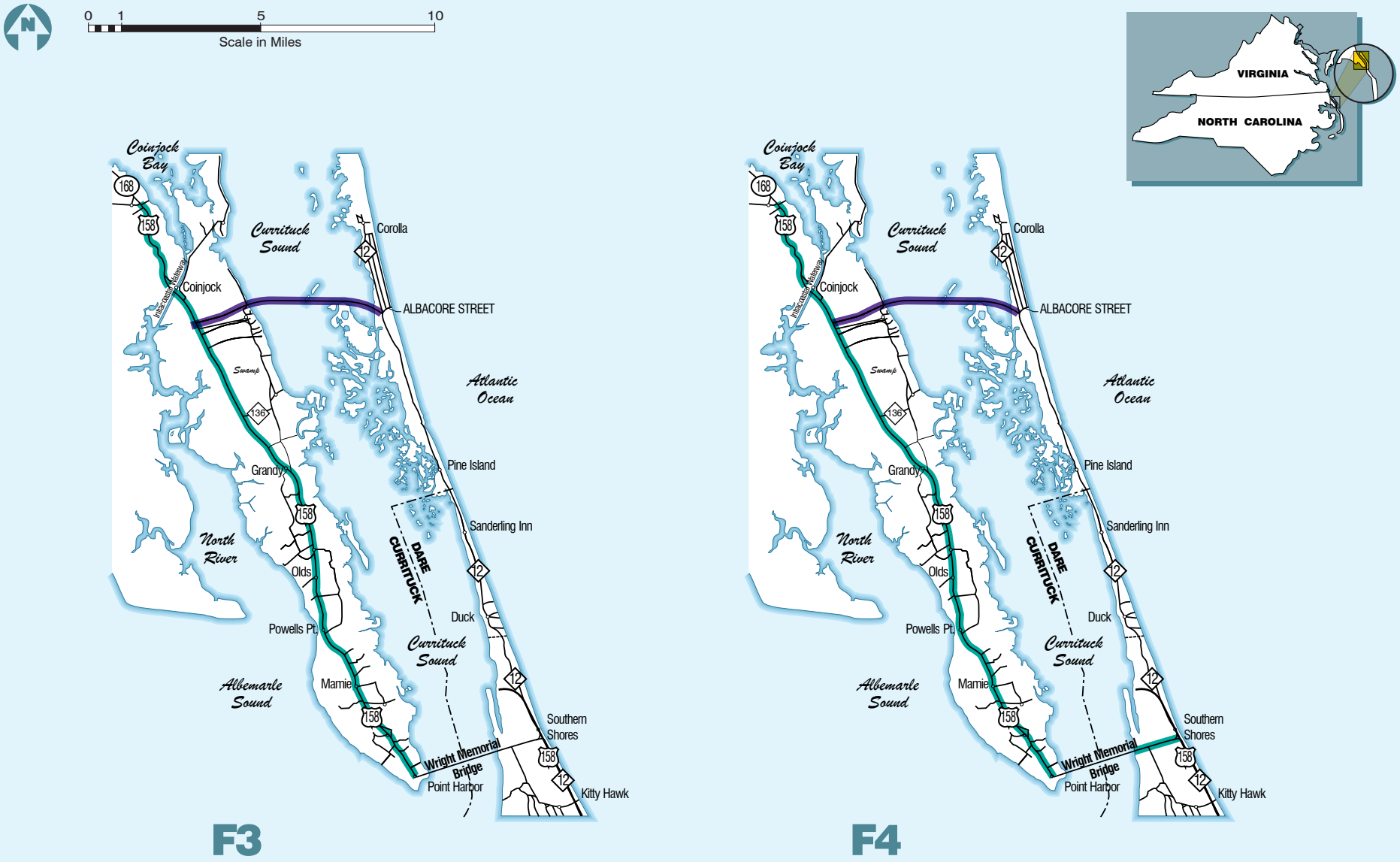


LEGEND

- Eight Lanes
- Six Lanes
- Four Lanes
- Three Lanes
- Third Outbound Lane or Contraflow Lane
- Ferry Service

Ferry Alternatives F1 and F2

Figure 9



LEGEND

- Eight Lanes
- Six Lanes
- Four Lanes
- Three Lanes
- Third Outbound Lane or Contraflow Lane
- Ferry Service

Ferry Alternatives
F3 and F4

Figure

10

  - Widening US 158 to eight lanes between the Wright Memorial Bridge and the NC 12 intersection; and

  - Widening NC 12 to three lanes between US 158 and the Dare-Currituck County Line and to four lanes between the Dare-Currituck County Line and Corolla.

- F3

  - Providing a ferry service across Currituck Sound; and

  - Adding a third outbound lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane.

- F4

  - Implementing the components of F3; and

  - Adding a third outbound lane on US 158 between the Wright Memorial Bridge and NC 12 as an additional hurricane evacuation improvement.

For the Ferry Alternative, whether or not it meets the purpose and need depends on how the ferry component is defined. It would be possible to create a ferry service that provides the same level of service improvement as a Mid-Currituck Bridge. In examining the characteristics of a ferry service that would have the same travel benefits as a bridge, it was found that eight typical NCDOT ferry services would be needed to provide summer weekday travel benefits equivalent to a bridge, and 10 typical NCDOT ferry services would be needed to provide summer weekend travel benefits equivalent to a bridge. A typical NCDOT ferry service includes four operating ferries with a combined capacity of 80 vehicles per hour operating out of two ferry terminals, one at the origin and one at the destination. Creating such a service would raise the following issues:

- Much of the cost and impact associated with the approach road to a bridge over Currituck Sound (including the US 158 interchange and the bridge across Maple Swamp) would remain because the approach road would be required to provide the large number of ferry users access to the ferry terminals.

- Substantial land with associated impacts to communities and habitat would be required for the construction of the ferry terminals. The land needed for terminals would be 30 to 40 acres with 10 typical ferry services.

- Substantial impacts to the sound bottom and its habitat would result. Dredging the channels for 10 typical ferry services would affect 2,190 acres of Currituck Sound

bottom and require the disposal of 45 million cubic yards of material every five years.

- Initial capital costs would be more than the cost of a Mid-Currituck Bridge.

- Operating costs would be high, and typically, NCDOT only recovers 25 percent of its costs on existing ferries that charge a fare.

Given the above findings, which indicate that providing a ferry operation that would serve travel demand similar to a bridge could not be accomplished without substantial cost and potential for environmental impact, it was decided that providing such a level of ferry service was not practical. Therefore, the following assumptions were used in defining the ferry component of the ferry alternatives:

- The Ferry Alternatives uses equipment and has operating characteristics similar to the current ferry service operated by NCDOT which, because of NCDOT's many years of experience in operating ferry service in North Carolina, is assumed to have the equipment and operating characteristics best suited for North Carolina waters. The Ferry Alternative would build on and complement the existing North Carolina ferry service.

- For the Ferry Alternative to be a viable alternative to a bridge, it should not cost substantially more than the total cost (capital, operation, and maintenance) of a bridge over a period of 50 years.

The study team considered the cost of typical ferry operations over 50 years compared to the cost of building, operating, and maintaining a Mid-Currituck Bridge over the same period. The total cost of a single ferry service over 50 years would be approximately $300 million. The same cost for a two-lane Mid-Currituck Bridge would be approximately $500 million. Thus, the cost of two ferry services would higher but roughly equivalent to a two-lane Mid-Currituck Bridge. Given the limited capacity of ferry service, three typical ferry operations were assumed for the ferry component of F1 to F4 for comparison with a Mid-Currituck Bridge. Thus, the benefits presented in this analysis of a ferry in contrast with a bridge would come at an estimated cost of that is almost twice as much as the bridge project. One or two ferry services would cost less but have less travel benefit than three ferry services.

For construction and operation of a single typical ferry operation times three, the ferry component of F1 to F4 would involve a capital cost of $200 million (2007 dollars) for ferries and facilities and approximately $700 million dollars (2007 dollars) in operating costs over 50 years, including replacement of the ferry boats after 30 years of use. These costs were provided by the North Carolina Ferry Division specifically for this study.

As explained in Section 2.2.4.2, the ferry alternatives were found to provide minimal additional travel benefits at great additional cost. Given these shortcomings, the ferry

alternatives were not developed to the extent that would be needed to calculate specific impacts on natural resources and communities. However, based on their standard assumptions for operation of a ferry service, general estimates of land use and dredging were developed by the North Carolina Ferry Division for this study. A single ferry service would require:

- 3 to 4 acres of land for ferry terminals;
- 261,000 cubic yards of dredging annually for the access channel;
- 2,400,000 cubic yards of dredging every 5 years for the navigation channel;
- 400,000 cubic yards of dredging annually for turning basins;
- 20 acres of Currituck Sound bottom affected by dredging for the access channel;
- 186 acres of Currituck Sound bottom affected by dredging for the navigation channel;
- 31 acres of Currituck Sound bottom affected by dredging for turning basins; and
- 237 acres of Currituck Sound bottom affected in total by dredging.

These estimates apply to a single typical ferry service. If three ferry services were provided, as assumed in the analysis of Alternatives F1 to F4, these impacts would be tripled. The acres of sound bottom dredged would rise from 237 acres to 711 acres. The amount of dredged material to be disposed would be 14.5 million cubic yards over five years. The total land required for ferry terminals and associated community impacts in Aydlett on the mainland and community and natural resource impacts on the Outer Banks would be 9 to 12 acres.

2.2.4.2 Analysis and Conclusions

The Ferry Alternatives would provide minimal additional benefits, at a much higher cost, than the comparable existing road (ER) or Mid-Currituck Bridge (MCB) alternatives.

Alternative F1. Alternative F1 would combine a ferry service with the road improvements contained in ER1. As explained above, the ER1 alternative itself is unreasonable because of its high cost and high number of displacements. Combining a ferry service with ER1 would compound the shortcomings of that alternative. Like ER1, F1 would meet the purpose and need of the project; however, F1 would be more expensive than ER1, while the travel benefits would barely increase over the benefits of ER1. Comparing the findings in Table 2 and Table 4 for ER1 and F1, respectively, the addition of a ferry service would offer minimal or no additional reductions in miles of road operating at LOS F overall or a poor LOS F. Other measures of travel benefit also change either by small amounts or not at all with the addition of a ferry service to ER1.

Alternative F1 is not a reasonable alternative because of its high cost and small incremental benefits compared to ER1. Also like ER1, Alternative F1 would not improve system efficiency; would not be economically feasible; would have high displacements; and would cause community fragmentation. It also would require 9 to 12 acres of land for ferry terminals with associated impact to communities and habitat, affect by dredging 711 acres of Currituck Sound bottom, and require the disposal of 14.5 million cubic yards of dredged material every five years.

Alternative F2. Alternative F2 combines a ferry service with the road improvements contained in Alternative ER2. As explained above, the ER2 alternative would provide some traffic benefits and meet the project's purpose and need. The same would be true for F2. However, like ER2, F2 would not improve system efficiency and NCTA does not consider it economically feasible. In addition, the incremental travel benefits offered by the ferry service, although greater than the incremental benefits of ER1 and F1, are still small in relation to the additional cost. (The one notable benefit of adding ferry service to ER2 is eliminating road operations at a poor LOS F.) F2 also would require 9 to 12 acres of land for ferry terminals with associated impact to communities and habitat, affect by dredging 711 acres of Currituck Sound bottom, and require the disposal of 14.5 million cubic yards of dredged material every five years. For these reasons, Alternative F2 is not a reasonable alternative.

Alternatives F3 and F4. Alternatives F3 and F4 combine a ferry service with the hurricane evacuation-related improvements on US 158 associated with MCB3 and MCB4. Improvements to NC 12 south of the ferry terminals (like those south of the MCB3 and MCB4 Outer Banks terminus) are not needed since the number of vehicles using the ferry service would be fewer than using a bridge, given the ferry service's lower capacity.

As indicted in Table 4, F3 and F4 do offer substantial traffic flow, travel time, and hurricane evacuation benefits and would meet the project's purpose and need. However, comparing F3 and F4 (Table 4) to their counterparts (MCB3 and MCB4 in Table 2) highlights the vast difference in performance between a ferry service and a bridge. For the same investment, the bridge would provide far greater transportation benefits. In addition, unlike MCB3 and MCB4, F3 and F4 would require 9 to 12 acres of land for ferry terminals with associated impact to communities and habitat, affect 711 acres of Currituck Sound bottom, and require the disposal of 14.5 million cubic yards of dredged material every five years. Because of their equivalent total cost (capital and operating), low benefits, and additional environmental impact compared to MCB3 and MCB4, Alternatives F3 and F4 are not reasonable alternatives.

Ferries and Hurricane Evacuation. In terms of hurricane evacuation, a ferry would not achieve the hurricane evacuation benefit associated with a Mid-Currituck Bridge. As noted in Section 2.1.1.2 under "Assumptions—US 158 Hurricane Evacuation Improvements," the Mid-Currituck Bridge would eliminate the need for a third

outbound lane or for using the center turn lane as a third outbound emergency lane on US 158 between a Mid-Currituck Bridge and the Wright Memorial Bridge. Instead, with the Ferry Alternative, the additional outbound lane would be needed for the full distance (25 miles) between NC 168 and the Wright Memorial Bridge with the Ferry Alternative for the following reasons:

- The Ferry Division shuts down its operations 12 hours before the arrival of tropical or gale force winds in order to get its equipment and personnel to safety. Thus, the ferry would not operate for 12 of the 21.8 to 27.4 hours of clearance time associated with the MCB alternatives.
- Travel during an evacuation peaks during the middle 50 percent of the clearance time. Thus, the ferry service would not operate during the entire period of peak evacuation traffic.

2.3 Agency and Public Comments

Agency and public comments were solicited on multiple occasions during the alternatives study process. These comments were considered in the development and comparison of alternatives and in the selection of the detailed study alternatives. These comments are summarized in this section.

2.3.1 Agency Comments

The alternatives screening analyses for this project have been discussed with federal and state environmental resource and regulatory agencies in a series of Turnpike Environmental Agency Coordination (TEAC) meetings in 2006, 2007, and 2008. The TEAC meetings were conducted under a Project Coordination Plan that satisfies the requirements for interagency coordination on transportation projects under Section 6002 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (23 USC § 139). SAFETEA-LU authorizes the federal surface transportation programs for highways, highway safety, and transit for the 5-year period 2005 to 2009.

Alternatives analyses for the Mid-Currituck Bridge Project in 2006 and 2007 were discussed with the agencies at meetings held on: January 17, April 18, May 23, June 20, July 18, August 15, September 19, and November 14, 2007. The TEAC also met in the project area on July 10, 2007. At the June 20 and July 18, 2007 TEAC meetings, FHWA and NCTA presented their recommendations for the Mid-Currituck Bridge detailed study alternatives for discussion and requested written comments. FHWA and NCTA initially recommended carrying forward only MCB3. In response to comments from agencies, MCB4 was developed and carried forward.

Many of the issues raised and discussed at the 2007 TEAC meetings and in correspondence from the agencies have been resolved. For example, the definition of the Ferry Alternatives was developed, and MCB4 was included in the analysis based on comments raised at the TEAC meetings. There also was general agreement that ER1 and MCB1 should not be evaluated in detail in the DEIS because of the substantial displacement of existing land uses that would occur in Dare County if NC 12 were widened to four lanes. These agency comments were based on a draft comparison of alternatives that evaluated the MCB alternatives as a four-lane bridge in 2007.

However, in comments submitted in August and October 2007, several of the agencies expressed a desire for additional alternatives to be carried forward for detailed study. The principal agency comments are summarized below.

- Alternative MCB2. The US Army Corps of Engineers (USACE) requested that MCB2 be retained for detailed study because of its potential for additional traffic benefits.

- Alternative ER2. The North Carolina Wildlife Resources Commission (NCWRC), the North Carolina Department of Natural Resources (NCDENR) Division of Marine Fisheries (DMF), the US Environmental Protection Agency (USEPA), NCDENR Division of Water Quality (DWQ), and NCDENR Division of Coastal Management (DCM) each asked in written letters that the ER2 alternative be retained for detailed study. The reasons included: its potential for less wetland, habitat and natural resource impacts; a desire to have a non-bridge alternative for detailed study; and a disagreement that its slightly higher displacements, poor affordability and lesser travel benefits were suitable reasons for its elimination.

- Use of Economic Feasibility to Screen Alternatives. The USEPA indicated a concern over the consideration of affordability as a criterion for selecting detailed study alternatives. Its representatives felt that feasibility from an economic standpoint should not be a part of the decision because none of the alternatives considered that offered substantial travel benefits had committed to cover the full cost of the project.

The TEAC representatives requested an opportunity to provide additional comment after alternatives study findings were presented to the public. On April 7, 2008, NCTA released a revised Alternatives Screening Report to the public. This document was distributed to agency representatives at the TEAC meeting held on April 8, 2008. A total of eight agency comment letters were received, which brought up similar issues on the recommended alternatives for further study identified in the April 2008 Alternatives Screening Report. A summary of the principal agency comments is presented below.

- ER2. The USACE, USEPA, NCDENR-DWQ, and NCWRC requested that ER2 be carried forward in the DEIS because it is the least expensive and potentially has the least environmental impacts of all alternatives. Additionally, the agencies believe that a non-bridge alternative should be in the DEIS to fully assess direct and indirect

impacts and to have a full range of feasible and comparable alternatives for public review.

- MCB2. USACE and USEPA requested that MCB2 be carried forward in the DEIS because it has greater system traffic improvement benefits than MCB3 or MCB4.

- MCB3. USACE recommended MCB3 be dropped as an alternative for further study because its hurricane clearance times are the worst of the alternatives. MCB3 would not have additional system benefits over MCB4 other than a cost savings of $7 million. Additionally, USEPA stated that the scope and components of the MCB3 and MCB4 alternatives are nearly identical.

- ER1 and MCB1. USEPA indicated that Alternatives ER1 and MCB1 are not reasonable and could be eliminated based on potential impacts to the human and natural environment, traffic benefits provided, and more than double the capital costs over other alternatives. The other agencies did not advocate for the detailed assessment of ER1 and MCB1.

- General. NCDENR-DWQ stated that avoidance and minimization begins with alternative selection and continues through the selection of the Least Environmentally Damaging Practical Alternative (LEDPA). If impacts on resources in Currituck Sound, especially fishing and wildlife, are shown to be significant, and all non-bridge alternatives have been dropped during NEPA review, the NCDENR-DWQ would require the 401 Water Quality Certification application that a non-bridge alternative be evaluated to ensure that proper avoidance and minimization of impacts has occurred.

2.3.2 Public Comments

Citizens Informational Workshops were held in three locations around the Currituck Sound: Corolla (Currituck Outer Banks), Currituck (Mainland), and Southern Shores (Dare County Outer Banks) on February 26, 27, and 28, 2008, respectively. These meetings were informal, open house informational sessions that provided the public an opportunity to learn about the project and discuss issues with project staff, as well as provide input on the project's purpose and need and range of alternatives. Of the 292 comments received during a comment period that ended March 28, 2008, 186 indicated they preferred the construction of a bridge, and 28 indicated they favored widening existing roads. Primary reasons for favoring a bridge were reduced future congestion, improved hurricane evacuation times, and potential positive economic impacts. Primary concerns related to a Mid-Currituck Bridge project were: natural resource impact, changes in views of Currituck Sound, increased day visitors, increased crime, community impacts (particularly in Aydlett), and that a bridge would not completely solve area traffic problems. Those who favored widening existing roads also felt that such an alternative would reduce congestion and facilitate huricane evacuation. Primary concerns with widening existing roads included: changes in community

character, the safety of pedestrians that cross NC 12, negative economic impacts from loss of business parking, and health risks associated with traffic and emissions being closer to residences. Eleven respondents indicated that they favored the No-Build Alternative, primarily because the traffic problem in the project area is currently confined to summer weekends. A majority of comments regarding tolling were favorable about this financing tool. Some comments noted that improved pedestrian and bicycle access should be provided regardless of the alternative pursued. Local officials, both at local officials meetings held on February 27 and 28, 2008 and in resolutions, indicated that they favored the bridge project over widening existing roads.

No comments were received related to the other alternatives considered and rejected except the ferry alternative. The ten comments regarding ferry service were equally split between proponents and opponents. Several expressed concern that ferry service had been tried and was unsuccessful. Others noted that the sound is too shallow and could not sustain ferry service. Some respondents noted that tourists might enjoy the novelty of a ferry and be inclined to use it.

On April 7, 2008, the NCTA released the April 2008 Alternatives Screening Report to the public. This document was delivered to five municipal offices around the project area in Currituck, Corolla, Kitty Hawk, Southern Shores, and Duck, North Carolina, and posted on the project website. Stakeholders were notified of the release of this document through a postcard mailing and via the project website. A total of 65 comments were submitted to the NCTA via email, conventional mail, telephone, as well as formal comment sheets distributed through the project website. The Towns of Nags Head and Southern Shores, Currituck County, and the Albemarle Commission submitted official resolutions, the Town of Duck submitted a letter, and recommendations were made by a special interest group and a property owner's association. Governmental resolutions and letters supported the Mid-Currituck Bridge.

Eight citizen comments were received that referenced the Alternatives Screening Report. These respondents generally opposed construction of a Mid-Currituck Bridge. One comment was a general statement of approval for the report and the project.

General project comments also were received during this comment period. Common themes both in favor of and opposed to various alternatives remained similar to comments received during the previous public comment period.

Many of the positive public comments regarding the Mid-Currituck Bridge alternatives mentioned improved accessibility to the beaches, the mainland, and the economic assets and services available on either side of Currituck Sound as a primary factor for support of these alternatives. Other positive comments addressed reduction of traffic congestion, travel time and fuel costs. Enhanced hurricane evacuation capacity also was a frequently cited benefit of the bridge.

Negative bridge comments focused on impacts to wildlife, habitat, communities, and visual quality; the potential for over development and commercialization of the Outer Banks; and increased traffic and crime. Two comments favored the ER alternatives because they would reduce traffic congestion. Seventeen comments opposed all alternatives that included improvement of existing roads. There was considerable concern that widening roads would damage the distinctive community character, encourage speeding, and have negative impacts on the economy of the area.

3.0 Bridge Corridor Screening

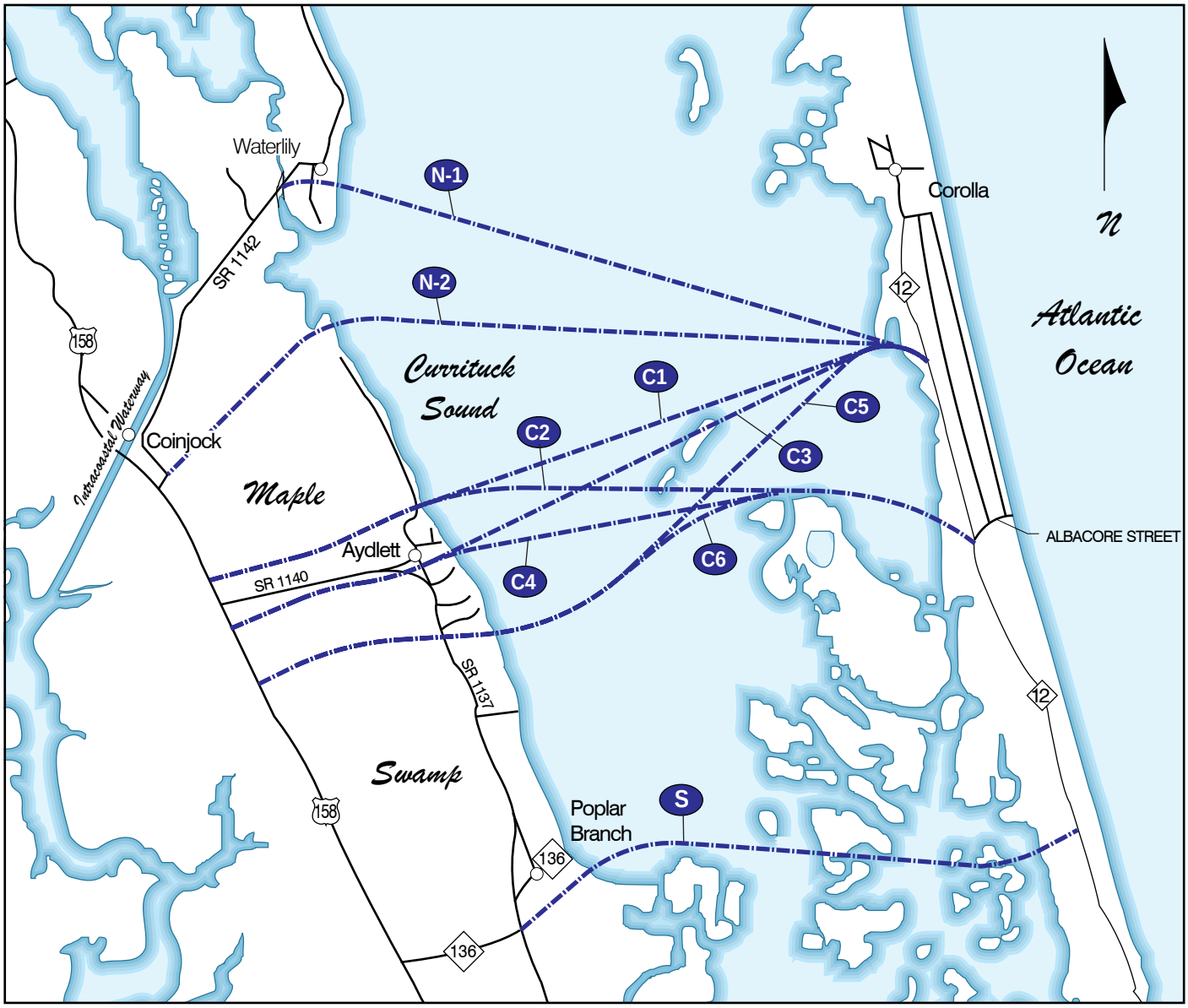
The bridge corridor screening identified and evaluated potential locations for a two-lane toll bridge across Currituck Sound. The starting point for this screening was a review of the bridge corridors discussed in an *Alternatives Study Report* prepared in 1995 by NCDOT, which subsequently was presented in a DEIS prepared for the Mid-Currituck Bridge Project and released for public review in 1998. This DEIS was rescinded by FHWA in 2008 (Federal Register Vol. 73, No. 107, page 31733). This earlier work is referred to as the 1995 studies in the rest of this report.

The 1995 studies focused on the evaluation of nine corridor alternatives called:

- **N1**—Parallel to SR 1142 and across the Sound to Corolla Bay.
- **N2**—Between Waterlily and Aydlett and across the Sound to Corolla Bay.
- **C1**—Parallel to the power line right-of-way and across the Sound to Corolla Bay.
- **C2**—Parallel to the power line right-of-way and across the Sound to Albacore Street.
- **C3**—Parallel to SR 1140 and across the Sound to Corolla Bay.
- **C4**—Parallel to SR 1140 and across the Sound to Albacore Street.
- **C5**—Between Aydlett and Poplar Branch and across the Sound to Corolla Bay
- **C6**—Between Aydlett and Poplar Branch and across the Sound to Albacore Street.
- **S**—Parallel to NC 136, while avoiding the center of Poplar Branch, and across the Sound to the Currituck Shooting Club.

These corridors are illustrated in Figure 11. The 1995 studies identified alternatives C1 to C6 as the reasonable bridge corridor alternatives to be evaluated in detail in a DEIS.

The 1995 study findings were considered to be a reasonable starting point for the identification of bridge corridors for detailed evaluation in the 2008 DEIS. A review of the merits of these nine corridors was completed in the context of the current 2007-2008



Legend

Corridor Alternatives

North

- **N-1** SR 1142/Corolla Bay
- **N-2** Between Waterlily and Aydlett/Corolla Bay

Central

- **C-1** Parallel to Power Line/Corolla Bay
- **C-2** Parallel to Power Line/Albacore Street
- **C-3** Parallel to SR 1140/Corolla Bay
- **C-4** Parallel to SR 1140/Albacore Street
- **C-5** Between Aydlett and Poplar Branch/Corolla Bay
- **C-6** Between Aydlett and Poplar Branch/Albacore Street

South

- **S** NC 136/The Currituck Club

1995 Preliminary Corridor Alternatives

Figure 11

alternatives studies. The review focused on whether changes had occurred in the settings of the nine corridors between 1998 and 2007 that could result in corridor selection decisions different from those associated with the 1995 studies. The review was based primarily on an examination of aerial photography and the same GIS information listed in Section 2.1.2.1 under "Potential Impacts on Natural Resources and Communities" used in the comparison of project concepts. Based on this review, it was determined that the reasons for eliminating the N and S corridors remained valid; therefore, this corridor screening focuses on the six C corridors. The primary changes in the setting of the six C corridors were some additional development in Aydlett along the C3/C4 corridor on the mainland and the presence of a subdivision (platted with infrastructure improvements but only one completed home in 2007) at the C1/C3/C5 corridor on the Outer Banks. The representative alignment used in the assessment of these corridors was adjusted to account for these changes.

Section 3.1 evaluates the six C corridors (C1 through C6) with the purpose of determining which are reasonable alternatives for evaluation in the DEIS. All six C corridors meet the purpose and need of the project. Therefore, the screening process focuses on their potential for environmental impact. This screening resulted in a decision to evaluate two bridge corridor alternatives in detail in the DEIS.

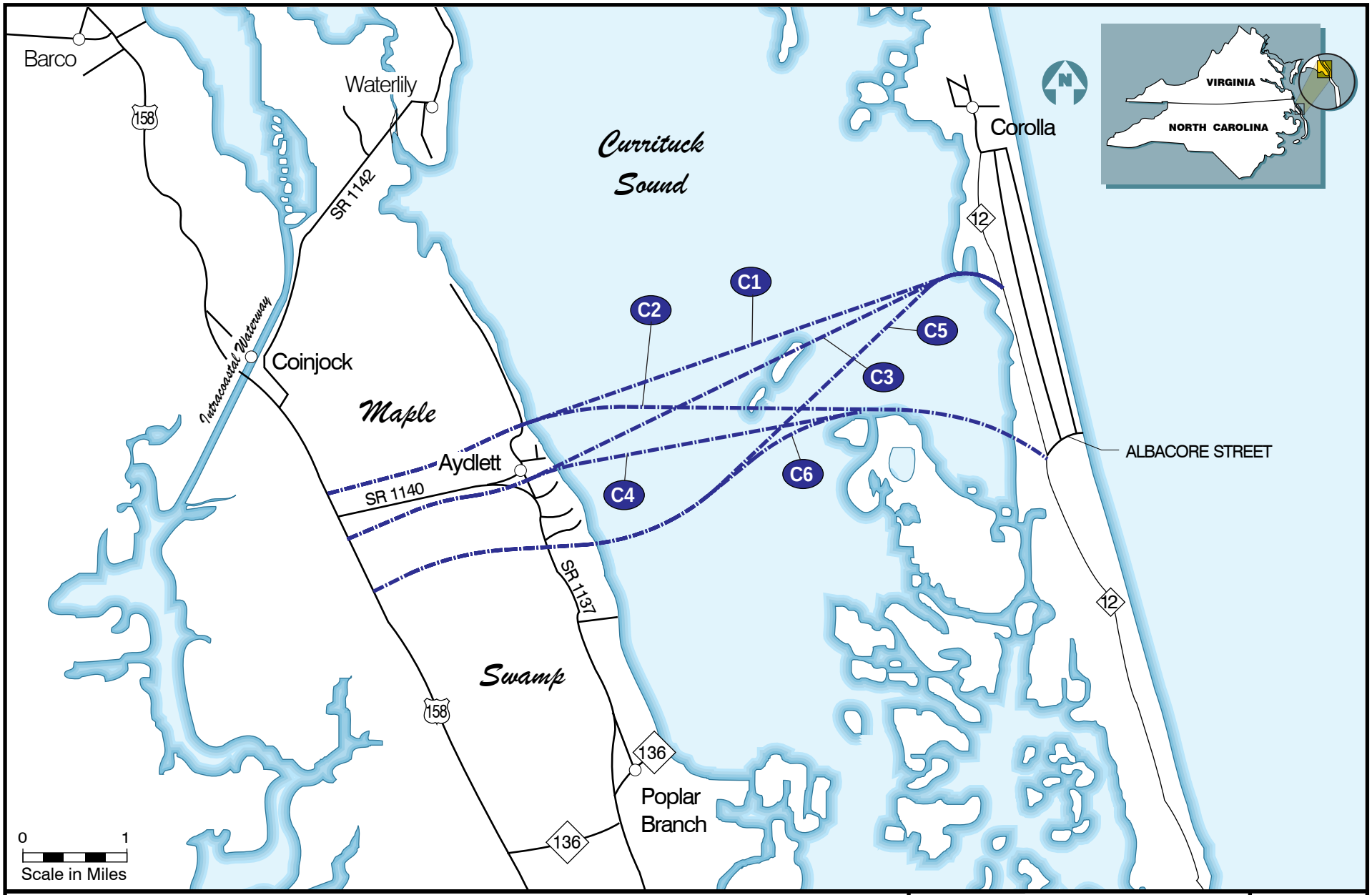
C1 and C2 were selected for detailed study in the DEIS. On the mainland, C1 and C2 share a single approach corridor, which parallels an existing powerline easement; on the Outer Banks, C1 and C2 have different bridge termini, one in the Albacore Street area and one approximately 2 miles north.

Section 3.2 reviews the other alternatives considered in the 1994 to 1998 studies and why they were found not to be potential detailed study alternatives. In response to public comments received at the Citizens Informational Workshops conducted February 26 to 28, 2008, the merits of a bridge corridor that terminates on the mainland at the US 158/ NC 168 intersection are discussed. The results of the review of the 1994 to 1998 studies also are presented in this section.

3.1 Bridge Corridor Alternatives

3.1.1 Development of Bridge Corridor Alternatives

Figure 12 shows the locations of corridors C1 through C6. The factors used in comparing C1 to C6 are presented in Table 5 . These are the same factors defined in NCDOT's Merger 01 process for comparing alternatives on new location. Added are right-of-way costs. Natural resource impacts are based on available GIS data bases available for the project area (see listed in Section 2.1.2.1 under "Potential Impacts on Natural Resources and Communities"), as well as a field review made to the project area by the study team and representatives from state and federal environmental resource and regulatory agencies on July 10, 2007.



LEGEND

Bridge Corridors

Corridors C1 through C6

Figure 12

Table 5. Comparison of Bridge Corridors C1 Through C6

		C1	C2	C3	C4	C5	C6
SOCIAL, ECONOMIC, AND CULTURAL IMPACTS	Major Utility Conflicts (yes or no)	No	No	No	No	No	No
	Railroad Crossings (number)	0	0	0	0	0	0
	Displacements (number)						
	• Residences	6	6	7	7	0	0
	• Businesses	0	1	0	1	0	1
	• Cemeteries (all or part)	1	1	1	1	0	0
	• Recorded Historic Sites	0	0	0	0	0	0
	Rural Community Fragmentation on Mainland	Passes through Aydlett north of its center		Passes through center of Aydlett		At southern end of Aydlett	
	Beach Community Fragmentation on Outer Banks	Passes between 2 subdivisions, taking southern end of one	None, in commercial area	Passes between 2 subdivisions, taking southern end of one	None, in commercial area	Passes between 2 subdivisions, taking southern end of one	None, in commercial area
	Greenway Crossings (number)	0	0	0	0	0	0
	Low Income or Minority Populations (yes or no)	No	No	No	No	No	No
	Potential Section 4(f) Impacts (yes or no)	No	No	No	No	No	No
	Hazardous Materials Sites (number completely or partially used)	0	0	0	0	0	0

Table 5 (concluded). Comparison of Bridge Corridors C1 Through C6

		C1	C2	C3	C4	C5	C6
NATURAL RESOURCES IMPACTS	Known Federally-Listed Species Habitat (Natural Heritage Program) (number of areas affected)	0	0	0	0	0	0
	100-Year Floodplain Impacts (yes or no)	Yes	Yes	Yes	Yes	Yes	Yes
	Habitat Fragmentation (Maple Swamp Bridged on Mainland)	Bridge corridor parallel to power line corridor; swamp forest lost; in vicinity of existing forest edge		Bridge corridor parallel to Aydlett Road ; swamp forest lost; in vicinity of existing forest edge		Bridge corridor is a new crossing ; swamp and bay forest lost; new forest edge created	
	Wetland Impacts[1]						
	• Crossings (number)	3	3	4	4	4	4
	• Total Area on Mainland (acres; bridged is width of bridge times length)	7.6 (fill) 7.4 (bridged)	7.6 (fill) 7.4 (bridged)	15.9 (fill) 6.6 (bridged)	15.9 (fill) 6.6 (bridged)	19.0 (fill) 5.5 (bridged)	19.0 (fill) 5.5 (bridged)
	• Total Area on Outer Banks (acres; bridged is width of bridge times length)	1.5 (bridged)	2.5 (bridged)	1.5 (bridged)	2.5 (bridged)	1.5 (bridged)	2.5 (bridged)
	• Coastal (CAMA) wetland area on Outer Banks (acres; bridged is width of bridge times length)	1.2 (bridged)	1.0 (bridged)	1.2 (bridged)	1.1 (bridged)	1.2 (bridged)	1.0 (bridged)
	Stream Impacts						
	• Crossings (number)	0	0	0	0	0	0
	• Length in feet (within design construction limits)	0	0	0	0	0	0
	Potential Riparian Buffer Impacts (yes or no)	No	No	No	No	No	No
	Water Supply Critical Areas (yes or no)	No	No	No	No	No	No
	High Quality Resources	Maple Swamp; Gordonia Forest	Maple Swamp; Gordonia Forest	Maple Swamp; Gordonia Forest; North River/ Great Swamp	Maple Swamp; Gordonia Forest; North River/ Great Swamp	Maple Swamp; Gordonia Forest	Maple Swamp; Gordonia Forest
		Forest is different character and quality than C3 to C6. and while of value is not as unique		Bay forest exists but is thinner and smaller than C5 and C6.		Passes though a bay forest unique primarily because of the large size of the trees.	
	• Crossings (number)	2	2	2	2	2	2
	• Area (acres)	0.85 (fill) 7.8 (bridged)	0.85 (fill) 7.8 (bridged)	6.44 (fill) 6.5 (bridged)	6.44 (fill) 6.5 (bridged)	7.23 (fill) 5.5 (bridged)	7.23 (fill) 5.5 (bridged)

[1]Assumes a two-lane Mid-Currituck Bridge, additional NC 12 intersection approach lanes, and a US 158 interchange. Uses available GIS wetlands data.

3.1.2 Evaluation of Bridge Corridor Alternatives

A comparison of the full range of factors yields the conclusion that the corridors show differences in their potential for impact only in relation to natural resource impact (in particular the location where impact occurs) and community fragmentation or division. Consideration of this information, as well as field trip results and written and oral comments made by environmental resources and regulatory agencies made at TEAC meetings in 2007, the following findings and conclusions were reached about the corridor alternatives.

3.1.2.1 C5 and C6

C5 and C6 on the mainland would minimize the fragmentation or division of the community of Aydlett, since the bridge would pass through the community near its southern perimeter. Displacement would be confined to a single business. These corridors would have the highest potential for filling wetlands and would pass through a unique bay forest found within Maple Swamp. This forest is made up of loblolly bay (*Gordonia lasianthus*) and red bay (*Persea palustris*), with a few sweet bays (*Magnolia virginiana*). The NC Natural Heritage Program recognizes it as a Significant Natural Heritage Area called the "Maple Swamp Gordonia Forest." These corridors would add an additional break in the tree cover of Maple Swamp, further fragmenting the resource and creating a new forest edge. Finally, Great Swamp adjoins the western right-of-way edge of US 158, increasing the potential for impacts resulting from the interchange with US 158 included with the bridge project. The environmental resource and regulatory agency representatives agreed that this corridor should be eliminated from consideration. The possibility exists that NCTA would not be able to obtain the Section 404 permit and associated Section 401 certification (both under the Clean Water Act) to build a bridge in this corridor because other practicable corridors with less natural resource impact exist. Because these corridors would potentially have the greatest natural impact and in particular a substantial effect on a unique natural area, the C5 and C6 corridors were not selected for detailed analysis in the DEIS, despite their lower potential community impact.

3.1.2.2 C3 and C4

C3 and C4 on the mainland would fragment or divide Aydlett by passing through the center of the community. Most of the seven residential displacements associated with these corridors would occur in Aydlett. The natural resource impacts associated with this corridor would be similar to C5 and C6 with two exceptions where the impacts would be less:

- The corridor would be in the area of the bay forest where the bay trees are less frequent and smaller in diameter; and
- The corridor would be near an existing forest edge and habitat fragmentation point, Aydlett Road.

The environmental resource and regulatory agency representatives indicated that it would be desirable to not consider a corridor south of Aydlett Road. Because of the remaining natural resource impacts, Aydlett community fragmentation, and the fact that the remaining corridors C1 and C2 showed a lower potential for impact in both these areas of concern, the C3 and C4 corridors were not selected for detailed evaluation in the DEIS.

3.1.2.3 C1 and C2

On the mainland, the corridors would pass through Aydlett, north of the center of the community. There would be six residential displacements, primarily along US 158. One cemetery would be displaced. This alternative would pass adjacent to the site of a structure (formerly a home) whose architectural features warrant it eligibility for inclusion in the National Register of Historic Places (NRHP). These corridors would have the least potential for wetland impacts in the US 158 interchange area because unlike the other corridors, upland adjoins the western edge of the US 158 right-of-way. For the most part, the unique bay trees do not occur in this corridor and the bridge could parallel or be close to an existing forest edge (a power line right-of-way) as it passes through Maple Swamp.

At the Outer Banks termini for these corridors, the C1 terminus would pass through a proposed development that is expected to be completed prior to right-of-way acquisition (should NCTA decide to build a bridge). C1 would create community fragmentation and have noise and visual impacts. The C2 Outer Banks terminus would reach NC 12 in a commercial area. This terminus was established in the early 1990s as a potential terminus for a Mid-Currituck Bridge on an Official Map. Land owners are required to notify NCDOT before they build at this location to provide NCDOT with an opportunity to buy the right-of-way before it is developed. From a natural resources perspective, C1 has the least potential for wetland and habitat impact. From a traffic operations perspective, C1 could be easier to implement because the C2 terminus area has numerous nearby driveways and local streets that would need to be relocated or altered to eliminate left turns in order for the intersection of the bridge and NC 12 to operate at an adequate level of service. This issue is addressed in Section 5.3. Since both corridors appear to be feasible, and notable trade-offs exist between them in terms of potential impacts, C1 and C2 will be carried forward as detailed study alternatives in the DEIS.

Environmental resource and regulatory agency representatives indicated a preference for C1 and C2 over C3, C4, C5, and C6 based on environmental impacts. These agencies requested that the NCTA consider the following during preliminary design of a project in these corridors:

- On the mainland, widen the C1/C2 corridor to Aydlett Road to provide additional preliminary design flexibility as more detailed natural resource information is gathered in the corridor. NCTA agreed to the wider mainland corridor and to

gather detailed environmental resource data, including wetland delineations, for this wider mainland corridor. These data were considered in developing the preliminary design that will be assessed in the DEIS.

- On the Outer Banks, make adjustments to conceptual alignments considered during the alternatives study to reduce wetland, and particularly coastal wetland, impacts associated with C1. NCTA considered adjustments at both terminus locations.

- At US 158, examine interchange design alternatives that would minimize wetland impacts west of US 158. The decision to focus on the C1 and C2 corridors already aids in this effort because a larger area of uplands occurs west of US 158 than with the other corridors. NCTA investigated alternative designs.

The results of these studies are presented in Section 5.0.

3.2 Additional Alternatives Considered and Eliminated

As indicated above, in 1995 NCDOT prepared an *Alternatives Study Report* that examined nine preliminary bridge corridors to select the reasonable and feasible bridge and approach road corridor alternatives. The nine preliminary alternatives are shown in Figure 11. Six of those corridors were discussed in Section 3.1. This section considers the remaining three corridors, N1, N2, and S, as well as the merits of considering a corridor further north or south of these three alternatives.

3.2.1 Assessment of N1, N2, and S Corridors

The 1995 assessment of the N1, N2, and S corridors (as well as the 1995 assessment of C1 to C6) considered:

- Engineering considerations
  - Total cost
  - Percent curved bridge over Currituck Sound
  - Total length
- Traffic considerations
  - US 158 level of service
  - NC 12 level of service
- Social, economic and cultural resource considerations
  - Displacement
  - Proximity of homes to the edge of the approach roads' near lanes
  - Mainland community cohesion
  - Outer Banks subdivision compatibility

  - Public recreation lands impacted
  - Historic resources impacted

- Natural resource considerations

  - Wetlands impacted
  - Open water/potential submersed aquatic vegetation (SAVs) affected by bridge
  - Length of bridge near marsh islands
  - Undisturbed upland affected
  - Fragmentation of Maple Swamp
  - Listed or managed natural resource areas affected
  - Potential for affecting protected species

The review of N1, N2, and S to determine if the 1995 findings remained valid discovered only one substantial change within the corridors. It was along the S corridor and involved the development of a NRHP-listed historic landscape.

The S corridor would pass through the Currituck Shooting Club, which was listed on the NRHP in 1995. The club's boundaries are extensive and encompass the marsh islands along the eastern shore of Currituck Sound. The club is still listed on the NRHP, even though the associated club building was destroyed by fire in 2003, and much of the Outer Banks portion of the site has been developed as a golf course community.

The following paragraphs discuss the merits of N1, N2, and S and why they are not reasonable alternatives for evaluation in the DEIS. The findings all assume a two-lane Mid-Currituck Bridge.

3.2.1.1 Corridor N1

Corridor N1 would be substantially more costly and would have high social and wetland impacts. N1 would be a longer project (10 miles long versus approximately 7 miles for the other corridor alternatives). This additional length would result in a higher cost compared to other corridors, approximately 40 to 46 percent higher ($71 to $88 million versus $50 to $60 million in 1995 dollars). N1 would bisect the community of Waterlily by placing bridge traffic on SR 1142, which passes through the community. Approximately 51 acres of wetlands would be impacted, including 18.5 acres of coastal wetland under the jurisdiction of CAMA.

3.2.1.2 Corridor N2

Corridor N2 would have higher natural resource impacts compared to other corridors. This corridor would impact 40.7 acres of wetlands (again assuming a two-lane bridge), would cross Maple Swamp at its widest point, and would not follow an existing forest edge, further fragmenting the habitat.

3.2.1.3 Corridor S

Corridor S would have high social and natural resource impacts and would use land from a property listed on the NRHP. Also, S would not improve the level of service on NC 12 as well as the other corridors because bridge traffic would mix with a larger number of travelers on NC 12 going to and from destinations south of the bridge.

Corridor S would pass through the community of Poplar Branch on the mainland side of the project with associated noise, visual, and community cohesion impacts. Corridor S also would pass through a group of marsh islands currently considered a Significant Natural Heritage Area. Some of these islands would be crossed.

Corridor S would pass through the Currituck Shooting Club, which is listed on the NRHP. The club's boundaries are extensive and encompass the marsh islands along the eastern shore of Currituck Sound. The club is still listed on the NRHP, even though the associated hunt club building was destroyed by fire in 2003, and much of the Outer Banks portion of the site has been developed as a golf course community (The Currituck Club). This introduces additional social impacts that were not present in 1995, the division of a second community and increased right-of-way costs. The following summarizes the impacts to The Currituck Club community:

- The primary impact would be to the golf course. One hole would be displaced (including a water hazard) and three fairways would have to be shortened by either moving the tee box or the green. The easy movement of players from one hole to the next would be affected in two ways, through the loss of the hole and the bridge corridor, which would separate two remaining holes from the balance of the course. A passageway under the approach road to the bridge from NC 12 would need to be provided for access to the two holes.

- The corridor's presence would cause noise and visual impacts to nearby homes (10 homes are presently within 250 feet of the corridor). A local north-south road would need to be bridged to maintain the continuity of the subdivision's existing circulation system. Because the land used is primarily associated with the golf course, no displacement of homes or businesses would occur.

- The right-of-way costs and mitigation costs for modifying the golf course would add to the cost of building the project.

- Corridor S could be moved to the south or north to take a different pathway through the community. If this were done, in either direction, two golf course holes would be displaced or shortened by several hundred feet. Four to six homes would be displaced.

3.2.1.4 Conclusion

For reasons listed above, N1, N2, and S were not found to be reasonable alternatives for detailed evaluation in the DEIS, just as they were in 1995.

3.2.2 Far North and South Corridors

In 1995, alternatives north of Corridor N1 were not assessed for the following reasons:

- They would have necessitated a new high-level bridge across the Intracoastal Waterway and would have resulted in a bridge longer than that of Corridor N1. For example, such a project between the mainland at the US 158/ NC 168 intersection and the Outer Banks in the same general area as N1, N2, and three of the C corridors would be approximately 15 miles long, almost all of the distance over open water, wetlands, or coastal marsh. This compares to the approximately 7-mile length of the alternatives considered in the C corridors. Both of these factors would have resulted in substantially higher costs for a Far North corridor.

- The Outer Banks terminus would have to be placed at or south of the northern end of NC 12, as noted in the example in the previous bullet. Locations north of the N1, N2, C1, C3, and C5 Outer Banks terminus and south of the end of NC 12 would affect additional wetlands, developed areas, the viewshed of the Whalehead Hunt Club (listed on the NRHP), and/or use land from the Whalehead Hunt Club, Currituck Beach Light Station, or Corolla Historic District (all either listed or eligible for inclusion in the NRHP).

These reasons remain valid in 2008 and, therefore, alternatives further north than N1 were not found to be reasonable for detailed evaluation in the DEIS.

In 1995, alternatives south of Corridor S were not assessed for the following reasons:

- The project is defined as a bridge in Currituck County.

- In order to avoid impacts to the Pine Island Audubon Sanctuary (which also is a Coastal Barrier Resources Act designated area and which parallels NC 12 for approximately 3.8 miles in Currituck County beginning at the Dare /Currituck County line).

- A bridge in Dare County would have brought bridge traffic into the most congested portion of NC 12 where widening the existing road to accommodate traffic coming on and off the bridge would have caused displacement and community disruption since the NC 12 right-of-way is only 60 feet wide.

- The further south the bridge was considered for placement, the less travel demand would shift from on NC 12 and US 158 in Dare County where the highest levels of

congestion occur in 2025. Therefore, the travel benefits of the bridge would diminish.

These reasons remain valid in 2008 and, therefore, alternatives further south than the S corridor were not to be reasonable for detailed evaluation in the DEIS.

3.3 Agency and Public Comments

Agency and public comments were solicited during the comparison of bridge corridors. These comments were considered in the assessment and selection of the bridge corridors for detailed study. These comments are summarized in this section.

3.3.1 Agency Comments

The findings of the corridor analyses were discussed with federal environmental resource and regulatory agencies within the context of the series of TEAC meetings described in the introduction to Section 2.3. Many of the issues raised and discussed at the TEAC meetings were resolved. For example, as indicated above TEAC representatives indicated a strong preference for not assessing the C3, C4, C5, and C6 corridors in detail in the DEIS. They also indicated a strong preference for assessing C1 in detail in the DEIS because its use of natural habitat and wetlands would be less than C2. These preferences are reflected in NCTA's decision to assess the C1 and C2 corridors as a part of both MCB3 and MCB4. The North Carolina Department of Cultural Resources, State Historic Preservation Office (HPO), stated a preference for the alignments of C2, C4, and C6 because of the National Register-listed historic properties in and around Corolla.

The remaining concerns of TEAC representatives related to the alignment of the project within the C1 and C2 corridors are presented below.

- NCWRC, NCDENR Division of Marine Fisheries (DMF), and NCDNER-DWQ requested that the C1 alignment be adjusted to avoid coastal wetlands defined under the CAMA wetlands. NCTA responded by examining four additional C1 alignments and selecting one that avoided coastal wetlands, as described in Section 5.3.

- USEPA cautioned NCTA that dropping corridors prior to performing a migratory bird analysis could be problematic. The other corridors could be better options with specific regard to migratory bird impacts once detailed information on migratory birds is obtained. However, USFWS and NCWRC representatives felt that C4 to C6 could be dropped at this time. To address this concern, NCTA expanded the width of C1 and C2 on the mainland southward to Aydlett Road, gathered detailed wetland information, and conducted a survey for large trees. These data were used to refine the C1 and C2 alignments. (See Section 5.2).

- NCDENR-DWQ indicated that it was very interested in the preservation of SAV. NCDNER-DWQ said that C1 appeared to have the least amount of SAV impact potential. NCDENR-DWQ asked to review the results of NCTA SAV surveys before finalizing their opinion. The surveys were provided to NCDENR-DWQ upon their completion and SAV and the potential for SAV in Currituck Sound was a factor considered in the alignment refinements addressed in Section 5.3. The other agencies also indicated an interest in SAVs.

- The agencies requested that NCTA look at alternative US 158 interchange configurations that might avoid and minimize wetland impact. The findings of this work are presented in Section 5.1.

3.3.2 Public Comments

Public comments on the alignments generally focused on concerns related to direct impacts associated with the bridge termini, including noise impacts at nearby homes in Aydlett, changes in views (including those of historic structures), the family cemetary displacement in the US 158 interchange area with C1 and C2, and impacts to the Corolla Bay subdivision by C1 (proximity to bridge, change in sound views, and right-turn only access to residential and commerical components). Many of the comments on these alternatives came from persons who would be personally affected by a particular corridor, as well as people concerned about potential impacts on their community in general.

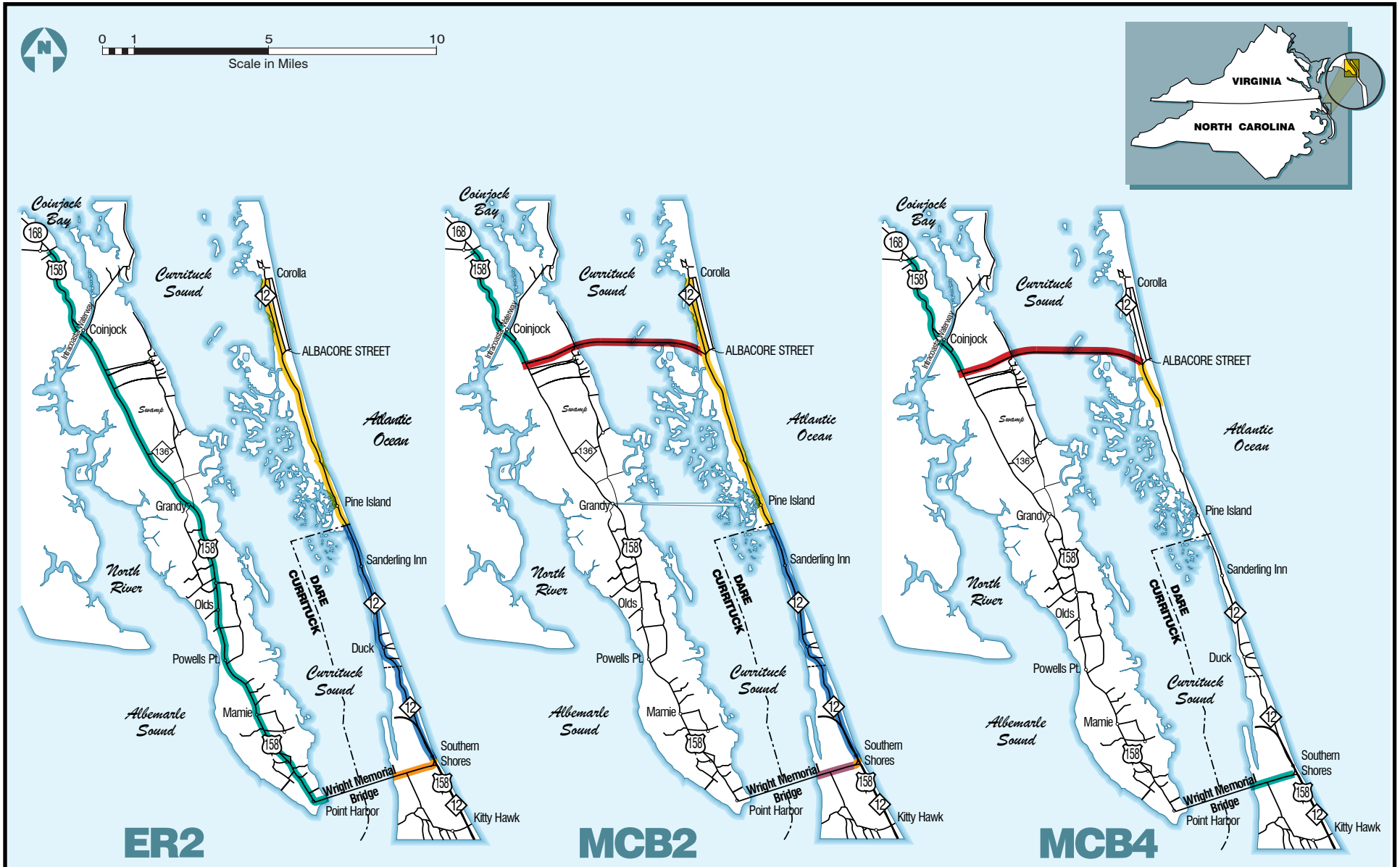
Several persons suggested that the bridge end on the mainland at the intersection of US 158 and NC 168. It was felt that such a corridor would reduce community impact and help hurricane evacuation by providing a second bridge across the Intracoastal Waterway and a direct route to NC 168. This concept was considered but eliminated for reasons described in Section 3.2.2 of this report.

4.0 Detailed Study Alternatives

Based on discussions at the July 10, 2007, field trip, comments made at the June and July, 2007 and April 2008 TEAC meetings, and written comments received from the agencies and public, NCTA selected ER2, MBC2, and MCB4 as detailed study alternatives. These alternatives are shown in Figure 13, and consist of:

- **ER2**

  – Adding a third outbound lane on US 158 between NC 168 and the Wright Memorial Bridge as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;



LEGEND

- Eight Lanes
- Six Lanes
- Four Lanes
- Three Lanes
- Mid-Currituck Bridge
- Third Outbound Lane or Contraflow Lane

Detailed Study Alternatives

Figure 13

- Widening US 158 to eight lanes between the Wright Memorial Bridge and the NC 12 intersection; and

- Widening NC 12 to three lanes between US 158 and the Dare-Currituck County Line and to four lanes between the Dare-Currituck County Line and Corolla.

- **MCB2**

  - Constructing a two-lane toll bridge across the Currituck Sound in Currituck County;

  - Adding a third outbound lane on US 158 between NC 168 and Aydlett Road (SR 1140) as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;

  - Widening US 158 to six lanes between the Wright Memorial Bridge and Jupiter Trail/Wal-Mart entrance and eight lanes from Jupiter Trail/Wal-Mart entrance to the NC 12 area; and

  - Widening NC 12 to three lanes between US 158 and the Dare-Currituck County Line and to four lanes between the Dare-Currituck County Line and Corolla.

- **MCB4**

  - Constructing a two-lane toll bridge across the Currituck Sound in Currituck County;

  - Adding a third outbound lane on US 158 between NC 168 and Aydlett Road (SR 1140) as a hurricane evacuation improvement or using the center turn lane as a third outbound evacuation lane;

  - Adding a third outbound lane on US 158 between the Wright Memorial Bridge and NC 12; and

  - Widening NC 12 to four lanes for approximately two to four miles south of the intersection with a Mid-Currituck Sound Bridge.

A preliminary design was later developed for each of these alternatives for use in the detailed assessment of environmental impacts in the DEIS. During preliminary design, intersection turning movement forecasts were developed for the widening components of all three of the detailed study alternatives in order to size signalized intersections so they at least achieve a level of service appropriate for the travel benefits associated with the additional lanes. Such turning movement forecasts were developed for the end-points of a Mid-Currituck Bridge during the alternatives screening. This work included for ER2 and MCB2 the US 158/ NC 12 intersection where traffic volumes approaching this intersection forecast for 2035 during the alternatives study were great enough that it

was possible that an interchange would be required to adequately serve the intersection's turning movements. The need for an interchange at the US 158/NC 12 intersection was identified during those studies and was added to ER2 and MCB2 during preliminary design for evaluation in the DEIS. In addition, during preliminary design, it was decided to use a super-street on US 158 between the Wright Memorial Bridge and NC 12 with ER2 and MCB2.

The bridge component of both MCB2 and MCB4 will be evaluated in two bridge corridor alternatives (see Figure 13):

- **C1**—On the mainland, Corridor C1 will be between Aydlett Road (SR 1140) and a line approximately 500 feet north of the powerline that parallels Aydlett Road. On the Outer Banks, Corridor C1 will end at the southern end of the Corolla Bay subdivision.

- **C2**—On the mainland, Corridor C2 will include the same area as Corridor C1 and on the Outer Banks will end in the vicinity of Albacore Street (SR 1402).

5.0 Corridor C1 and C2 Alignment Refinements

Per the request of TEAC representatives during development of the conceptual designs for the two bridge corridors evaluated in the DEIS, NCTA considered the following:

- At US 158, examined interchange and intersection design alternatives that would minimize wetland impacts west of US 158.

- On the mainland, considered field surveyed wetland boundaries and the results of a survey for large trees to determine whether natural resource impacts would be better minimized if the preliminary design alignment was north or south of the powerline right-of-way within the C1/C2 corridor.

- In Currituck Sound and on the Outer Banks, made adjustments to conceptual alignments considered during the alternatives study to reduce wetland impact, particularly coastal wetland impact, and SAV associated with both the C1 and C2 termini.

The study team also decided to assess an alternative alignment for C2 that would reduce the number of changes to driveways and local streets on NC 12. The results of these assessments were discussed with TEAC representatives and Currituck County. The results also were presented at the February 2008 Citizens Informational Workshops.

5.1 Refinements to Western Terminus (US 158 / Mid-Currituck Bridge Interchange)

Three interchange concepts were developed in order to avoid or minimize wetland impacts in the US 158/Mid-Currituck Bridge interchange area. They are:

- Trumpet interchange with a single toll plaza;
- Compressed Y interchange with ramp toll plazas; and
- Partial interchange/intersection with a single toll plaza.

These interchange designs are illustrated in Figure 14. Table 6 compares these alternatives from the perspectives of:

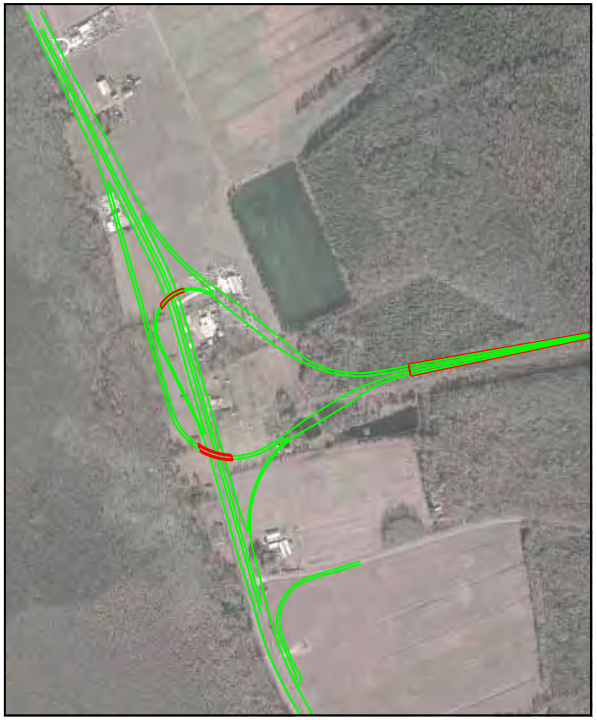
- Wetlands bridged and filled;
- Displacements;
- Operational characteristics; and
- Cost.

NCTA selected the compressed Y interchange for detailed study because it would affect the least area of wetlands, provide a high capacity to move traffic, and would be the least expensive of the three interchange concepts. The partial interchange/intersection configuration would have had operational limits that would have risked backups onto US 158 in certain situations and would not have minimized wetland impacts. The trumpet interchange would have had the greatest wetland impacts, both in terms of wetlands filled and wetlands bridged. The cost of the latter two interchange configurations would have been higher and bridged more wetlands because of the wide approaches to the toll booths, which would be over wetlands and in Maple Swamp.

5.2 Maple Swamp Alignment

Wetland field surveys found that the potential for wetland use in Maple Swamp would be similar wherever an alignment was placed in the swamp because Maple Swamp and associated wetlands cross the entire C1/C2 corridor at a generally consistent width. A survey for large caliper trees in the corridor in Maple Swamp showed that few trees greater than 22 inches diameter breast high (DBH) are in the corridor. None are in the area immediately north of the powerline corridor where conceptual designs prepared for the alternatives studies placed a C1/C2 bridge within Maple Swamp.

Trumpet Interchange Design



Compressed Y Interchange Design

Partial Interchange/Intersection Design

NCTA Selected Concept

LEGEND

Roadway (Edge of Pavement)

Grade Separated Roadway Section

Not to Scale

Interchange Concepts

Figure

14

Table 6. Comparison of US 158 Interchange Alternatives

		Trumpet Interchange With Single Plaza	Compressed Y Interchange With Ramp Plazas	Partial Interchange/ intersection With Single Plaza
Wetlands Bridged / Filled (all non-coastal in acres)		14.7 / 5.4	7.8 / 2.1	14.7 / 1.8
Displacements	East of US 158	3 residences and 1 business	3 residences and 2 businesses	3 residences and 1 business
	West of US 158	1 business	1 business	1 business
Operational Characteristics	Interchange Capacity	High	High	Medium
	Toll Plaza	Single toll plaza for eastbound and westbound flow	Split toll plazas for eastbound and westbound flow	Single toll plaza for eastbound and westbound flow Requires one additional eastbound toll lane to account for gaps in traffic caused by traffic signal
	Ramp Design	Directional interchange (no signals); high speed ramp serving US 158 southbound to bridge (90% of incoming traffic)	Directional interchange (no signals); high speed ramp serving US 158 southbound to bridge (90% of incoming traffic)	Includes a traffic signal; US 158 southbound to bridge (90% of incoming traffic) must pass through or stop at the signal
	US 158 Through Traffic	US 158 traffic maintained at high speed through interchange	US 158 traffic maintained at high speed through interchange	Potential for signal queuing to backup into US 158 traffic under special conditions[1]
Costs (in millions)		$124	$92	$127

[1] For example, higher than average summer volumes because of peak summer weekends (such as July 4th), special events (such as a beach festival), variations in willingness to pay a toll and use the bridge, and toll plaza maintenance.

The conceptual design for the alternatives studies closely paralleled a powerline corridor for much of its length and crossed Maple Swamp at a right angle. This design would reduce potential habitat fragmentation and the length of the project's Maple Swamp crossing, both important advantages. Since the new studies affirmed this location from the perspective of wetlands and large tree avoidance, NCTA decided to continue to use the conceptual alignment during preliminary design.

5.3 Refinements to the Outer Banks Termini

Figure 15 shows several alternative Outer Banks termini for the C1 and C2 corridors considered primarily at the request of environmental resource and regulatory agencies. These alternatives and the reasons they were considered are:

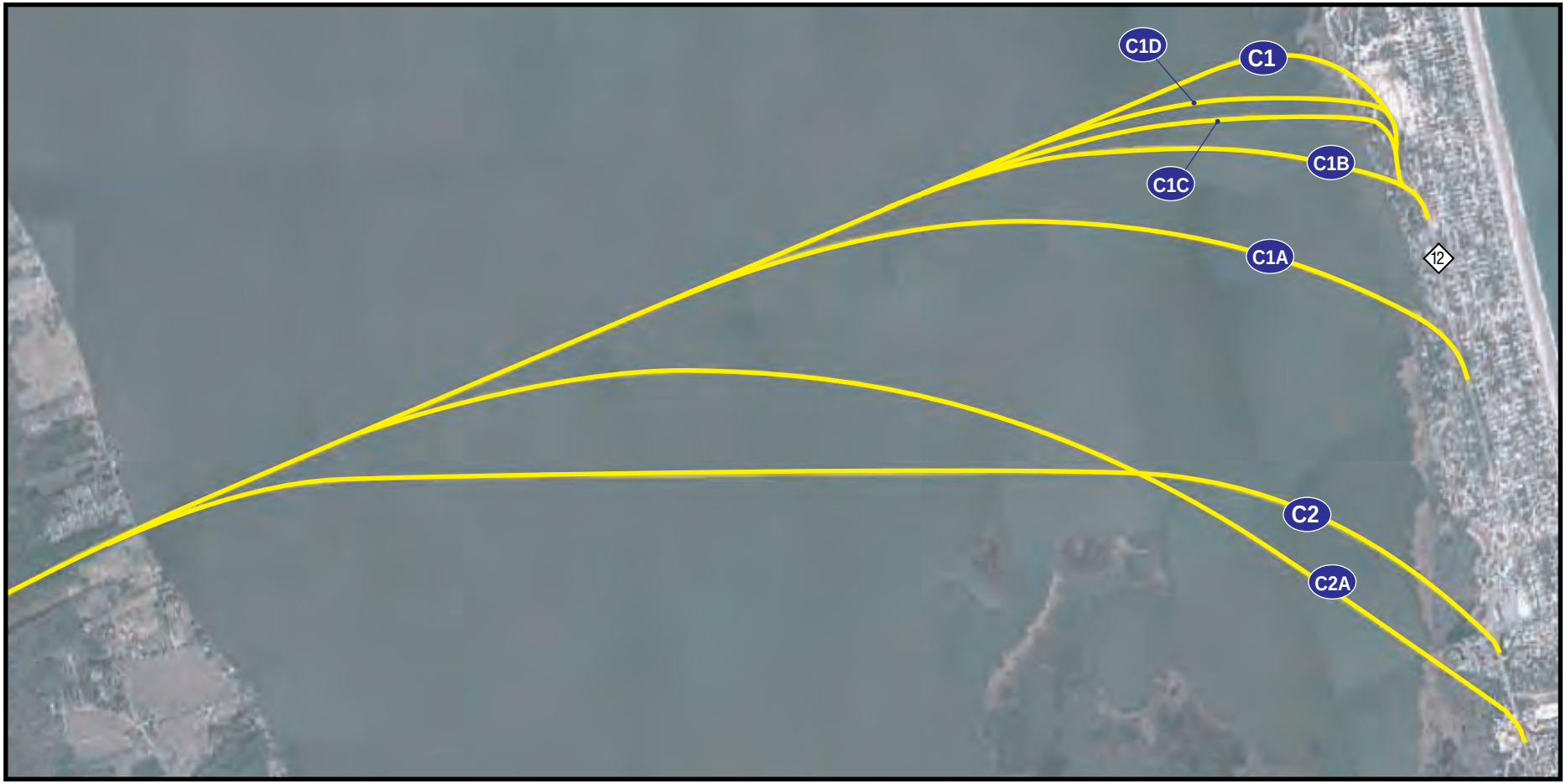
- Original C1;
- C1A—to minimize bridging of existing SAVs;
- C1B—to use of the narrowest land area between Currituck Sound and NC 12;
- C1C—to avoid coastal wetlands;
- C1D –to avoid coastal wetlands;
- Original C2; and
- C2A—to reduce changes in driveway and local road access to NC 12.

Table 7 compares these alternatives from the perspectives of:

- SAV bridged;
- Potential SAV habitat bridged (bridge over areas of sound less than 4 feet deep);
- Coastal wetlands bridged;
- Non-coastal wetlands bridged and filled;
- Displacements;
- Community impacts;
- Changes required in local road and driveway access; and
- Proximity to marsh islands (closest point in feet).

Cost was not considered to be a factor in the comparison of these alternatives and was not assessed. The results were reviewed with the environmental resource and regulatory agencies at the TEAC meeting on November 14, 2007. They also were discussed with representative of Currituck County on November 26, 2007. The two termini revisions selected for preliminary design were presented at the February 2008 Citizens Informational Workshops.

Not to Scale



LEGEND

Bridge Corridors

C1 and C2 Alignment Options

Figure

15

Table 7. Comparison of NC 12 Intersection Alternatives

		Original C1	C1A	C1B	C1C	C1D	Original C2	C2A
SAV Bridged (in acres)[1]		3.2	0.0	4.4	4.5	4.3	6.0	5.5
Potential SAV Habitat Bridged (over areas of sound less than 4 feet deep in acres)		6.5	7.9	8.5	8.1	7.7	14.2	12.6
Potential SAV Habitat Bridged (over areas of sound less than 6 feet deep in acres)		13.3	16.1	15.3	14.9	14.5	20.6	17.9
Coastal Wetlands Bridged/Filled (in acres)		2.1 / 0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	0.0 / 0.0	1.4 / 0.0	0.8 / 0.0
Non-Coastal Wetlands Bridged/Filled (in acres)		0.8 / 0.7	0.3 / 0.4	0.0 / 0.9	0.3 / 1.4	0.6 / 1.5	1.8 / 0.2	1.4 / 0.0
Displacements		• 1 home • 13 vacant residential parcels	• 9 homes • 11 vacant residential parcels	• 2 homes • 1 vacant residential parcels	• 6 homes • 4 vacant residential parcels	13 vacant residential parcels	1 business	None
Community Impacts		Bisects a developing subdivision	Bisects existing subdivision; separates approximately ¾ of homes from community center; substantial change in internal traffic movement.	Passes between two sections of a subdivision but both have independent access to NC 12; pond filled	At edge of a developing subdivision; pond partially filled	Bisects a developing subdivision but more towards its southern boundary than original C1	None, except those related to NC 12 access	None
Changes Required in Local Road and Driveway Access (Currituck Clubhouse Road to Virgin Gordo Crescent)	NC 12 Widening to 4 Lanes (in miles)	4.2	3.2	3.7	3.8	4.1	2.5	2.1
	Total NC 12 Access Points	27	19	24	26	26	17	10
	Access Points with Revised Access	13	10	12	12	13	10	3
	• Right In – Right Out (RIRO) Only	10	8	10	8	10	8	3
	• Proposed Leftovers (no left turns from access point)	3	2	2	3	3	2	0
	• Road Closure	0	0	0	1	0	0	0
Proximity to Marsh Islands (closest point in feet)		Beyond 1,000 feet					900 feet	575 feet

[1]The SAV and wetland impacts assume a two-lane bridge, as well as additional NC 12 intersection approach lanes.

NCTA decided to use the C1D alignment in the project's preliminary design to represent the C1 corridor for the following reasons:

- It would not bridge or fill coastal wetlands;
- It would not displace existing land uses; and
- It would move the alignment south, closer to the southern end of a planned subdivision, leaving a larger area of the subdivision intact.

NCTA decided to use the C2A alignment in the project's preliminary design to represent the C2 corridor because it would substantially reduce NC 12 access impacts to subdivision and commercial development north and south of the bridge terminus while not increasing natural resource impacts substantially.

5.4 Agency and Public Comments

5.4.1 Agency Comments

In discussing these findings with TEAC representatives, they indicated:

- When considering SAV impacts, both actual and potential areas for SAV should be considered, as reflected in Table 7;
- Agreement with the decision to use the compressed Y interchange design in the assessment of impacts in the DEIS;
- Agreement that an alignment that closely paralleled the powerline in the C1 and C2 corridors on the mainland should be assumed when assessing impacts in the DEIS;
- That C1B, C1C, or C1D would be acceptable alignments in the C1 corridor; that C1A would not be appropriate because of its substantial community fragmentation impact; and original C1 would not be appropriate because it bridges coastal wetlands; and
- A preference for C2A because of its local traffic operation benefits.

5.4.2 Public Comments

Those who expressed an opinion on the Outer Banks termini overwelmingly indicated a preferrence for ending the C2 corridor south of TimBuckII because it would affect the community and traffic circulation the least. Many opposed the C1 northern terminus because of concerns that it would increase traffic through the Whalehead Beach community. No comments were directed to the interchange configuration on the mainland.

6.0 Mainland Approach Road Option B

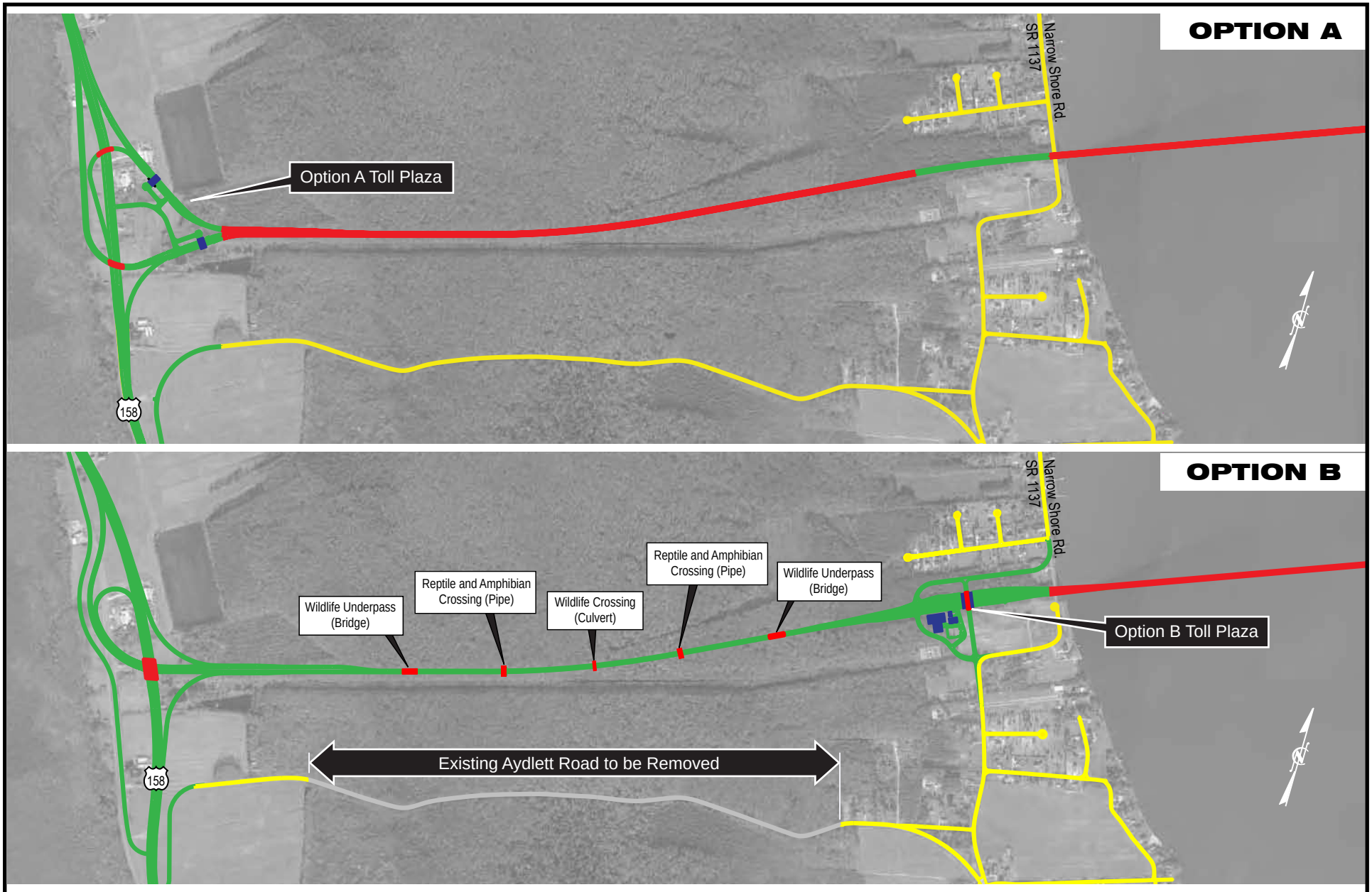
Mainland approach road (US 158 to Mid-Currituck Sound) Option B is an alternative design option for consideration with MCB2 and MCB4 alternatives. It was developed during the preliminary design for the detailed study alternatives. The design concept for the mainland approach that was assumed during the assessment that resulted in the selection of the three detailed study alternatives is Option A.

The two options are shown in Figure 16. The key differences between the two options are shown in Table 8.

Table 8. Design Differences between Mainland Approach Options A and B

Option A	Option B
• Crosses Maple Swamp on a two-lane bridge	• Crosses Maple Swamp on a two-lane road on fill with provisions for wildlife crossing
• Access to Aydlett via Aydlett Road is unchanged	• Access between US 158 and Aydlett is on the approach road; Aydlett Road is removed and its right-of-way restored to its natural condition.
• No direct access from Aydlett to the Outer Banks is provided.	• No direct access from Aydlett to the Outer Banks is provided. On July 14, 2009, local officials indicated that providing direct access to the Outer Banks from Aydlett was unacceptable.
• The toll plaza is placed near US 158. Vehicles operating between US 158 and Aydlett would not pass through the toll plaza but would use Aydlett Road.	• The toll plaza is placed near Currituck Sound in Aydlett. Vehicles operating between US 158 and Aydlett would not pass through the toll plaza.
• Approximately 230 acres of land locked parcels (private parcels that would lose public road access) would be purchased and protected from development and logging.	• Approximately 600 acres of land locked parcels would be purchased and protected from development and logging.

This alternative was introduced for consideration because it was estimated that it could reduce the cost of MCB2 and MCB4 by approximately $60 million, primarily by eliminating the bridge across Maple Swamp. The closure of Aydlett Road is an essential component of Option B. The removal of Aydlett Road (an existing road on fill through Maple Swamp) and the restoration of its right-of-way are needed to mitigate the impact of the new road on fill in Maple Swamp that is a part of Option B.



LEGEND

- Existing Road
- Proposed and Improved Existing Road
- Proposed Toll Plaza and Buildings
- Proposed Bridges and Other Structures

Design Options A and B

Figure

16

In terms of the criteria discussed in Section 2.1.2 that were used to select MCB2 and MCB4 for detailed study, the use of Option B instead of Option A would:

- Lower the project cost (however, with MCB2, it would not be lowered enough to make MCB2 economically feasible; MCB4 would remain economically feasible but less financing would be required).

- Provide the same regional travel benefits as Option A as presented in Table 2. Option B also would benefit travelers between US 158 and Aydlett because they could use the US 158 interchange during peak weekend travel periods when heavy traffic makes it difficult to turn from Aydlett Road to US 158.

- Provide the same system efficiency benefits as Option A as presented in Table 2.

- In general, result in similar environmental impacts because the same corridor would be used.

- Result in displacements similar to Option A as presented in Table 2. However, the toll plaza could introduce noise, visual, and lighting impacts to Aydlett. Option B would alter local traffic circulation patterns in Aydlett, where Option A would not change Aydlett circulation patterns.

- Eliminate an existing forest edge once restored vegetation in the Aydlett Road right-of-way matures.

- Add approximately 12 acres of fill to wetlands over Option A as presented in Table 2; however, approximately 9.2 acres of the Aydlett Road right-of-way could be restored as wetland. As noted in Table 8, a larger area of Maple Swamp would be purchased and preserved.

- Connect with the alternative bridge corridors C1 and C2 from the western shore of Currituck Sound to the Outer Banks without changing the environmental impacts in that area, but only change the impacts between US 158 and Currituck Sound.

While the impacts indicated above would be different from Option A, it was concluded that Option B presented no flaws that would cause one to say that Option B would not warrant detailed study. Indeed as noted above, Option B would offer several natural resource benefits not associated with Option A.

Option B was discussed with environmental resource and regulatory agencies at a Turnpike Environmental Agency Coordination (TEAC) meeting on June 10, 2009.

Agency representatives indicated their support of the detailed assessment of Option B in addition to Option A. Issues raised included:

- Concern over what party would be in charge of the 600 acres purchased by NCTA.
- Concern over how much of the 600 acre property was timbered, and how much would be timbered prior to purchase by NCTA. Agencies requested that up-to-date information concerning the amount of land that is timbered be provided in the DEIS.
- The agencies wanted information in the DEIS on the functionality of the wildlife crossings through the fill in Maple Swamp.
- Whether it was possible to give Aydlett residents free passes, so that the toll plaza could be moved out of environmentally sensitive areas. It was noted that the toll plaza would be on uplands like Option A.
- The proximity of Option B to the existing power lines.
- Ownership of lands north and south of the project right-of-way in Maple Swamp and how one would preclude future pressures to connect the new road across Maple Swamp to other properties that in the future might be proposed for development.
- The status of a proposed hotel in Carova. The study team indicated that the hotel was denied by the Currituck County Commissioners.

Because of the change in impacts to the Aydlett community associated with Option B, a meeting was held with local officials on July 14, 2009. Local stakeholders in attendance were three Currituck County commissioners, the County Manager, and the County Engineer. Comments included:

- Direct access between Aydlett and the Outer Banks across the Mid-Currituck Bridge should absolutely not be provided. This was the primary message from local officials at this meeting.
- Interest was expressed in maintaining Narrow Shore Road underneath the bridge across Currituck Sound, which would minimize the change in local circulation patterns associated with the alternative. This was not included as part of Option B because of concern about continued erosion of the shoreline and the associated costs involved with building a bulkhead to prevent that erosion. Also it could be accomplished only by a combination of lowering the elevation of Narrow Shore Road and raising the toll plaza on fill.
- The potential for impacts associated with the toll plaza were recognized.

- A desire for pedestrian and bicycle provisions on the Mid-Currituck Bridge was indicated. Accommodations for pedestrians and bicycles across Maple Swamp did not appear to be a priority to county officials.

Therefore, given the potential for substantial cost savings, the limited difference in impact potential, and an indication from local officials and environmental resource and regulatory agencies that Option B merited a detailed assessment and comparison with Option A, NCTA decided to include Option B as a detailed study alternative.

Appendix

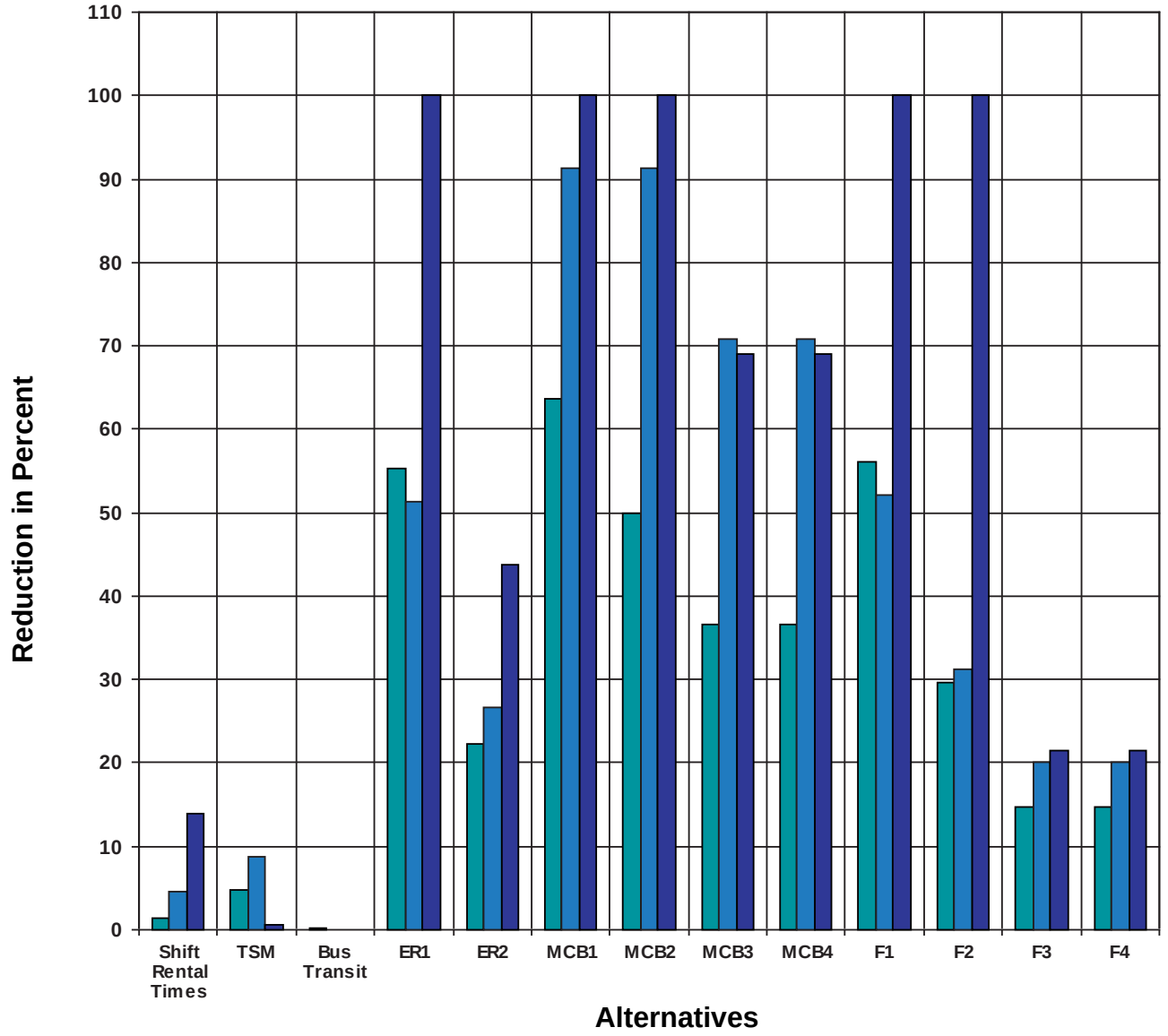
Supporting Data

Table 9. Travel Benefit Data for All Alternatives Considered in Concept Screening (in Absolute Numbers)

	No-Build	Low Capital Investment & Operational Strategies			Highway Improvement Alternatives		Bridge Alternatives				Ferry Alternatives			
		Shift Rental Times	TSM	Bus Transit	ER1	ER2	MCB1	MCB2	MCB3	MCB4	F1	F2	F3	F4
2035 Traffic Flow Benefits (2035)														
Congested Annual Millions of VMT														
• At LOS E or F	66.1	65.1	62.9	66.0	29.6	51.4	22.3	31.4	40.2	40.2	29.0	46.5	56.4	56.4
• At LOS F	60.6	57.8	55.3	60.6	29.6	44.4	5.3	5.3	17.7	17.7	29.0	41.7	48.5	48.5
• At a poor LOS F	15.8	13.6	15.7	15.8	0.0	8.9	0.0	0.0	4.9	4.9	0.0	0.0	12.4	12.4
Miles of Road Operating at LOS F														
• Summer Weekday (SWD)	14.7	14.7	13.5	14.7	0.0	5.9	0.0	0.0	5.7	5.7	0.0	5.9	9.1	9.1
• Summer Weekend (SWE)	43.5	41.4	43.5	43.5	27.5	39.0	4.8	4.8	11.7	11.7	28.7	40.2	41.4	41.4
• Weighted Average of SWD & SWE	22.9	22.3	22.1	22.9	7.9	15.4	1.4	1.4	7.4	7.4	8.2	15.7	18.3	18.3
Miles of Road Operating at a poor LOS F														
• Summer Weekday (SWD)	5.7	5.7	5.7	5.7	0.0	3.7	0.0	0.0	0.8	0.8	0.0	0.0	5.7	5.7
• Summer Weekend (SWE)	7.9	5.7	7.9	7.9	0.0	5.9	0.0	0.0	2.0	2.0	0.0	0.0	5.7	5.7
• Weighted Average of SWD & SWE	6.3	5.7	6.3	6.3	0.0	4.3	0.0	0.0	1.1	1.1	0.0	0.0	5.7	5.7

Table 9 (concluded). Travel Benefit Data for All Alternatives Considered in Concept Screening (in Absolute Numbers)

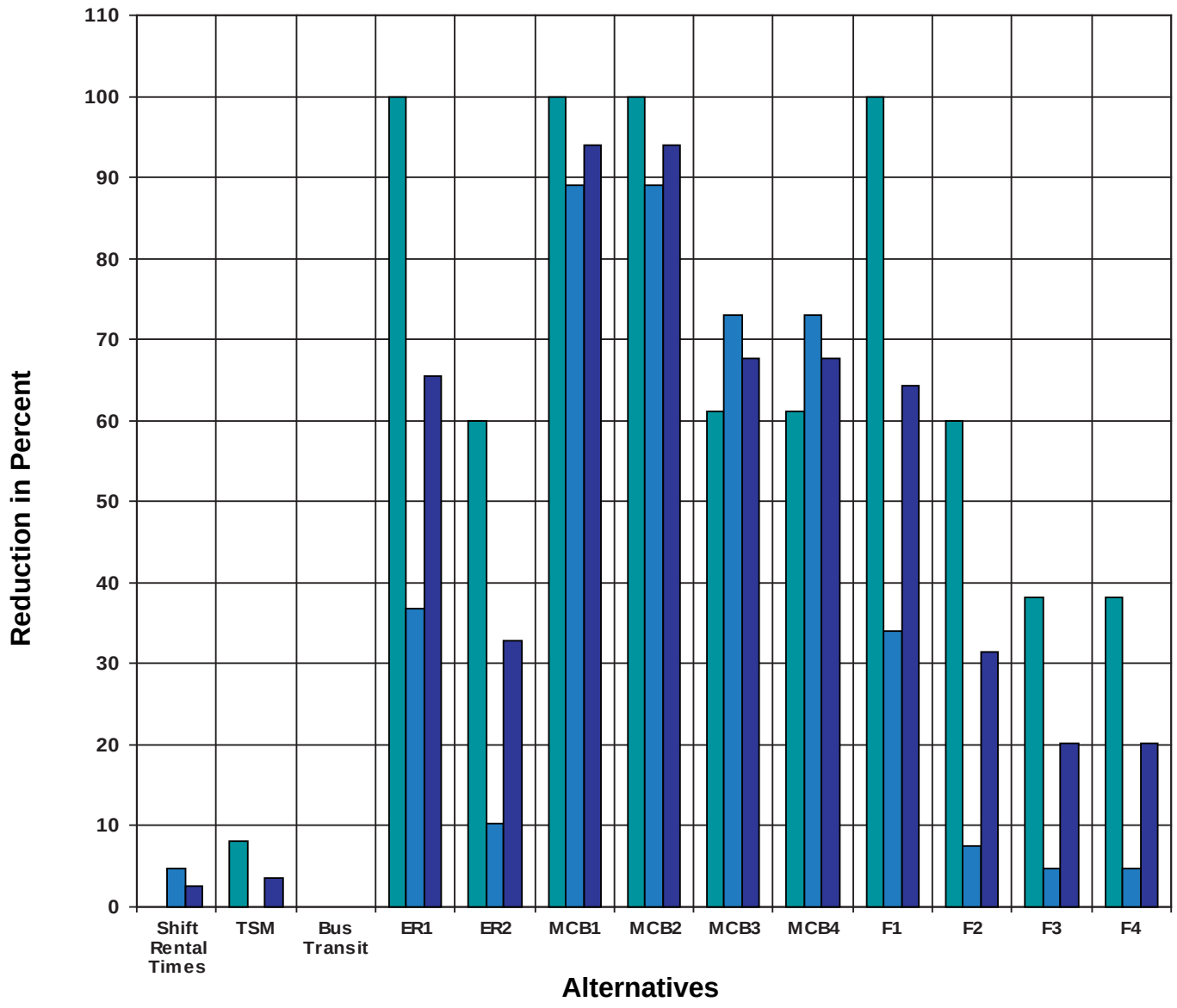
	No-Build	Low Capital Investment & Operational Strategies			Highway Improvement Alternatives		Bridge Alternatives				Ferry Alternatives			
		Shift Rental Times	TSM	Bus Transit	ER1	ER2	MCB1	MCB2	MCB3	MCB4	F1	F2	F3	F4
2035 Travel Time Benefit Aydlett Road to Albacore Street														
Summer Travel Time via Wright Memorial Bridge (weighted average of SWD & SWE)	153.7	152.3	137.3	153.7	79.7	125.0	73.0	86.3	106.7	106.7	76.8	113.5	136.3	136.3
Summer Travel Time via Currituck Sound Crossing (weighted average of SWD & SWE)	NA	NA	NA	NA	NA	NA	11	11	11	11	63	63	63	63
2035 Hurricane Evacuation Benefit														
Clearance Time with US 158 Outbound Contraflow Lane	36.3 hrs	Improvement not part of alternative so remains 36.3 hrs	27.4 hrs	Improvement not part of alternative so remains 36.3 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs	27.4 hrs
Clearance Time with US 158 Third Outbound Lane			Improvement not part of alternative so remains 36.3 hrs		21.8 hrs	21.8 hrs	21.8 hrs	21.8 hrs	21.8 hrs	21.8 hrs	21.8 hrs	21.8 hrs	26.6 hrs	21.8 hrs
System Linkage and Efficiency Benefit														
• Total Annual Millions of VMT	663.9	664.6	663.9	662.7	663.9	663.9	577.7	578.3	578.3	578.3	643.9	643.9	643.9	643.9
Consistent with Strategic Highway Corridor Vision Plan	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No
Consistent with Intrastate System Designations	No	No	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No



LOS E and F
LOS F
Poor LOS F

Percent of Reduction in Congested Annual Millions of Vehicle Miles Traveled Operating at LOS E and F, LOS F, and Poor LOS F in 2035

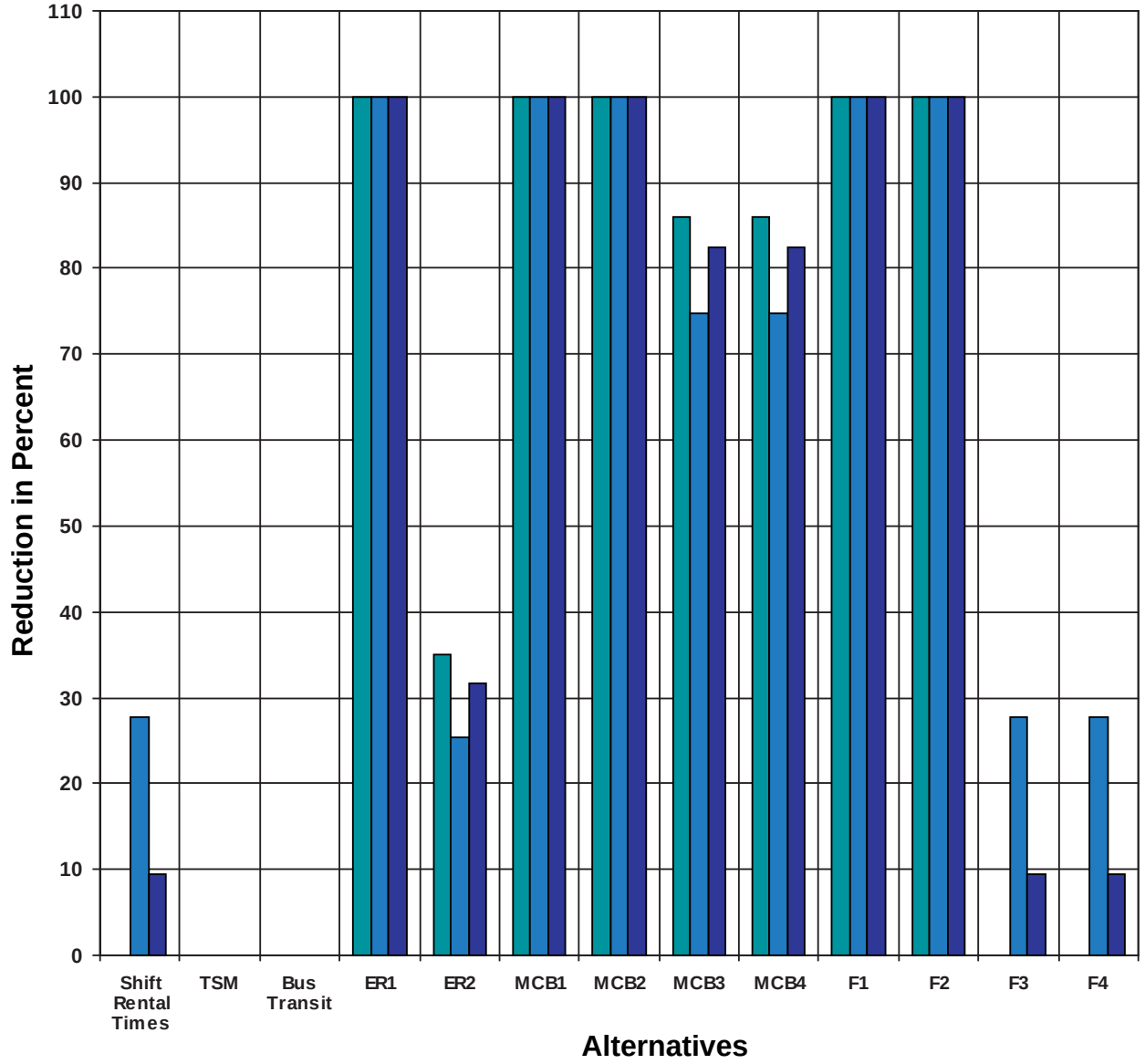
Chart
1



Summer Weekday (SWD)
Summer Weekend (SWE)
Weighted Average of SWD & SWE

Percent of Reduction in Miles of Road Operatig at LOS F (V/C Ratio >1.0) in 2035

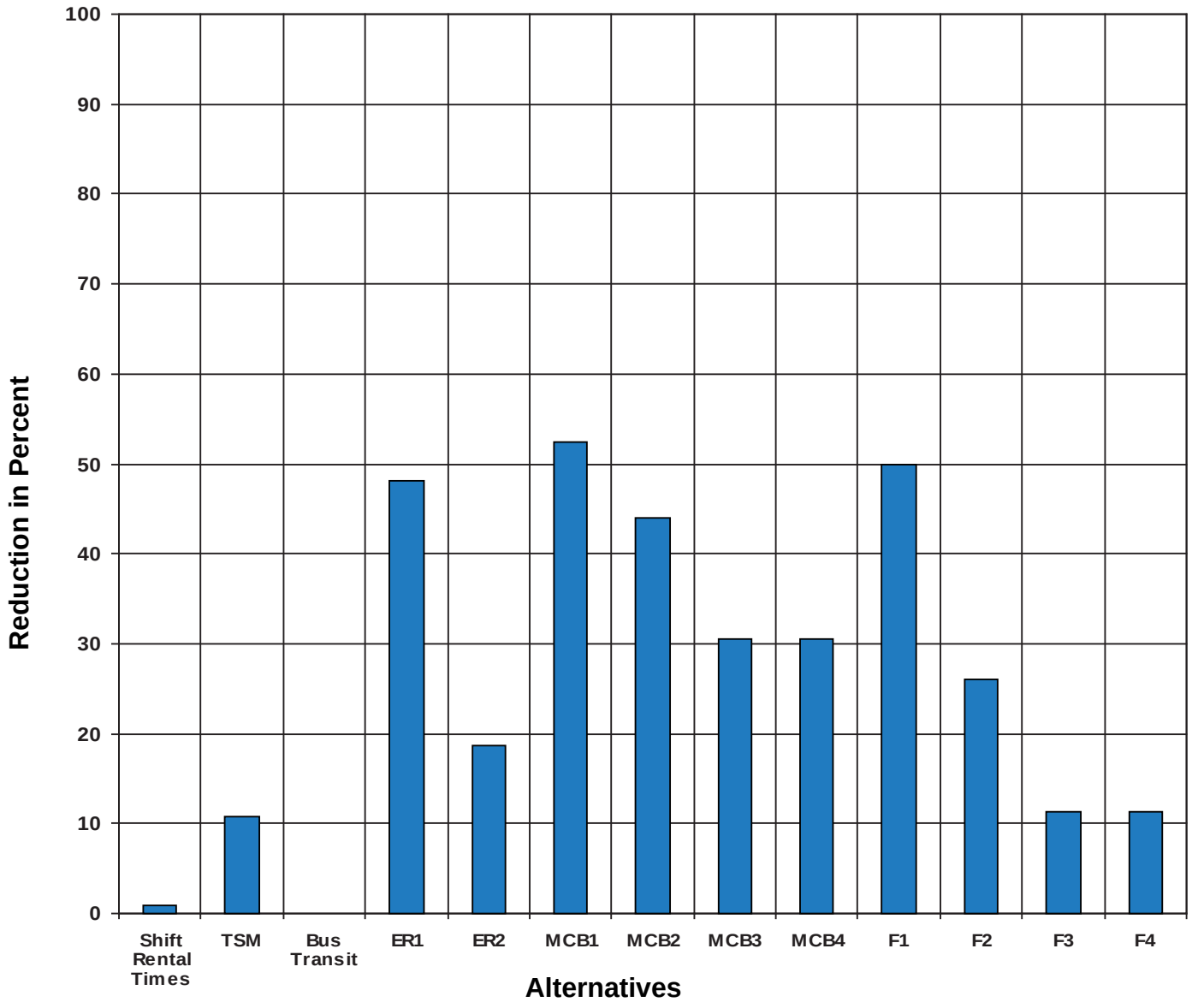
Chart
2



Summer Weekday (SWD)
Summer Weekend (SWE)
Weighted Average of SWD & SWE

Percent of Reduction in Miles of Road Operatig at Poor LOS F (V/C Ratio >1.3) in 2035

Chart
3



Percent Reduction in Summer Time Travel via Wright Memorial Bridge (Weighted Average of SWD & SWE)

Percent of Reduction in Summer Time Travel via Wright Memorial Bridge (Weighted Average of SWD & SWE) in 2035

Chart

4