

Final Report
Outer Banks Transportation Study

For the
Outer Banks Transportation Task Force

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EXECUTIVE SUMMARY

Background

Traffic congestion has become severe in the northern Outer Banks, particularly during peak summer vacation months, and it affects tourists and residents alike. The area has a year-round population of approximately 30,000, but it grows to 200,000 persons during the summer season and may reach 300,000 during a holiday weekend. According to the Outer Banks Chamber of Commerce, the area attracts about 7,000,000 tourists each year.

Like many resort areas, in some ways the Outer Banks has become a victim of its own success. Its many natural and man-made attractions have led to rapid growth in both tourists and residents, and this growth is causing a number of related problems, in particular, growing traffic congestion. A recent study by the American Highway Users Alliance and AAA found that the Outer Banks rated as number 5 on a list of the 25 most congested tourist destinations in the country. The ranking was based on existing bottlenecks in an area, number of traffic lanes, and estimated summer travel trips and miles driven.

A key issue for the Outer Banks, like many popular resort areas, is finding enough employees to staff the hotels, restaurants, stores and tourist attractions during the summer season. Part of the problem is that affordable housing close to work locations is increasingly hard to find.

On June 21, 2004, the Outer Banks Transportation Task Force was created to address this problem. In the fall of 2004, the Task Force requested assistance from North Carolina State University (NCSU) through the Gateway County program. The Task Force was seeking assistance in conducting a facilitated public input and planning process and in preparing a report and recommendations based on the work of the Task Force.

The Task Force's primary goal was to develop a process to gather public input and reach consensus on recommendations for transportation improvements to improve mobility and alleviate highway congestion. It wanted both short- and long-term improvements to the highway congestion problem, but the emphasis was on short-term "implementable" solutions.

In early-March 2005, five community meetings were held throughout the Outer Banks in order to allow the community to participate in the study process. The meetings were held in Corolla, Southern Shores, Nags Head, Buxton and Manteo. At each meeting the public was asked to identify and rank what they perceived to be the key transportation problems on the Outer Banks, and to then brainstorm possible solutions. About 100 people participated in this process. The following table summarizes the problems identified.

Table 1: Transportation Problems Identified in Community Meetings

	So. Shores	Buxton	Manteo	Corolla	Nags Head	Total
Problem Category	# Votes	# Votes	# Votes	# Votes	# Votes	# Votes
Highway design and congestion issues	59	9	16	11	46	141
More bicycle and pedestrian facilities are needed	27	21	5	16	4	73
Inadequate traffic signage and information	15	8	0	2	16	41
Local vs. through trips, speeding, shortcutting, lack of alternative routes	21	5	11	0	0	37
Lack of public transportation alternatives	8	0	4	7	8	27
Need for better maintenance of transportation facilities	7	10	0	10	0	27
Traffic signal problems	5	0	5	5	5	20
Workforce transportation problems	5	0	4	2	5	16
Truck-related problems	9	0	1	1	4	15
Misc.	5	3	10	12	7	37

On October 12, 2005, a community “symposium” was held in order to give the public a chance to hear and discuss the study’s recommendations. These recommendations were presented to the participants by the study consultants, followed by general discussion and small-group breakout sessions where specific topic areas could be discussed in more detail. A summary of the results of this symposium is provided as Appendix 3.

Existing Transportation

Most people reach the Outer Banks by automobile and that is also the way most people get around once there. There is no commercial air service on the Outer Banks—the closest commercial airport is in Norfolk, VA, 90 miles to the north. Neither is there public transportation except for limited van service provided mainly to clients of social service agencies by Dare County Transit and in Currituck County, by the Inter-county Public Transportation Authority.

There are two major north-south highways—NC 12 which runs the length of the Outer Banks close to the beach, and US 158 (locally known as the “bypass”) which runs principally between Southern Shores/Kitty Hawk and Nags Head. Both of these roads suffer major traffic congestion during the tourist season. A major problem area is where NC 12 and US 158 intersect in Southern Shores/Kitty Hawk. Particularly on summer weekends, this intersection becomes a real bottleneck as many visitors come across the Wright Memorial Bridge from the mainland and then try to head north toward Duck and Corolla, or south toward Kill Devil Hills, Nags Head, and Hatteras Island.

Bicycles are fairly common on the Outer Banks, both for tourists and residents. There is a fairly good network of bicycle facilities including wide paved shoulders on roads, wide curb lanes, side paths next to roads, and multi-use paths away from the roadway. In addition, many of the summer guest workers from other countries often use bicycles to get around.

Case Studies

As part of the study, nine case studies of other vacation destinations were conducted with the idea that they might offer some lessons for the Outer Banks in terms of how they have dealt with transportation problems. In general, transportation problems, especially traffic congestion, are a common theme at popular tourist destinations. These problems are unlikely to be solved by road or highway improvements alone. Rather, a multi-faceted, multi-modal strategy is required. It is not enough to simply build more road capacity, even if adequate funds and land were available to do so. Moreover, necessary land is usually limited and often very expensive.

In most of the case studies examined, public transportation has become an integral part of moving large numbers of tourists around. In addition, the development of bicycle and pedestrian facilities is being used in several areas as an important transportation strategy for helping to reduce automobile traffic. Such facilities can also have important secondary benefits by attracting more hiking and biking tourists to an area. Water transportation is also playing an increasingly important role in some areas. Transportation demand management (TDM) strategies designed to limit or shift automobile use are being used more and more.

Many areas have created special agencies that can deal with transportation problems in a more regional and/or multi-modal way. Examples include transit authorities, regional planning agencies, and a public/private cooperative.

Recommendations

A number of recommendations are made for alleviating various transportation problems that were identified. Underlying these recommendations are some key goals:

- Reducing traffic congestion (without reducing the number of tourists).
- Providing transportation alternatives that will be a tourist attraction (e.g. old-style trolley buses and bicycle paths).
- Providing mobility for those without cars or unable to drive (seniors, disabled persons, children, guest workers, etc.).
- Preserving valuable open space and limiting the amount of land needed for roads and parking.
- Improving air quality.

Public Transportation

A number of trolley bus routes are proposed for consideration. The routes would operate during the main tourist season, May-September, seven days a week from approximately 6 AM to 10 PM, and would serve tourists, residents and seasonal employees. One route would operate between Whalebone Junction and Manteo/Roanoke Island. Another route would operate between Kitty Hawk/Southern Shores and the Duck area. Between these two routes, and connecting to them, are two possible alternatives.

Alternative 1: Two routes would operate as loops on NC 12 and US 158 between Whalebone Junction and Kitty Hawk/Southern Shores. A northern loop would operate between the NC 12/US 158 intersection in Southern Shores/Kitty Hawk and Ocean Bay Blvd. A southern route would connect with the northern route at Ocean Bay Blvd. and operate to Whalebone Junction. These loop routes would serve the large hotels, condominium buildings and beach access locations on NC 12, and the many commercial areas, tourist attractions and public facilities (hospital, YMCA, etc.) on US 158.

Alternative 2: This alternative involves four routes. A “backbone” route would run in both directions in the US 158 corridor from Whalebone Junction to Kitty Hawk/Southern Shores. This route would be about 32 miles round trip and one bus should be able to provide service every hour if the number of stops is limited and an average speed of 32 miles per hour can be maintained (the speed limit on US 158 is 50 mph). Two buses would therefore be able to provide 30-minute service frequency. Three small loop routes would connect to the backbone route providing transit links to the hotels, condos and beach access areas in the NC 12 corridor.

Bicycle and Pedestrian Facilities

A number of recommendations are made in regard to bicycle and pedestrian facilities. These include recommended goals, policies and standards for such facilities, and specific facilities improvements such as additional wide paved shoulders in several locations, a multi-use path on the sound side in Duck, and a side path to connect the villages of Waves, Salvo and Rodanthe.

Traffic Solutions

A number of short-term traffic engineering improvements, many of which were suggested in the community meetings in March, are recommended. These include better informational signage that would help to eliminate confusion, maintain traffic speed, and reduce accidents (esp. on US 158), adding left turn lanes and traffic calming measures in villages between Whalebone and Hatteras, and adding more right turn lanes on US 158.

Although this study’s focus was on shorter-term “implementable” improvements, in the longer-term one of the most frequent comments at the community meeting in Southern Shores was in regard to the need to build the proposed Mid-Currituck Bridge. The study team recognizes the high level of interest in building this bridge, the fact that the Transportation Task Force has endorsed it, and its potential for alleviating the serious traffic congestion that occurs on weekends in the area of the Wright Memorial Bridge,

the US 158/NC 12 intersection, and northward into Duck and Corolla. However, it was not made part of this study for two primary reasons:

- The proposed bridge is the central focus of the much larger multi-year federal Environmental Impact Assessment that is being conducted and that is not scheduled for completion until at least 2008 (the Mid-Currituck Sound Transportation Study). It didn't make sense to try to duplicate this very extensive (and expensive) undertaking.
- The budget, scope, and timeframe for this study were inadequate to address such a complex issue.

The study team did, however, make some long-term conceptual proposals for four key traffic trouble spots that were identified by the Transportation Task Force and by many of the participants in the community meetings. These proposals are intended to provide some creative, "unconventional" ideas for potential ways to solve the traffic problems at these locations. The locations, two of which are corridors, and two of which are intersections, are:

1. The US 158 corridor between the Wright Memorial Bridge and the US 64/US 264 intersection in Nags Head (Whalebone Junction).
2. The NC 12 corridor through Duck.
3. The intersection of US 64 and US 264, NC 345 and Virginia Dare Blvd. in Manteo (Midway intersection).
4. The intersection of US 158 and SR 1493 (access to NC 12) east of the Wright Memorial Bridge.

Three of the proposals incorporate aspects of what is sometimes referred to as a "Superstreet" concept (the exception is the US 158/NC 12 intersection in Kitty Hawk/Southern Shores for which a grade separation is proposed due to the heavy traffic volumes). Superstreet is a design concept for arterial roads that has the potential for moving more vehicles efficiently and safely without resorting to major widening projects, bypasses, flyovers or interchanges that are usually expensive, unpopular with roadside businesses, and/or environmentally disruptive. The concept basically involves reducing the number of intersections and left-turn possibilities, and more efficient timing of traffic signals (fewer signal phases, and improved "progression" which allows vehicles to move along a road at a steady speed hitting one green signal after another).

Transportation Demand Management

Transportation demand management is the practice of dealing with traffic congestion by influencing trip demand rather than by simply building new road capacity. The recommendations include conducting a study of parking management possibilities as a way of limiting automobile usage, continuing the exploration of shifting more rental turnover from Saturday to Sunday or Friday, and conducting publicity or educational programs that would encourage people to use transit when at the Outer Banks, do more carpooling, or shift their travel to times or places where traffic congestion is not a problem.

Organizational/Institutional

Because of the special geographic nature of the Outer Banks and its special transportation problems, the creation of a Transportation Management Association (TMA) is recommended. This type of organization typically includes both the private and public sectors, is able to take a multi-modal approach to problems, and would allow an ongoing and focused attention to the kinds of transportation problems faced by the Outer Banks in a way that the various counties and municipalities are unable to. (The Transportation Task Force would serve as an excellent starting point or model for such an organization.)

In addition, the Outer Banks should consider joining or forming a regional transit authority. This is something that the NCDOT/Public Transportation Division is encouraging as a way of increasing the efficiency and effectiveness of transit systems throughout North Carolina. Possibilities include joining the existing Inter-County Public Transportation Authority (ICPTA) that consists of five counties to the north of Dare, or forming a new regional agency along with Hyde, Terrell and/or Washington Counties. Being part of a regional transportation agency provides a number of benefits including increased access to state and federal funds.

INTRODUCTION

Traffic congestion has become severe in the northern Outer Banks, particularly during peak summer vacation months, and it affects tourists and residents alike. The area has a year-round population of approximately 30,000, but it grows to 200,000 persons during the summer season and may reach 300,000 during a holiday weekend. According to the Outer Banks Chamber of Commerce, the area attracts about 7,000,000 million tourists each year.¹ Weekend or day visitors are a relatively small proportion of tourists compared to many other tourist destinations. In general, most tourists stay for a week or so.

On June 21, 2004 the Outer Banks Transportation Task Force was created to address this concern. The Task Force was formed in response to the recommendations of the Dare County Transportation Advisory Board that had been discussing this issue for several months. The Task Force is made up of 23 individuals representing various area businesses, commercial interests, and local governments. (Task Force members are listed in Appendix 1.)

In the fall of 2004, the Task Force requested assistance from North Carolina State University (NCSU) through the Gateway County program to facilitate a public input and planning process to determine appropriate transportation enhancements to alleviate highway congestion. The Task Force was seeking guidance from ITRE and NCSU on how to best develop this process and for assistance in preparing a report and recommendations based on the work of the Task Force.

The Institute for Transportation Research and Education (ITRE), in conjunction with the College of Design and the Department of Civil, Construction and Environmental Engineering at NCSU, submitted a formal proposal to conduct the study and in November 2004 the proposal was approved with funding from the NCDOT Public Transportation Division (90%) and local Outer Banks governments (10%). The primary area of focus for the study was Dare County, particularly on the Outer Banks and Roanoke Island, and Corolla, in Currituck County.

The Task Force's primary goal was to develop a process to gather public input and reach consensus on recommendations for transportation improvements to improve mobility and alleviate highway congestion. It wanted both short- and long-term improvements to the highway congestion problem, but the emphasis was on short-term "implementable" solutions. These could involve such things as public transportation services, improved traffic engineering, an education campaign aimed at reducing the number of tourist vehicles, and changes to current land use/development patterns.

¹ Outer Banks Chamber of Commerce (www.outerbankschamber.com/relocation/history.cfm, 8/10/05).

The Task Force proposed the following plan of action:

- Conducting community meetings to build consensus among the public and elected officials for adoptability of the ultimate solutions.
- Compiling an inventory of currently available transportation resources.
- Conducting case studies of similar tourist/resort destinations to see if similar problems have been met with solutions that can be applied here.
- Conducting preliminary analysis of potential alternative solutions -- the anticipated costs and benefits of various solutions that could be selected for implementation.
- Selecting preliminary alternative solutions that could be implemented in the short-term.
- Facilitating, with the Outer Banks Transportation Task Force, a final community symposium featuring recommendations for further action.

STUDY METHODOLOGY AND ACTIVITIES

In order to conduct this study, a study team was formed of staff from NC State's Institute for Transportation Research and Education (ITRE), College of Design, and College of Engineering. The study team reviewed existing reports and information, visited the area several times, interviewed key stakeholders in person or by phone, attended several meetings of the Transportation Task Force, and collected new information from a variety of sources. In addition, the team examined nine case study sites for ideas that might have applicability to the Outer Banks.

An important part of the study process was involving the community. This is described in more detail below.

COMMUNITY INVOLVEMENT

In early March 2005, five community meetings were held throughout the Outer Banks in order to allow the community to participate in the study process. The meetings were held in Corolla, Southern Shores, Nags Head, Buxton and Manteo. At each meeting the public was asked to identify and rank what they perceived to be the key transportation problems on the Outer Banks, and to then brainstorm possible solutions. About 100 people participated in this process.

The problems identified at the community meetings are summarized in Table 2 on the next page:

Table 2: Transportation Problems Identified in Community Meetings

	So. Shores	Buxton	Manteo	Corolla	Nags Head	Total
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Local vs. through trips, speeding, shortcutting, lack of alternative routes	21	5	11	0	0	37
Lack of public transportation alternatives	8	0	4	7	8	27
Need for better maintenance of transportation facilities	7	10	0	10	0	27
Traffic signal problems	5	0	5	5	5	20
Workforce transportation problems	5	0	4	2	5	16
Truck-related problems	9	0	1	1	4	15
Misc.	5	3	10	12	7	37

It should be noted that at the Southern Shores meeting, more than 50 votes were received in favor of building the Mid-Currituck Bridge. However, this particular transportation issue is the subject of another, more extensive study, not this one.

A more detailed summary of the community meeting results is included as Appendix 2.

As part of the community participation process, a project website was created that would provide information to the public about the study’s purpose and progress, and allow the public to submit comments. (www.itre.ncsu.edu/obx)

Finally, a community symposium was held on October 12th in order to allow the community to hear and respond to the study’s recommendations. About 80 people attended the one-half day session which featured a presentation by the study consultants of the study’s conclusions and recommendations. This was followed by small-group breakout sessions that allowed a more detailed discussion of the following topics:

- Public transportation
- Bicycle and pedestrian transportation
- Traffic solutions
- Traffic demand management (strategies to ease traffic congestion by reducing or shifting transportation demand)

A summary of the comments received at the symposium is provided as Appendix 3.

OUTER BANKS TRENDS

Like many resort areas, the Outer Banks has in some ways become a victim of its own success. Its many natural and man-made attractions have led to rapid growth in both tourists and residents, and this growth is causing a number of related problems, in particular, growing traffic congestion. A study by the American Highway Users Alliance and AAA found that the Outer Banks rated as number 5 on a list of the 25 most congested tourist destinations in the country. The ranking was based on existing bottlenecks in an area, number of traffic lanes, and estimated summer travel trips and miles driven.²

According to U.S. Census data, between 1990 and 2003 the population of Dare County grew to 33,116, an increase of 45.6 percent. (It is assumed that most of this growth occurred in that part of Dare County which includes the Outer Banks.) This compares to population growth of 26.8 percent for the state as a whole. (Just between April 2000 and July 2003, it is estimated that the Dare County population grew by 10.5 percent.) By 2010, Dare County's population is projected to grow to 37,991, 26.8 percent more than in 2000, and 67 percent more than in 1990.³ Similar if not greater growth rates have been experienced in the Currituck County portion of the Outer Banks (Corolla, etc.). In total, about 41,000 persons currently live in the Outer Banks areas of Dare and Currituck Counties, and on Ocracoke Island.⁴

The elderly population (persons 65 or older) of Dare County has been increasing as a proportion of the total population—13.8 percent in 2003 compared to 12.5 percent in 1990. This is important because as the population ages, more people become dependent on public transportation to get around.

Between 1990 and 2000, the number of housing units in Dare County increased by almost 24 percent. In 2000, one-half of these housing units were listed as for “seasonal, recreational or occasional use.” This represents an increase in these types of units of over 100 percent since 1990.

By tourist resort standards, the Outer Banks is relatively low-density. In general, houses are limited to 35 feet in height which allows for three floors of livable space. Hotels, etc. are generally limited to 52 feet, or five stories. Most dwellings are smaller buildings or single-family detached cottages, although a recent trend is very large rental cottages that will house multiple vacationing families. These large rental cottages/houses usually have parking spaces for numerous vehicles.

² *Summer Jam: Most Congested Spots Listed*, MSNBC.com, June 30, 2005. (According to the study, the Outer Banks (#5) is less congested than the Tidewater region of Virginia (#2), and more congested than Cape Cod (#6) or Lake Tahoe (#16).)

³ Outer Banks Chamber of Commerce (www.outerbankschamber.com/economics2.cfm, 8/10/05).

⁴ Outer Banks Chamber of Commerce (www.outerbankschamber.com/relocation/history.cfm, 8/10/05).

A key issue for the Outer Banks, like many popular resort areas, is finding enough employees to staff the hotels, restaurants, stores and tourist attractions during the summer season. Part of the problem is that affordable housing is increasingly hard to find. One solution has been to recruit and hire guest workers from other countries. This has helped solve the problem but these workers often encounter difficulty getting around the Outer Banks and have to resort to bicycles, shared use of used cars, or walking. In addition to guest workers from other countries, other employees are recruited from the mainland. For example, as described in more detail below, there are currently 23 vanpools of employees who come to the Outer Banks from the Currituck mainland.

THE TRANSPORTATION SITUATION

Existing Transportation Services and Facilities

Highways/Autos

Transportation on the Outer Banks is primarily by auto. Even for the relatively few who arrive by air (the nearest commercial airport is 90 miles to the north), once on the Outer Banks a car is required to get around. A number of highways serve the Outer Banks, the principal ones being north-south routes NC 12 from Corolla to Ocracoke (mostly 2 lanes), and US 158 (five lanes) from the Wright Memorial Bridge to Whalebone Junction. US 64/264 provides a 4-5 lane link to Roanoke Island and the Dare County mainland.

Traffic congestion occurs primarily on NC 12 north of Kitty Hawk/Southern Shores, and on US 158 between Kitty Hawk/Southern Shores and Whalebone Junction. The problems are particularly bad on Saturdays which are the primary changeover days for vacationers. More specifically, the Transportation Task Force initially identified the following locations as key congestion problem areas:

- Coinjock to NC 12 along US 158 from 11 a.m.-6 p.m. on Saturdays and Sundays.
- Pirate's Cove to US Bus 64 into Manteo, specifically the Midway intersection and from the right-turn onto 64 until approximately the Christmas Shop.
- From the traffic light at the Market Place in Southern Shores on US 158 up NC 12 to the S. Dogwood light.
- The intersection at US 158 and NC 12 in Kitty Hawk.
- Village Commercial Area in Duck from 8-9 a.m. and at 5 p.m. on weekdays in season.
- US 158 from Colington Road to Ocean Acres Drive in Kill Devil Hills.
- Whalebone Junction in Nags Head including the intersections of NC 1243 and NC 12.
- The K-Mart area on US 158 in Kill Devil Hills
- Rodanthe at the Raceway attraction
- The commercial district of Buxton
- Salvo from Surf or Sound Realty to Outer Beaches Realty (Sat & Sun only)

Public Transportation

Transit service for the general public is virtually non-existent other than a few demand-response trips operated by Dare County Transit, an agency that primarily serves the transportation needs of social service agency clients—elderly persons, people with disabilities and Medicaid clients. Therefore, for the most part getting around the Outer Banks requires a car.

The lack of public transportation has created a serious problem for the seasonal workers who come to the Outer Banks, often from another country. They have to resort to bicycles, shared autos, or walking in order to reach their jobs or take care of their personal needs outside of work. For this reason, a pilot bus service was started in the summer of 2005 that provided free service in the Nags Head/Kill Devil Hills/Kitty Hawk/Southern Shores area during weekday evenings from 5:30 PM to 9:30 PM. The service was designed to allow the workers a way to take care of personal needs such as grocery shopping, doing laundry, or visiting the library. This service was operated by Dare County Transit using two vans usually used for daytime service. In total, 275 persons used this service in the two months between July 5 and September 2. (Workers were 80 percent of the riders, residents 16 percent, and tourists 4 percent.)

In addition to the pilot van service aimed at seasonal workers, there is some other employee transportation provided in the area. The main example is the vanpool service operated by 2Plus, a non-profit agency, with funding from NCDOT/Public Transportation Division (PTD) and some local businesses. Currently 23 vans bring employees from the Currituck mainland (Elizabeth City, etc.) primarily to hotels on the Outer Banks. Another 5-10 vans are in varying stages of discussion or planning.

It should be noted that there are currently efforts underway to develop transit service in two other areas of the Outer Banks—Corolla and Ocracoke. In Corolla, Currituck County has asked ICPTA (Inter-County Public Transportation Authority) to implement a fare-free trolley bus service serving that community. In addition, Currituck County has expressed an interest in providing bus service to the Outer Banks from the Edenton/Elizabeth City/Camden area. Currituck County is reported to have offered to provide \$500,000 toward the cost of the services.

On Ocracoke, Hyde County and the National Park Service hired a consultant to do a feasibility study of trolley bus service that would help to ease transportation problems there. The consultant has recommended a “flex route” type of service in order to satisfy ADA (Americans with Disabilities Act) requirement without having to also add a complementary paratransit service for disabled persons. This type of service is essentially fixed-route service but upon advance request will deviate from the route in order to pick up persons that need a vehicle to come closer to their residence.

Two types of service are proposed:

- An internal circulator in Ocracoke Village operating on 15-minute service intervals. Two “trams” will be used to provide this service.

- A beach route operating every 30 minutes between the ferry docks and the Pony Pens. This service will be provided with a 30-passenger trolley bus.

The estimated operating cost of the service is \$237,000 for the first year. Capital costs (vehicles, bus shelters and benches, etc.) are estimated at \$540,000. Both services are proposed to be fare-free in order to encourage more ridership. Funding is being sought from Hyde County, the National Park Service, and NCDOT/Public Transportation Division.

Other Ground Transportation

There are several limousine, taxi, shuttle and tour companies that operate on the Outer Banks, and also some car rental agencies. These are listed in Appendix 4. In addition, several residential developments and resort complexes offer shuttle bus service for their residents and guests, e.g. in the Corolla area.

Bicycle/Pedestrian Facilities

The Outer Banks region is one of the prime cycling destinations in North Carolina. To improve the safety of bicyclists and motorists in the area, the North Carolina Department of Transportation (NCDOT), in partnership with Outer Banks municipalities and tourism agencies, has built an extensive system of bicycle facilities over the past ten years. These facilities include multi-use paths, wide-paved shoulders, sidepaths, wide curb lanes and bicycle-safe bridge accommodations. In addition, several bicycle routes have been designated and a Dare County Bicycle Map that shows the location of the all current improvements has been published. Private developers have also built special bicycle accommodations throughout the area. In combination, these improvements serve to create a more bicycle-friendly environment for the Outer Banks region. The various types of facilities, as well as information on current and planned improvements, are described in Appendix 5.

High levels of visitation by bicyclists and a corresponding positive impact on the economy were identified in a 2003 study entitled *The Economic Impact of Investments in Bicycle Facilities: a Case Study of the North Carolina Outer Banks*.⁵ This study revealed that of the approximately four million annual visitors to the northern half of the Outer Banks, 17%, or 680,000, bicycle while there. Expenditures by those who choose the region because of bicycling or who stay extra days to bicycle infuse \$60 million into the economy annually. Indications are that visitors and residents alike have a favorable impression of the bicycling environment and, more specifically, the bicycle facilities. The study also revealed a high level of support for the expenditure of state and federal dollars to expand and improve bicycle facilities in the region.

Air Service

There are no commercial airports on the Outer Banks—most people who come by commercial air fly into Norfolk, VA, about 90 miles away. Other airports are in

⁵ Conducted by the Institute for Transportation Research and Education for the NCDOT/Division of Bicycle and Pedestrian Transportation, 2003.

Greenville, NC (140 miles), and Raleigh-Durham (200 miles). There are three general aviation airports or airstrips on the Outer Banks:

- Dare County Regional Airport (MQI). Located on the northern end of Roanoke Island.
- Airstrips. Daylight use only, limited day use aircraft parking available.
 - First Flight Airstrip (FFA)* is located at the Wright Brothers National Memorial in Kill Devil Hills, NC.
 - Billy Mitchell Airstrip* is located on Hatteras Island at the National Park Campground in Frisco, NC.

Water Transportation

As is well known, there are a number of ferry services currently operating in the Outer Banks area. These are:

- Currituck-Knotts Island. Year-round service. Crossing: 45 minutes. Fare: free.
- Hatteras-Ocracoke. Year-round service. Crossing: 40 minutes. Fare: free.
- Ocracoke-Swan Quarter. Year-round. Crossing: 2.5 hours. One-way fares: pedestrian--\$1; bicycle rider--\$3; motorcycles--\$10; vehicles under 20 ft.--\$15; vehicles 20 ft.-40 ft.--\$30; vehicles 40 ft.-65 ft.--\$45.
- Cedar Island-Ocracoke. Year-round service. Crossing: 2.25 hours. One-way fares: same as Ocracoke-Swan Quarter.

In addition to the above, a ferry service between Currituck and Corolla is being developed. This will be passenger-only service using a 49-passenger “pontoon boat.”

At the community meetings in March, there was interest expressed for using the many water resources in the area as a transportation resource. For example, there was a suggestion for “water taxi” service between Manteo and the Nags Head/Kill Devil Hills area, or even to Duck. There was also a suggestion that water taxis serve Roanoke Island attractions such as Festival Park and the Fort Raleigh/Elizabethan Gardens area. One suggestion made was that such water taxis be able to accommodate bicycles on board.

Two of the case study cites incorporate some kind of water transportation—Bar Harbor and Cape Cod. In addition, Lake Tahoe has plans to institute ferry service between its north and south shores. In fact, the recent federal transportation bill, SAFETEA-LU, contains \$8 million for this service.

Current NCDOT Plans

A number of highway and road improvements are currently planned (or are being studied) by NCDOT. These projects are included in its 2006-2012 State Transportation Improvement Program (STIP). The projects range from installing a traffic signal at a hazardous intersection in Kill Devil Hills, to widening the paved shoulders on US 158 to make it safer for bicyclists, to planning a new bridge over Currituck Sound. Some of these projects are underway, some are approved and funds have been programmed for them, and some are either unfunded or are only in the planning stages. These projects are described in more detail in Appendix 6.

Of particular note in regard to the Outer Banks Transportation Study is the federally-required Draft Environmental Impact Statement (DEIS) involving the proposed Mid-Currituck Bridge. A DEIS discussed at public hearings in 1998 found that a new bridge would not fully serve future travel demand in the northern Outer Banks. The study was therefore expanded to include US 158 from the US 158/NC 168 intersection at Barco to the US 158/NC 12 intersection at Kitty Hawk and NC 12 from the US 158/NC 12 intersection to the northern terminus of NC 12.

The expanded study, a Supplemental Environmental Impact Statement, is called the Currituck Sound Area Transportation Study. It is being conducted by NCDOT with the help of the engineering and consulting firm of Parsons Brinckerhoff. Under the current study schedule, the Final Environmental Impact Statement (FEIS) will not be completed until 2008. This means that it is unlikely that any significant highway improvements, e.g. widening NC 12 north of Kitty Hawk, could proceed until that time. More information on this study can be found at www.ncdot.org/projects/currituck/.

Other Transportation Studies

The Roanoke Island Transportation Committee commissioned a study to review the short- and long-term planning efforts of the Transportation Committee to date and to develop a comprehensive transportation plan for the Town of Manteo and the northern end of Roanoke Island. The study, conducted by the consulting firm of Kimley-Horn, was targeted for completion in September 2005.

CASE STUDIES

Introduction

In order to see what other tourist destinations have done in order to deal with tourist-related transportation problems, the study included nine case study sites that were thought to have some possible lessons for the Outer Banks. Although the sites are all major tourist destinations, and most of them are either on barrier islands or are on the ocean, they also are different in many ways from the Outer Banks. Like the Outer Banks, some are mainly oriented to summer activities, are relatively isolated geographically, cater to longer-term vacationers, and draw many visitors from relatively far away. Others are more year round, are close to major urban areas, cater more to short-term or day visitors, and/or draw most of their visitors from nearby. Some are relatively low-density like the Outer Banks, others are more densely populated. All of them experience varying degrees of traffic congestion.

Highlights of these case studies are provided below. Additional details about each case study can be found in the summary table in Appendix 7. A more complete description of each site is provided in a separate report.

General Description of Case Study Sites

The nine case study sites are briefly characterized below:

Bar Harbor (Maine). An island of about 100 square miles off the coast of Maine; some villages, mostly forests. It's about a six-hour drive north of Boston. Many of the area's three million annual tourists come to visit Acadia National Park and the upscale town of Bar Harbor. Significant traffic congestion occurs getting onto the island and in the national park.

Biloxi (Mississippi). The Biloxi-Gulfport tourist corridor on the Gulf of Mexico is largely oriented to gambling which was legalized there in 1992. The area is substantially more developed than the Outer Banks with a significant year-round population. There are approximately 26 miles of manmade beachfront on which many large casinos/hotels are located. About 10-12 million people visit each year.

Cape Cod (Massachusetts). Cape Cod is a peninsula (technically an island) extending into the Atlantic Ocean. Approximately 75 miles from Boston and Providence, Rhode Island, it has 30 miles of beachfront and 560 miles of coastline. 4.7 million tourists come each year, many of them to visit the Cape Cod National Seashore.

Clearwater Beach (Florida). Clearwater Beach is a barrier island chain in the Gulf of Mexico off the coast of major urban development (Clearwater/St. Petersburg/Tampa). It includes 30 miles of beachfront and draws 4.5 million visitors a year.

Gatlinburg (Tennessee). Gatlinburg draws many visitors to the many tourist attractions in the town itself. Another major attraction in the area is the nearby Great Smoky Mountains National Park. In addition, the Gatlinburg-Pigeon Forge-Sevierville corridor has developed into a major entertainment center for music and other attractions including Dolly Parton's amusement park—Dollywood. This 14-mile corridor, flanked by mountainous country, has become a serious traffic bottleneck.

Jersey Shore (New Jersey). This case study is of the Upper Jersey Shore in Monmouth and Ocean counties. In particular, the focus is on the barrier peninsula and island in Ocean County, the area of the Jersey Shore that most closely resembles the Outer Banks in its physical character. The island is 18 miles long. Although there are many hotels/motels, like the Outer Banks most visitors rent housing units.

Lake Tahoe (California). Lake Tahoe is a year-round tourist destination in the Sierra Nevada Mountains that is anchored by a large lake that includes 30 high-altitude beaches. In the winter it attracts large numbers of skiers. It is relatively isolated from large urban areas.

Ocean City (Maryland). Ocean City, Maryland's only coastal community, is a barrier island of only about 10 miles of beachfront. It hosts 3.3 million annual tourists. One of its main attractions is a three-mile boardwalk that is home to restaurants, shops and entertainment.

Virginia Beach (Virginia). A mainland beach located just north of the Outer Banks, Virginia Beach is part of the Hampton Roads region that also includes the cities of Norfolk, Hampton, Newport News, Chesapeake, Portsmouth, Suffolk and Williamsburg. With a year-round population of 425,000, Virginia Beach is the most populous city in Virginia and has a relatively high density. It has 35 miles of shoreline but most of the beach facilities and attractions are concentrated along a 40-

block stretch of beach approximately two miles in length. An estimated 2.9 million out-of-town visitors traveled to the area in 2004.

Transportation Solutions

Public Transportation

All of the case study sites have some kind of transit service for both tourists and the general public. However, the Upper Jersey Shore only has limited service provided by Ocean County, mainly for seniors, persons with disabilities, and clients of human service agencies. Most have instituted several different kinds of transit including regular buses, trolley buses, trams, and park-n-ride shuttles. Some examples:

- In Bar Harbor, the “Island Explorer” operates eight routes providing access to hotels, campgrounds and Acadia National Park.
- In Biloxi-Gulfport, six regular bus lines and one trolley bus line are operated by the Coast Transit Authority. Several hybrid-electric trolley buses have been purchased for this purpose. Area casinos also operate private shuttle buses.
- On Cape Cod, there are nine routes with fixed-route bus service, demand-response service, trolley/shuttles, and a planned 2006 “flex-route” that will serve the Outer Cape (the flex route will be a combination of fixed-route and demand-response).
- Clearwater Beach has two trolley services. The Pinellas Suncoast Transit Authority operates the Suncoast Beach Trolley along the islands from Clearwater Beach to Pass-A-Grill. The Jolley Trolley operates two routes—one from Clearwater Beach to Sand Key, the other from Clearwater Beach to downtown Clearwater.
- In the Gatlinburg area, transit service is provided by the Sevierville Fun Time Trolley and Gatlinburg Mass Transit (Trolley). A high-capacity Bus Rapid Transit (BRT) system is in the planning stages for the Gatlinburg-Sevierville corridor.
- Lake Tahoe offers a variety of transit services. The BlueGo umbrella system provides its own shuttle service on the South Shore and connections to private and public transit providers, shuttles and trolleys throughout the basin. TART (Tahoe Area Regional Transportation) operates shuttle services on the North Shore. “Nifty Fifty” is a trolley service that operates two routes on the South Shore. Private transit operators are found throughout the region. In addition, Lake Tahoe just received \$8 million in the recent federal transportation bill (SAFETEA-LU) for new ferry service that will connect the north and south shores.
- In Ocean City, there is the Coastal Highway Transit Bus, demand-response paratransit, a boardwalk tram, and park-n-ride shuttles.
- Virginia Beach offers many fixed route bus services operated by Hampton Roads Transit, and also the Wave Beach Trolley that consists of three routes serving popular tourist destinations. In 2007, Bus Rapid Transit (BRT) service, a \$21.4 million project, is planned in connection with expansion of the convention center. This service would replace the current trolley buses.

Bicycle and Pedestrian Facilities

Several of the case study sites have incorporated bicycle and pedestrian facilities as part of their overall transportation strategy. For example:

- Bar Harbor has 45 miles of bicycle trails on carriage roads in Acadia National Park. A local community task force has identified 70 more miles of trail than can be converted for bike use.
- On Cape Cod, there are many miles of bicycle trails and paths including a 26-mile converted railroad right-of-way and several trails at the Cape Cod National Seashore. The total mileage of bike trails in the region is approximately 52 miles. Many buses can accommodate bicycles. Local businesses are also encouraged to provide bike storage facilities for employees and customers.
- Clearwater Beach has widened roadways to accommodate bicycles.
- Lake Tahoe is expanding bicycle trails significantly. There are three classes of paved bike trails ranging from those separated from the main road to those that are marked and integrated with the flow of traffic.
- In Ocean City, a bike trail parallels the Boardwalk and goes to the state park.
- Along the New Jersey Shore, a former railroad right-of-way serves as a 14-mile trail for cyclists.

Transportation Demand Management

Transportation demand management (TDM) involves managing the demand for transportation rather than simply building new capacity. It generally seeks to make existing transportation facilities more efficient. Transit can be considered one form of TDM—using high-capacity vehicles to move more people over existing roads. Another form is parking management—limiting parking supply or increasing its price so as to encourage people to take transit or to carpool when possible. As a recent study of parking in San Francisco suggested, “if there is parking, they will come.” Abundant free parking not only encourages people to drive their cars, it also uses up what is usually limited and expensive land in resort areas.

Several areas use parking strategies to help control the use of automobiles and/or raise revenue for transportation purposes:

- On Cape Cod, access to most town beaches requires purchase and display of a parking sticker, and some town beaches are open only to town residents.
- On the Upper Jersey Shore, metered parking is used in municipal parking lots and on many streets. The Point Pleasant Beach website advises, “If free parking is what you want, be prepared to walk a few blocks.”
- Several areas use park-n-ride facilities located away from areas of congestion, and then provide some kind of bus or shuttle service to key destinations, e.g. in Biloxi-Gulfport and in Ocean City.
- Beginning in 2005, the town of Ocean City began the installation of automated parking meters to replace the old models in operation. The new meters accept credit and debit cards and will enable customers to retain and reuse unused parking time.

- In Virginia Beach, parking is restricted in the resort area. Residential parking permits, which are available to residents at no fee, are required to park between 8 PM and 6 AM on most residential streets. On the oceanfront, there are 1500 off-street municipal parking spaces and 786 on-street metered spaces. The parking meters have a three-hour time limit, cost \$.75 per hour, and are enforced. Municipal parking lot spaces cost \$4-\$7 per day.

Traffic Solutions

Of course, one solution for alleviating traffic congestion is to build more road capacity, or to use traffic engineering techniques such as adding left-turn lanes to increase the throughput of existing roads.

- In the Gatlinburg-Pigeon Forge-Sevierville corridor, construction is nearly complete on a second arterial highway meant to compensate for increased traffic on the main road running through the region.
- On Cape Cod, the highway leading from the entrance of the island has been expanded. Further plans indicate that a second highway may be renovated in the near future.
- The entry point into Bar Harbor, Rt. 3, is the subject of much debate in that region. It is considered a “choke point” for all traffic to and from the island. Methods to alleviate the problem include installation of traffic signals, the elimination of local school busing in favor of a year-round community transit system, the construction of an off-island park and ride facility, and converting Rt. 3 into a toll road to cover the costs of transit alternatives similar to the Island Explorer shuttle.

Water Transportation

Water transportation is an obvious potential transportation resource in many resort areas. For example:

- In Bar Harbor, the CAT high-speed ferry carries over 900 passengers between Nova Scotia and Bar Harbor in less than three hours.
- Several ferries serve Cape Cod, e.g high-speed ferry service between Boston/Plymouth and Provincetown, and regular ferry service to Nantucket and Martha’s Vineyard.
- Recent federal legislation has made possible a waterborne transportation system on Lake Tahoe to ferry persons between opposite shores of the lake without having to use the already congested roadways.
- In the Virginia Beach region, the natural gas powered Paddlewheel ferry carries passengers across the Elizabeth River between Norfolk and Portsmouth (approx. 2 miles). The ferry holds about 150 people.

Organizational/Institutional

One of the problems in regard to transportation issues is that they are often regional and multi-modal in scope and cross the geographic or functional boundaries of local governments or agencies. For this reason, several tourist areas have created special agencies that can more effectively deal with such problems.

- The Cape Cod Commission was created in 1990 by an Act of the Massachusetts General Court and confirmed by a majority of Barnstable County voters. In the wake of an unprecedented growth boom in the 1980s, the Cape Cod Commission Act found that the region known as Cape Cod (Barnstable County) possesses unique natural, coastal, historical, cultural and other values which are threatened by uncoordinated or inappropriate uses of the region's land and other resources. The Commission was established as a regional planning and regulatory agency to prepare and implement a regional land use policy plan for all of Cape Cod, review and regulate Developments of Regional Impact, and recommend designation of certain areas as Districts of Critical Planning Concern.
- Friends of Acadia is a non-profit group of public and private interests composed of more than 3,000 members. Through their advocacy campaign on Mt. Desert Island, the Island Explorer service was launched. Management of the transit service is handled by the local Downeast Transportation Company.
- Several of the areas have formed transit authorities, e.g. Gatlinburg Mass Transit, Cape Cod Regional Transit Authority, and the Hampton Roads Transit System.
- Due to a number of different public and private transit providers in the Lake Tahoe basin, the BlueGo umbrella system was established to unite the systems. The new system now can inform customers of vehicle position, arrival time, and schedules of all other nearby transit services.

Funding

- Funding for the Island Explorer in Bar Harbor is provided by both public and private agencies, large and small. Most notably, the outdoor clothing and supply company L.L. Bean, agreed to help fund the shuttle service. Acadia National Park has also been involved. Donations of all sizes allow this service to remain free of charge.
- On Cape Cod, the Cape Cod National Seashore has been involved in funding transportation studies and purchasing transit vehicles.
- Transit provided by the Pinellas County Transportation for Clearwater Beach was funded predominantly by local taxes (63 percent). Farebox revenue funded one-third of the service. The remainder is provided by state and federal grants and revenue from advertising.
- The Virginia Department of Transportation provides free shuttle service between Williamsburg, Busch Gardens, and Virginia Beach during the peak vacation season.

Lessons for the Outer Banks

Transportation problems, especially traffic congestion, are a common theme at popular tourist destinations. These problems are unlikely to be solved by road or highway improvements alone. Rather, a multi-faceted, multi-modal strategy is required. It is not enough to simply build more road capacity, even if adequate funds and land were available to do so. Moreover, necessary land is usually limited and often very expensive.

In most of the case studies examined, public transportation has become an integral part of moving large numbers of tourists around. In addition, the development of bicycle and pedestrian facilities is being used in several areas as an important transportation strategy for helping to reduce automobile traffic. Such facilities can also have important secondary benefits by attracting more hiking and biking tourists to an area. Water transportation is also playing an increasingly important role in some areas.

As described above, many areas have created special agencies that can deal with transportation problems in a more regional and/or multi-modal way. Examples include transit authorities, regional planning agencies, and a public/private cooperative.

Cape Cod may offer the richest example of various transportation solutions that have been developed in a major tourist area. It also shares many of the Outer Banks' characteristics including limited highway access, a beach-oriented vacation focus, an important national seashore, tourist accommodations that are primarily cottages and small hotels/motels, and tourists that tend to be relatively affluent.

The 1980 tourist boom experienced by Cape Cod bears remarkable similarity to the current situation along the Outer Banks. In both instances, increased urbanization, migration of tourists and commuters, as well as a fragile and tenuous environment has made future development a critical policy question. The two areas are similar in geography and roadway composition. Cape Cod however has a much larger population and greater population density than the Outer Banks. This is in part due to its larger land size and longer period of development. Both regions experience a large tourist influx, the Outer Banks with approximately seven million annually and Cape Cod with almost five million.

The two regions share other demographic similarities. Over one-third of all visitors to Cape Cod own seasonal homes or soon plan to. This rapid development is quickly reducing undeveloped land and driving property values higher and higher. Because it is predominantly a vacation destination, the area's industry has become reliant on a low-wage service industry.

Both the Cape and the Outer Banks make use of extensive ferry service. In both areas, a single roadway runs along the entire length of the area. With these similarities and differences in mind, there are several lessons to be learned from transit and transportation initiatives used on Cape Cod that might be applied to the Outer Banks.

A major highway improvement now under construction is the replacement of the rotary at the mainland side of the Sagamore Bridge with a grade separation between the bridge access and highway 3. This \$59.3 million improvement is anticipated to reduce travel time by 20 minutes when it is completed in Spring 2007.

The mainland side of the Bourne and Sagamore bridges also features a park and ride lot. In addition, six more free public park and ride lots are found throughout the Cape as well as the public Transportation Center in Hyannis that charges a parking fee. The

construction of the Hyannis Transportation Center serves as a prototype for similar transit hubs throughout Cape Cod. Two of the largest park and ride lots, the Sagamore and the Barnstable, are located adjacent to major intersections on the mid-Cape Highway, US-6. Well-placed parking lots and transportation centers have allowed commuters and tourists to take advantage of available transit without crowding the streets with their personal vehicles. These parking areas also offer accommodations for bicycles.

The Cape Cod area offers a wide array of bike trails, paved and off-road, for easy movement around the region. The trails total 52 miles, the longest one being the Cape Cod Rail Trail which runs 26 miles. Bike rentals are also available throughout the Cape. Each year, towns and businesses along the Cape participate in an annual Bike Week, where the advantages of bicycle transportation are promoted. Per a recommendation from the Cape Cod Commission, many of the municipalities encourage their local businesses to provide bike facilities for their employees.

In addition to transportation alternatives, the region also boasts a well-developed transit system. Fixed route, paratransit, and flex route service are all available. Service is provided by the Cape Cod Regional Transit Authority (CCRTA) as well as several private providers. The CCRTA operates three permanent shuttle routes and seven seasonal trolley routes. Two private providers are based off-Cape but provide single route service that spans the length of the Cape. The paratransit, or demand-response, service is called the b-bus. Customers using the b-bus may make reservations beforehand and based on their status (elderly or disabled) pay a reduced fare.

In addition to the transit authority, Cape Cod created a regional planning and land-use regulatory agency, the Cape Cod Commission, to help deal with the problems being caused by unplanned growth—traffic jams, mounting trash and water quality problems, and increased congestion in the once rural area. The Commission conducted the *Route 6 Outer Cape Traffic Flow and Safety Study* that recommended several actions to improve traffic flow including:

- Improving information to the traveling public, through pre-trip, en-route, and along the corridor means. This includes use of variable message signs at key locations both on the Cape and on the mainland, and use of other Intelligent Transportation Systems (ITS) components.
- Increasing enforcement of speeding and traffic control laws.
- Improving key intersections to increase safety and reduce confusion, including improving signage.
- Increasing use of access management techniques, such as reducing the number of driveway curb cuts.
- Developing additional public transit options, such as “attractions” shuttles.

RECOMMENDATIONS

A number of recommendations are made for alleviating various transportation problems that were identified. Underlying these recommendations are some key goals:

- Reducing traffic congestion (without reducing the number of tourists).
- Providing transportation alternatives that will be a tourist attraction (e.g. old-style trolley buses and bicycle paths).
- Providing mobility for those without cars or unable to drive (seniors, disabled persons, children, guest workers, etc.).
- Preserving valuable open space and limiting the amount of land needed for roads and parking.
- Improving air quality.

Modal Recommendations

Public Transportation

To some extent the Outer Banks is faced with a “density dilemma.” By design, the area has sought to keep its population density (including tourists) relatively low. High-rise development is limited and, in general, dwelling units are small and free-standing. An often heard sentiment is that “we don’t want to become another Myrtle Beach.” Yet fixed-route bus service works best when densities are high.

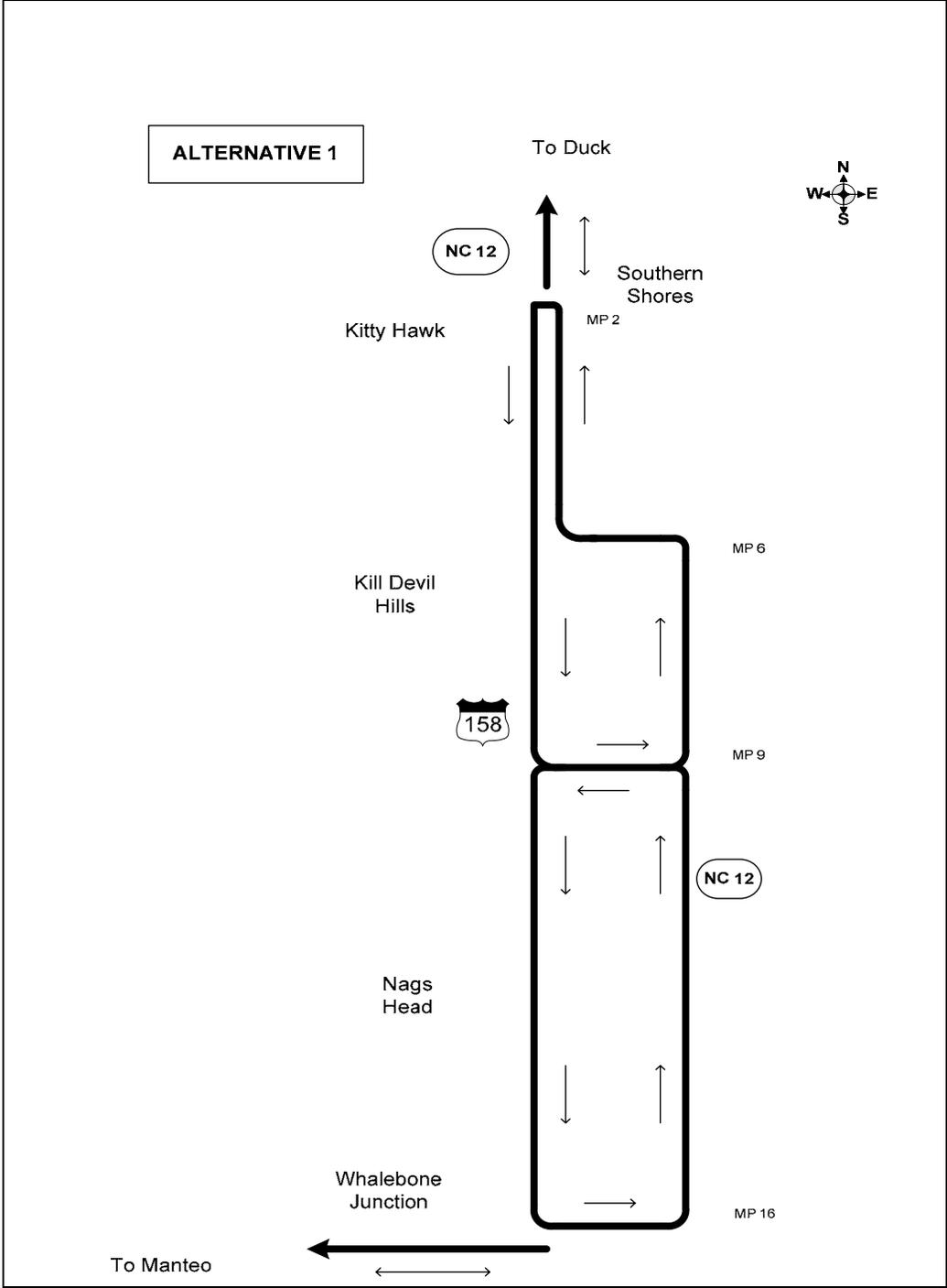
However, there are some areas of relative high-density on the Outer Banks, for example the NC 12 corridor from Nags Head to Kitty Hawk that contains many multi-story condominiums and hotels, and the extensive commercial development along US 158. Another example is the Town of Manteo and the several tourist attractions on Roanoke Island. Although the density on the Outer Banks is relatively low compared to many other tourist areas, it is increasing and related traffic congestion is getting worse.

For this reason it is recommended that public transportation service be tested. One purpose is to help alleviate traffic congestion, although at least initially transit is not likely to have a noticeable impact on it. However, traffic congestion is not the only reason that public transportation should be considered. There are, in fact, at least three reasons to consider it:

- As an alternative for tourists in order to encourage some of them to take transit instead of their cars for local trips;
- For seasonal workers who need a way to reach employment locations and take care of their personal trip needs such as grocery shopping and laundry; and,
- For residents who don’t have access to a car, or who may be unable to drive one (elderly or disabled persons, persons with low incomes, teenagers, etc.).

Two alternative route structures are proposed. Alternative 1 is shown on the next page.

ALTERNATIVE 1



In Alternative 1, four routes are proposed that would serve the major trip generators in the area and that therefore have the greatest likelihood of generating the most trip demand. These routes are as follows:

- Two loop routes between Whalebone Junction and the NC 12/US 158 intersection in Southern Shores. The two routes would meet at a midpoint around Ocean Bay Blvd. These loop routes would operate counterclockwise on both NC 12 and US 158 serving the major hotels, condominium buildings, and beach access areas on NC 12, and the major retail/commercial areas, tourist attractions (Wright Memorial, etc.), and institutions (Regional Medical Center, Outer Banks Hospital, YMCA, etc.) on US 158.
- A third route would provide service from Whalebone Junction to Roanoke Island, serving the town of Manteo and tourist attractions such as Festival Park. (This should be coordinated with the Manteo transportation plan now being developed by a consultant which may include a proposal for trolley bus service on the island. One idea would be to use Festival Park for a transfer location between the two services.)
- A fourth route would provide service to the Duck area and would link with the northern loop route described above. (This should be coordinated with the Corolla service now being planned by ICPTA.)

The two loop routes should be designed so that each loop takes a little less than an hour to operate. (Each route would be about 16 miles in length and this would therefore require an average speed of 16 miles per hour. The speed limit on US 158 is 50 mph.) This would allow each route a small amount of time to layover, or to make up for lost time due to traffic problems. Using two buses on each loop would then allow a service frequency of 30 minutes. Similarly, the third route to Roanoke Island should be designed so that two buses could provide 30-minute service. The fourth route to Duck is much shorter and one bus should be able to easily provide 30-minute service (except when traffic is backed up on weekends).

Note: None of the routes have been designed in detail. In order to develop a more precise estimate of possible service frequencies and therefore the number of buses required, it will be necessary to determine exactly where buses would stop, what streets they would operate on, and the routes then driven in order to determine a more accurate running time.

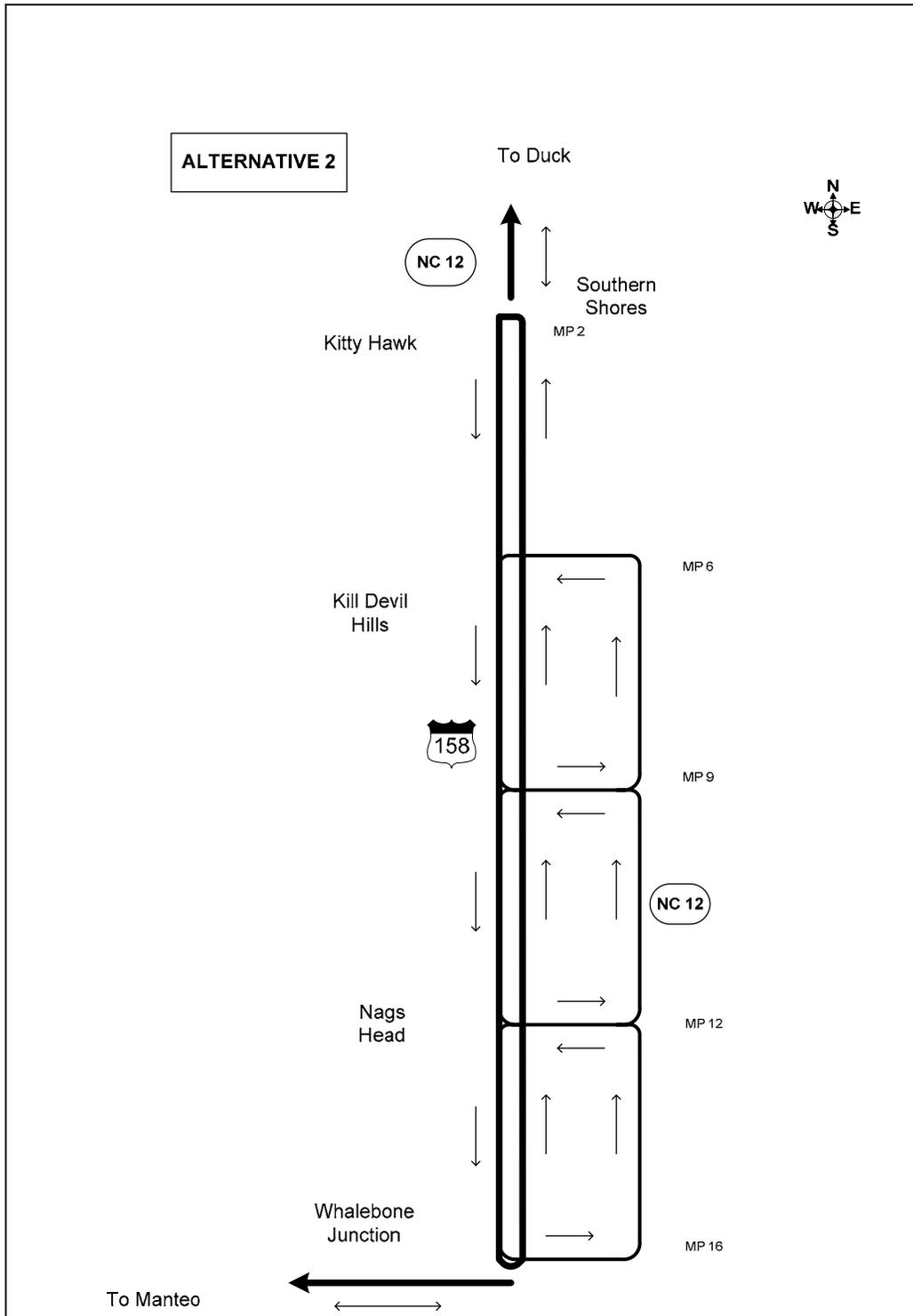
Pros:

- Simple to operate, less costly than Alternative 2.
- Timetables/schedules would be relatively easy to understand.
- Serves major trip/activity generators

Cons:

- Requires one transfer to get from a point on one of the loops to a point on the other.
- Riders must sometimes ride a long way on a loop to return to the point of origin.

Alternative 2 is diagrammed below.



Alternative 2 involves six routes. A “backbone” route would run in both directions in the US 158 corridor from Whalebone Junction to Kitty Hawk/Southern Shores. This route would be about 32 miles round trip and one bus should be able to provide service every hour if the number of stops is limited and an average speed of 32 miles per hour can be maintained (the speed limit on US 158 is 50 mph). Two buses would therefore be able to provide 30-minute service frequency. As in Alternative 1, this service would connect with another route to Duck at the north end, and a route to Manteo/Roanoke Island at the south end. Three small loop routes would connect to the backbone route providing transit links to the hotels, condos and beach access areas in the NC 12 corridor. Each loop would be about seven miles in length and one bus on each should be able to provide service every 30 minutes (would require an average speed of 14 miles per hour).

It should be noted that US 158 and NC 12 are fairly close together in most places (1/4 mile or less). It would not be difficult for many people to walk between the NC 12 corridor and the US 158 trolley bus route rather than taking one of the loop routes (unless they are carrying a lot of groceries, beach paraphernalia, etc.).

Pros:

- The two-way single route on US 158 facilitates travel from one end to the other without having to transfer.
- Both sides of US 158 are served.
- Provides more travel options.
- The loops are relatively short and wouldn't take as long to travel as the longer routes in Alternative 1.
- Serves major trip/activity generators.

Cons:

- More expensive to operate and more complicated to coordinate than Alternative 1.
- More complicated timetables/schedules; harder to understand and communicate.
- The US 158 route is relatively long, therefore more difficult to stay on schedule if there are traffic delays, etc.

For either of the alternatives, the service would initially operate every 30 minutes, 6am-10pm, Mon-Sun, from Memorial Day weekend through September (18 weeks). As experience is gained, the service hours and days should be adjusted to reflect actual levels of usage. The route schedules should be designed to the extent feasible to allow coordinated transfers from one route to the next, thus allowing longer trips to be made with a minimum of waiting.

It is recommended that fares be charged for the trolley bus service. Charging fares helps to offset the operating cost and reduce the amount that has to be obtained from other sources. Most of the transit systems at the case study sites charge fares. The exception is Bar Harbor (however, a \$20 entry fee is charged for entrance to Acadia National Park). (As mentioned above, the services planned for Corolla and Ocracoke have initially decided not to charge fares for reasons that are special to those areas).

Based on the nature of the proposed Dare County trolley bus service, two different fare structures are proposed for consideration. (It should be noted that fare structures are not set in stone and can be revised and refined as experience is gained.)

Option 1:

Type of Fare	Regular	Reduced (1)
Cash Fare	\$1.00	\$.50
Passes (unlimited rides)		
o Daily	\$3.00	\$1.50
o Weekly	\$15.00	\$7.50
o Monthly	\$45.00	\$22.50

- (1) Reduced fares would apply to seniors 65 or over, persons with disabilities, students, and children 5-12. Appropriate identification would be required except for children. (Children under five would ride for free.)

Transfers would not be provided—riders who need to use more than one bus for a journey would pay a fare each time a new vehicle is boarded unless they were using a daily, weekly or monthly pass. One reason for not recommending transfers is that they require a great deal of administrative overhead—printing, collecting and controlling them to prevent abuse.

Pass sale locations should be readily accessible to tourists, workers and residents. Particularly for tourists, passes will not be used much unless they are easy to acquire. Consequently, tourists who find it inconvenient to pay cash fares will be less likely to use the bus service at all. Possible pass sale locations would include visitors centers, hotels, city halls, and major grocery stores. Another possibility would be making them available through large employers. In Virginia Beach, unlimited ride farecards can be purchased from farecard machines located in the primary service area. (These machines cost \$30,000 or more each, depending on the level of security desired.)

The route structure proposed as Alternative 2 involves three small loop shuttle routes that serve both NC 12 and US 158 between Kill Devil Hills and Whalebone Junction. Because these routes are relatively short and will probably be used primarily to connect to the longer US 158 “backbone” route, it is suggested that the regular cash fare on these routes be \$.50, and reduced fares \$.25. Alternatively, because these routes will mainly be used to connect to the US 158 route, another approach to consider would be to not charge any fare on them.

Option 2:

An alternative fare structure worth considering is that used by Ocean Beach, MD. This system does not charge regular cash fares but instead sells unlimited-ride daily passes for

\$2.⁶ These passes are sold on the buses. This is an extremely simple fare structure to understand and publicize, and it avoids the need for any kind of paper transfers. One-half fare passes could be provided for children (5-12), and for elderly and disabled persons.

Whatever types of passes are offered, it will be important to develop a plan to control and account for them. They will have a significant cash value and therefore need to be treated as if they were cash.

Note: a more detailed report on the fare structures issue is available separately.

A key issue in developing a viable transit service will be promoting it extensively. Obviously, people will not use transit if they don't know about it, don't know where the routes go, or at what time it operates. Another key issue is using complementary policies or programs that will encourage people to use transit. Some examples are:

- Using parking management techniques that make parking less available/more expensive.
- Exploring possible incentives for using transit. For example, a tourist attraction like the NC Aquarium might offer a discounted admission for people who come by transit. (This would also benefit the Aquarium by reducing the amount of parking space needed.) Another example would be to encourage area retailers to offer discounted prices on merchandise or services. Or, hotels might give a limited number of free passes to guests in order to acquaint them with the service.
- Providing information about the trolley service in packets mailed to vacation renters so they are aware of this option ahead of time.
- Including transit information on the Visitors Bureau website. This would help to make tourists aware that trolley bus service is available on the Outer Banks, and might even induce a few visitors to bring fewer cars if they knew that transit service was going to be available.
- Prominently displaying trolley bus route maps and schedules at Visitors Centers, hotels and other locations frequented by tourists.

One idea that has been suggested is to incorporate, at least on some buses during certain hours, tour guides that could give a narrative description and history of the area to riders.

Estimated Operating Costs:

It is not easy to estimate the probable cost of operating this service. For one thing, it is a seasonal service. It will be more difficult to obtain vehicles and employees for a service that only operates 4-5 months of the year. Employees may have to be paid higher wages in order to attract them, and vehicle acquisition or leasing costs would have to be amortized over a shorter length of time. In addition, at least initially it is believed that a private contractor will be used to provide the service. In order to cover startup costs and

⁶ Senior citizens who are residents can ride for free; non-resident senior citizens can ride for one-half fare. In addition, a discounted 10-ride coupon book can be purchased for \$15.

build in a profit, a private contractor would probably have to charge more than would a public agency. Also, the cost that a contractor will charge will depend to some extent on whether the Dare County service can be packaged with the proposed Ocracoke and Corolla services in order to create a larger bidding opportunity that would be more attractive to a private contractor and that might provide for some economies of scale.

In order to develop an estimated operating cost, several different sources were looked at for guidance. These sources are summarized below:

- According to NCDOT/Public Transportation Division data (OPSTATS), in FY03, Dare County Transit’s operating cost was \$19.20 per vehicle hour. Including capital and administrative costs, it was \$22.60 (17.7% more). The FY03 average operating cost for all rural Community Transit systems in NC was \$31 per vehicle hour.
- In FY02, the average operating cost of small fixed-route urban systems (operating from 3-6 vehicles) in NC was \$48.76/vehicle hour.
- The project consultant, KFH Group, Inc., is estimating approximately \$50/hour for the operating cost of the proposed Ocracoke and Corolla trolley bus services. In part this is due to the anticipated difficulty of obtaining labor in these somewhat isolated and upscale communities.

The higher hourly cost of \$50 per vehicle hour has been used in making an estimate. In part this reflects the fact that the service is not projected to begin until summer of 2007 when costs will be higher, and the fact that higher fuel prices have become and are likely to remain a much more dominant component of overall operating cost. In part it is to provide an “upside estimate.” The estimated costs for Alternatives 1 and 2 are shown in the tables below. Each alternative includes two options: one for service every 30 minutes, one for service every 15 minutes. Note: these estimates do not include capital costs (vehicles, maintenance equipment, storage facilities, etc., or potential off-setting revenues if it is decided to charge fares).

Alternative 1

<i>30-minute Service</i>							
	<u>Hours</u>	<u>Days</u>	<u>Buses</u>	<u>Weeks</u>	<u>Total Hrs</u>	<u>Cost/Hr</u>	<u>Total Cost</u>
Weekdays	16	5	7	18	10080	\$50.00	\$504,000
Sat.	16	1	7	18	2016	\$50.00	\$100,800
Sun.	16	1	7	18	2016	\$50.00	\$100,800
Total					14112		\$705,600
<i>15-minute Service</i>							
	<u>Hours</u>	<u>Days</u>	<u>Buses</u>	<u>Weeks</u>	<u>Total Hrs</u>	<u>Cost/Hr</u>	<u>Total Cost</u>
Weekdays	16	5	14	18	20160	\$50.00	\$1,008,000
Sat.	16	1	14	18	4032	\$50.00	\$201,600
Sun.	16	1	14	18	4032	\$50.00	\$201,600
Total					28224		\$1,411,200

Alternative 2

<i>30-minute Service</i>							
	<u>Hours</u>	<u>Days</u>	<u>Buses</u>	<u>Weeks</u>	<u>Total Hrs</u>	<u>Cost/Hr</u>	<u>Total Cost</u>
Weekdays	16	5	8	18	11520	\$50.00	\$576,000
Sat.	16	1	8	18	2304	\$50.00	\$115,200
Sun.	16	1	8	18	<u>2304</u>	\$50.00	<u>\$115,200</u>
Total					16128		\$806,400
<i>15-minute Service</i>							
	<u>Hours</u>	<u>Days</u>	<u>Buses</u>	<u>Weeks</u>	<u>Total Hrs</u>	<u>Cost/Hr</u>	<u>Total Cost</u>
Weekdays	16	5	16	18	23040	\$50.00	\$1,152,000
Sat.	16	1	16	18	4608	\$50.00	\$230,400
Sun.	16	1	16	18	<u>4608</u>	\$50.00	<u>\$230,400</u>
Total					32256		\$1,612,800

There are a number of variations possible on these two basic alternatives that would reduce costs. For example:

1. Under either alternative, service might operate for less hours on Saturday and/or Sunday (when many tourists are arriving or departing, and when some employees are not working). Or, the service frequency might be reduced from every 30 minutes to every hour on weekends.
2. In Alternative 2, service could be operated every 15 minutes on the US 158 route, and every 30 minutes on the other routes. Or, every 30 minutes on the US 158 route, and every hour on the other routes.
3. Also in Alternative 2, service on the US 158 route could operate from 6AM to 10PM, but only from 9AM to 8PM on the other routes.

These are only some of the possibilities of how service could be tailored to meet actual travel patterns. It should be noted that the final service design will likely affect the estimated costs somewhat.

After the first season of operation, the service should be evaluated. The routes and schedules may need to be adjusted in regard to actual ridership patterns. For example, service seven days per week may not be justified, or it may be appropriate to either expand or reduce the hours of service on some routes. Once it is determined that transit service is viable and trip patterns have been identified, it would also be appropriate to consider installing benches and/or shelters at bus stops that generate a large number of boarding passengers.

Estimated Capital Costs:

The capital cost for buses and related facilities would be an additional cost. In addition to vehicles, a number of other things need to be considered and planned for, e.g. a place to park and maintain the buses, acquisition and erection of bus stop signs, purchase of necessary office equipment, and making arrangements for passenger transfer locations.

Alternative 1 would require a total of nine buses—seven to operate the service and two to serve as spares. Alternative 2 would require 10 buses—eight for operations and two for spares. Based on the per bus cost of \$120,000 used in the Ocracoke Public Transit Study, the cost of 9-10 trolley buses would be from \$1.1-\$1.2 million. This assumes 30-minute service. Service every 15 minutes would require twice as many buses. The cost could easily be higher depending on the quality and special features wanted--new trolley buses can cost up to \$300,000, especially if they are hybrid-electric vehicles. However, it would be difficult to justify buying new buses for an unproven service that operates, at least initially, only 18 weeks of the year. It would make more sense to lease vehicles if appropriate ones could be located at a reasonable price, or to let a private contractor furnish them if that is the approach chosen to operate the service. Another possibility would be to locate and purchase used buses.

The buses used to operate the service should be trolley “replica” buses, the ones designed to look like the streetcars of yesteryear. These would better fit the vacation atmosphere on the Outer Banks and would therefore be more appealing to tourists.



Due to the weather conditions often experienced on the Outer Banks, and the relatively high speeds at which they will operate on US 158, they should have closable windows as opposed to being the open-air type. As required by federal law (the Americans with Disabilities Act), the buses would have to be lift-equipped so that they can serve disabled passengers. In addition, it is recommended that alternative fuel such as clean diesel and/or biodiesel be considered for operation of the buses in order to minimize negative air quality impacts. It is also recommended that the buses be equipped to carry bicycles, surfboards, and other beach paraphernalia.

Ways to fund the operating and capital costs of this service are currently being explored.

Complementary Paratransit Service:

In addition to requiring wheelchair lifts on the trolley buses, federal law requires that a complementary “paratransit” service be operated in the same service area as the fixed-route service so that disabled persons unable to use the fixed-route service will also be served. In Dare County’s case, these types of passengers are already served by Dare

County Transit vans. It is therefore suggested that Dare County Transit provide the required ADA paratransit service. However this has implications for Dare County Transit in terms of ADA certification procedures, issuance of ID cards, providing 24-hour advance reservations, etc. that will need to be explored.

An alternative to Dare County Transit providing the ADA complementary paratransit service would be to operate the trolley bus service as “flex-route” service. This means that the buses would operate mainly as fixed-route service according to a schedule, but upon advance request would deviate from the fixed route up to a specified distance in order to pick up or drop off a disabled rider. The drawback to this is that if many route deviations occur, it can be very difficult or impossible to stay on schedule. In addition, it can be an inconvenience for other riders on the bus.

Bicycle and Pedestrian

Given the popularity of bicycling and the proven economic impact of bicycling visitors on the Outer Banks economy, maintaining and improving the network of bicycle improvements should be a high priority. Implementation of the following recommendations will improve the safety of bicyclists, pedestrians and motorists, increase mobility, and provide better bicycle and pedestrian access to key destinations.

Increasing facilities for bicyclists and pedestrians can offer at least two important benefits:

- It can serve to reduce automobile traffic by encouraging people to bicycle or walk (both tourists and residents).
- It can attract more tourists to an area who like to bicycle or walk as part of their vacation. This results in significant economic benefits to an area.

Goals/Policies/Plans/Guidelines/Standards:

- Build more bicycle facilities to meet growing demand, with the goal of creating a totally interconnected system within and between municipalities.
- Develop local and regional bicycle plans that address short-term and long-term needs and identify priority projects for funding.
- Provide for bicycle connectivity along selected west-to-east corridors across US 158 to link residential areas to beach access locations and commercial centers.
- Adopt policies, guidelines and procedures that “mainstream” bicycle and pedestrian needs into the regular municipal and regional operations and programs, e.g., regular sweeping of sand and debris from bicycle/pedestrian facilities.
- Provide adequate bicycle parking at popular destinations on public lands; encourage merchants to provide bicycle parking.
- Build new bicycle and pedestrian facilities to state and national standards (AASHTO and NCDOT) and upgrade existing sub-standard facilities to meet these standards; encourage private developers to adhere to these standards. (A description of AASHTO guidelines for bicycle facilities is included as Appendix 8. Guidelines for pedestrian facilities are included as Appendix 9.)

- Work with CAMA to develop and implement a policy for dune retention/stabilization to mitigate the problem of sand on the shoulders and edges of NC 12.
- Study existing and potential high-usage pedestrian crossing locations and make recommendations for improvements in signalization, crosswalk markings, and other facility treatments that increase pedestrian safety and/or provide greater access.

Specific Additional Facilities/Improvements Recommended:

- Wide paved shoulders along both sides of NC 12 from the Currituck County line to the existing shoulders in Duck.
- Sound-side multi-use path in Duck.
- Bicycle accommodations through the US 158 and NC 12 intersection in Kitty Hawk/ Southern Shores.
- Widen existing paved shoulders along NC 12 to six feet from US 158 in Kitty Hawk to existing widened shoulders at Third Street in Kill Devil Hills; provide for prevention of sand accumulation and regular sand removal through this section.
- Bicycle accommodations through the US 64/264 and NC 12 intersection at Whalebone Junction.
- Wide paved shoulders on both sides of Old Oregon Inlet Road (SR 1243).
- Wide paved shoulders along both sides of Colington Road from the existing multi-use path to the western terminus.
- Bicycle accommodations on the future bridge replacement over Oregon Inlet.
- Wide paved shoulders from Oregon Inlet to the existing wide paved shoulders north of Rodanthe.
- Sidepath to connect the villages of Waves, Salvo and Rodanthe.

Promotion and Education:

- Increase efforts to encourage bicycle usage by visitors and residents through a variety of safety, awareness and promotional initiatives.
- Continue and expand bicycle safety education programs in the schools (by the schools, local police or sheriff departments, etc.).

Other:

- Allocate funding for annual budget line-items in local governmental budgets for building and maintaining bicycle facilities and implementing other programs, such as safety education efforts.
- Include accommodations for bicycles on any new public transportation services that are implemented, including trolley bus and water transportation services.
- Enforce laws pertaining to bicyclist/pedestrian/motorist rights and responsibilities.

Traffic Solutions

The study team included a person who has extensive expertise in traffic congestion problems and solutions--Joe Hummer, a professional engineer and a professor at NC State's Department of Civil, Construction and Environmental Engineering. Dr. Hummer was asked to look at some of the key traffic congestion locations identified by both the Transportation Task Force and by participants at the community meetings in March, and to develop some creative potential solutions. He has presented his ideas in a separate, more detailed report. These ideas are summarized below.

A number of short-term traffic engineering improvements, many of which were suggested in the community meetings in March, are endorsed. These include:

- *Add right turn lanes on US-158.* Whether or not US-158 is converted into a Superstreet, the provision of more right turn lanes can only help. Right turn lanes typically provide modest safety and travel time benefits to corridors like US-158. Furthermore, until a six-lane Superstreet is constructed on US-158, there will be room within the 150-foot right-of-way to add right turn lanes so the cost will be relatively low.
- *Change rental turnover days.* Reducing the percentage of rental turnover on Saturday from its current figure of around 65 percent would likely be enormously beneficial to traffic. This is because the marginal effect of each additional vehicle on the road is so much greater when the system is over capacity.
- *Add left turn lanes to NC-12 in villages between Whalebone and Hatteras.* There are particular spots along NC-12 where moderate left-turning volumes cause some safety and congestion problems. Even if left turn lanes have to be short and narrow, due to right of way restrictions, they can be effective. In addition, a left turn lane is almost a necessity if a signal is to be installed, which may be necessary in some of those spots as side street volumes grow.
- *Add warning signs and flashing lights on eastbound US-158 at the Wright Memorial Bridge.* After several miles without a signal, drivers need to be aware that there is a traffic signal within a couple hundred yards of the end of the bridge.
- *Provide traffic calming measures on NC-12 in villages between Whalebone and Hatteras.* Possible "gateway" treatments that would tell drivers that they are entering a slower, pedestrian-friendly traffic environment include signs, lighting, plantings, medians, and lane narrowings. This project team does not recommend speed humps or rumble strips for such locations, but a roundabout can be an effective gateway device. Along NC-12 through the villages, curbs and on-street parking should be considered. Crosswalk treatments like signing, lighting, medians, textured pavements, and pedestrian-actuated signals may also be effective.
- *Provide pedestrians enough time to cross US-158 with the signal.* With the existing five-lane design this change has obvious safety implications and would increase pedestrian comfort levels.

In addition to the above projects, Dr. Hummer also presented some ideas for better traffic signage that would help to eliminate confusion, speed traffic, and reduce accidents. The inadequacy of informational signage was a frequent sentiment expressed during the study

because the lack of adequate signage often causes tourists to become confused, slow down, and sometimes make last-second moves that lead to accidents. The primary recommendation is for the installation of either overhead or advance street name signs along US 158 and possibly some portions of NC 12. (It should be noted that NCDOT has recently improved and replaced the mile marker signs on US 158 and NC 12. The signs are now larger, much easier to read, and are located every ½ mile instead of every mile.)

Although this study's primary focus was on shorter-term "implementable" improvements, in the longer-term one of the most frequent comments at the community meeting in Southern Shores was in regard to the need to build the proposed Mid-Currituck Bridge. The study team recognizes the high level of interest in building this bridge, the fact that the Transportation Task Force has endorsed it, and its potential for alleviating the serious traffic congestion that occurs on weekends in the area of the Wright Memorial Bridge, the US 158/NC 12 intersection, and northward into Duck and Corolla. However, it was not made part of this study for two primary reasons:

- The proposed bridge is the central focus of the much larger multi-year federal Environmental Impact Assessment that is being conducted and that is not scheduled for completion until at least 2008 (the Mid-Currituck Sound Transportation Study). It didn't make sense to try to duplicate this very extensive (and expensive) undertaking.
- The budget, scope, and timeframe for this study were inadequate to address such a complex issue.

The study team did, however, make some long-term conceptual proposals for four key traffic trouble spots that were identified by the Transportation Task Force and by many of the participants in the community meetings. These proposals are intended to provide some creative, "unconventional" ideas for potential ways to solve the traffic problems at these locations. The locations, two of which are corridors, and two of which are intersections, are:

1. The US 158 corridor between the Wright Memorial Bridge and the US 64/US 264 intersection in Nags Head (Whalebone Junction).
2. The NC 12 corridor through Duck.
3. The intersection of US 64 and US 264, NC 345 and Virginia Dare Blvd. in Manteo (Midway intersection).
4. The intersection of US 158 and SR 1493 (access to NC 12) east of the Wright Memorial Bridge.

It should be noted that the corridor/intersection proposals are at this point only "concepts;" they are not detailed design or engineering plans. If the concepts are considered worth pursuing, the next step would be to conduct more detailed feasibility-level studies similar to those conducted by the NCDOT Feasibility Studies Unit.

It should also be noted that the study team met with staff from NCDOT's Traffic Engineering and Safety Systems and Project Development and Environmental Analysis Branches to discuss the four proposals listed above. NCDOT staff had already been

considering similar ideas for two of the locations. In general, all four proposals were thought to be worth further exploration.

Finally, it should be remembered that the entire area of the Outer Banks from the Wright Memorial Bridge north into Corolla is the subject of a comprehensive federal environmental study in connection with the proposal to build the Mid-Currituck Bridge. This study is not scheduled to be completed before 2008 and it is unlikely that any major highway projects in that area will be able to proceed before that time.

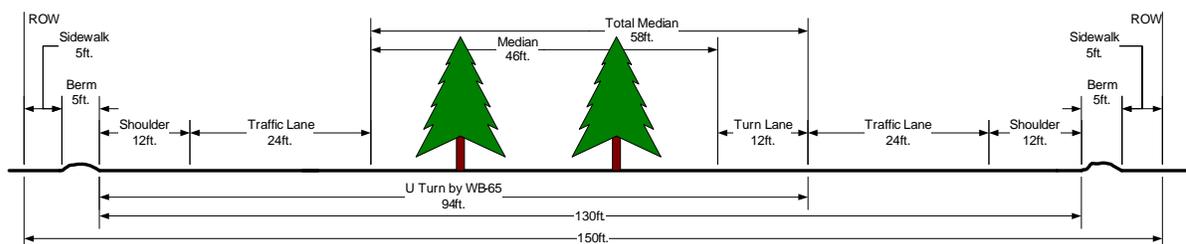
Three of the proposals incorporate aspects of what is sometimes referred to as a “Superstreet” concept (the exception is the US 158/NC 12 intersection in Kitty Hawk/Southern Shores). Superstreet is a design concept for arterial roads that has the potential for moving more vehicles efficiently and safely without resorting to major widening projects, bypasses, flyovers or interchanges that are usually expensive, unpopular with roadside businesses, and/or environmentally disruptive. The concept basically involves reducing the number of intersections and left-turn possibilities, and implementing more efficient timing of traffic signals (fewer signal phases, and improved “progression” which allows vehicles to move along a road at a steady speed hitting one green signal after another).

Each proposal is briefly summarized below. More details and explanation can be found in the accompanying report by Dr. Hummer. It should be noted that if planning for any of these proposals were to proceed to the next stage, consideration should be given to the appropriate accommodation of bicycle and pedestrian traffic. In addition, storm water management considerations need to be incorporated, particularly in planning for the US 158 corridor and the NC 12 corridor through Duck.

US 158 Corridor:

The main recommendation is for a six-lane Superstreet that would fit into the existing 150-foot right-of-way in the corridor. A possible cross section for such a facility would look like this:

Figure 1: Possible Superstreet Cross Section



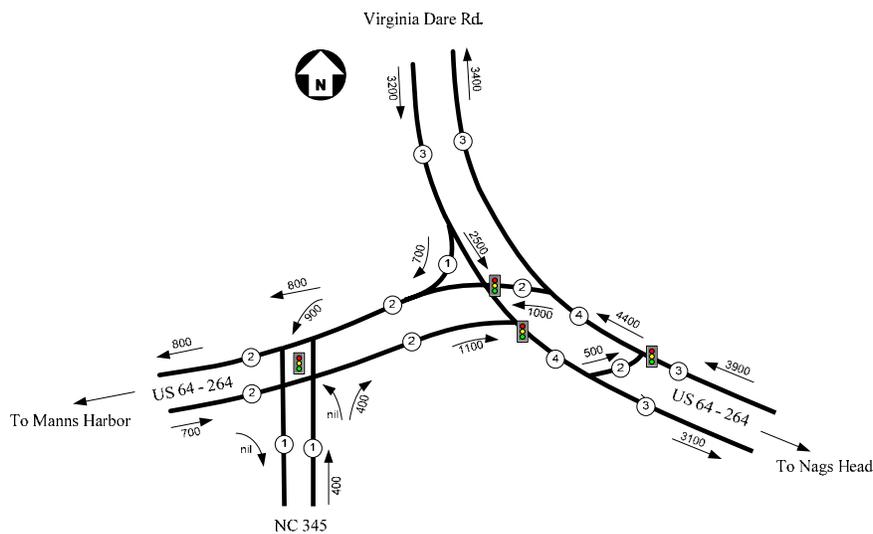
A rough cost estimate for constructions of such a facility would be on the order of \$5 million per mile (not including drainage, utility, or right-of-way costs).

A shorter-term, interim proposal is to pursue the existing NCDOT proposal to install a median in the existing alignment. This should be combined with increased access controls along the corridor. In addition, NCDOT should be encouraged to use one-way median openings, as few two-way median openings as possible, and a few “bulb-outs” to allow U-turns by large trucks and buses. This more modest proposal would cost about \$.5 million per mile.

US 64/US 264/NC 345/Virginia Road Intersection (in Manteo):

This has been the location of not just traffic congestion but also a number of serious vehicle accidents. Several proposals for this intersection—widening, a single point interchange, a flyover, and a traffic circle/roundabout—have been considered by NCDOT and rejected. This proposal is for a Superstreet treatment as shown below:

Figure 2: Superstreet Proposed for Manteo Intersection



This intersection design basically eases the congestion now created by the two heaviest traffic movements—westbound cars from Nags Head turning north into Manteo, and cars coming from Manteo turning east toward Nags Head. It should be adequate to meet the projected traffic for 2025-2030. The cost of this proposal would be about \$5 million.

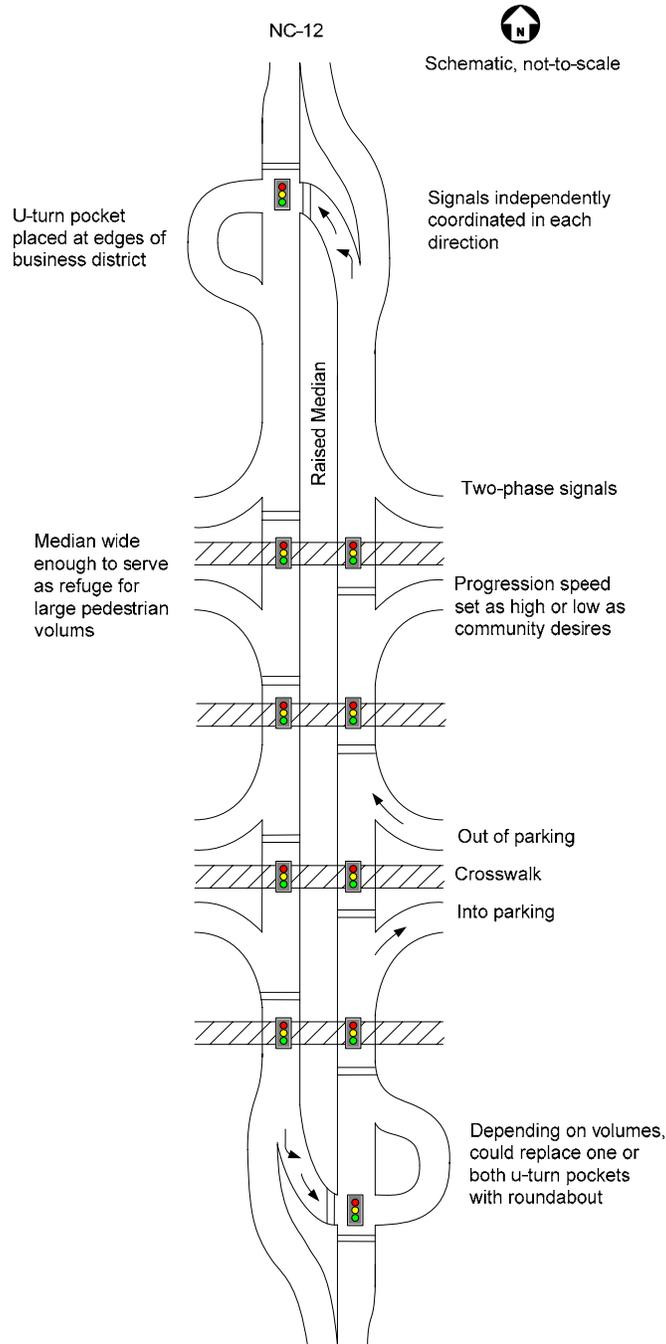
In addition to this proposal, NCDOT has been investigating another alternative for this location, a “continuous flow” intersection. This is also a promising option that should continue to be explored. A rough cost estimate is \$2 million.

Duck Commercial Area:

The Duck commercial corridor is a difficult one from a traffic engineering standpoint. The very things that make it a popular tourist destination are the same things that create traffic problems in the area—many tourist attractions, a narrow right-of-way, and many businesses and related parking very close to the road. The proposal is for a Superstreet

variation that would redirect all left turns and minor street through movements to one-way median openings at each end of the commercial district. A schematic representation is shown in Figure 3:

Figure 3: Superstreet Variation for NC 12 through Duck



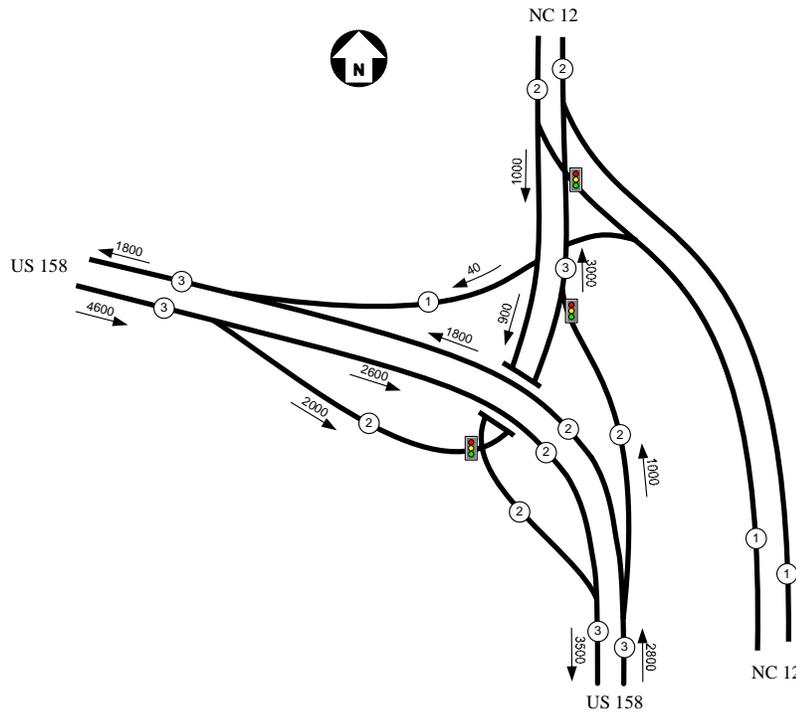
The long-term proposal believed necessary to meet projected 2025-2030 traffic demand is for two lanes in each direction. This would cost about \$7 million (not including right-of-way costs). In the shorter term, even one lane in each direction would offer a

significant improvement over the current situation. The cost of this shorter-term option would probably be on the order of \$4 million.

US 158/NC 12 Intersection (Kitty Hawk/Southern Shores):

This intersection presents the most difficult challenge because of the high traffic volumes involved. For this reason, the proposal involves an interchange that would allow the uninterrupted flow of traffic on US 158 by not requiring traffic to/from NC 12 to cross over US 158. The proposed interchange design is as follows:

Figure 4: Proposed Interchange Design for US 158/NC 12



A simpler and cheaper alternative is also presented that involves an overpass only for northbound US 158—see the accompanying report.

It should be noted that NCDOT has a \$320,000 planning project underway involving an interchange at this location (Project R-4457—see Appendix 6). However, information has been recently received that these funds have now been folded into the larger Currituck Sound Area Transportation Study.

As Dr. Hummer concludes in the accompanying report:

“...we were not shy in making recommendations. The four designs we recommended are big-ticket projects that will have a large impact on the quality of life on the Outer Banks for decades to come. Unfortunately, projects of lesser scale would not stand up to the test of the remarkable traffic

volumes forecast for 2025 and 2030 on the Outer Banks. If traffic growth approaches, meets, or exceeds the forecasts, projects of the scale we proposed or larger will be necessary to move traffic in an acceptable way during peak times and many off-peak times. Outer Banks stakeholders thus seem to face four basic choices regarding traffic:

1. Build the large improvements recommended here, or other projects of similar scale;
2. Make only minor adjustments in the traffic system and trust that the market will discourage travelers from frequenting the congested Outer Banks;
3. Restrict development more than forecast; or
4. Find ways to shift travelers from motor vehicles to other modes that do not use as much highway space.

Of course, a lasting solution to traffic problems on the Outer Banks could also involve some combination of these choices. Another section in this report discusses the potential of the fourth choice offered above. Given the difficulty of that fourth choice, and the unhappiness associated with the second and third choices above, we believe that the large improvements recommended here must play some role in the future.”

Water Transportation

There were several comments at the community meetings in March about exploring opportunities for water taxi service on the Outer Banks, e.g. on Roanoke Island between some of the tourist attractions there, or from Roanoke Island to such places as Nags Head or Kill Devil Hills. As was mentioned in the section about Case Studies, several other popular tourist destinations offer some kind of water transportation.

An inquiry was made to the NCDOT Ferry Division about how to pursue possibilities for water transportation. A response from the Ferry Division indicated that:

- The Ferry Division is not set up to perform feasibility studies for outside agencies. Therefore, the towns involved would have to conduct such studies.
- The estimated cost of constructing docks and related facilities could be provided by the Ferry Division’s Engineering Department (assuming that appropriate specifications are provided).
- There are no grant funds available for operation or construction; one possibility is to contact local legislators for support.

Therefore, additional study would be required to pursue water transportation opportunities.

Transportation Demand Management

Transportation Demand Management (TDM) is the practice of managing the demand for transportation so that more trips can be served with existing capacity. It is different than

Transportation Supply Management (TSM) which typically involves adding capacity, e.g. more lanes on a road, or new roads.

Several possibilities for TDM exist on the Outer Banks including parking management, better balancing the days on which rental turnover occurs, educational or publicity programs designed to influence trip-making behavior, and land-use planning and zoning.

Parking Management

Parking management may make sense in its own right in many situations, but it makes even more sense when used in conjunction with public transportation. For one thing, people are not going to be inclined to use public transportation if they have access to a car and if free parking is readily available. Several of the case study areas that were investigated as part of this study and that are dealing with serious congestion problems are using both parking and transit strategies as a way of dealing with them.

There are several possibilities for parking management strategies on the Outer Banks:

- Start with a policy that parking facilities will in general not be expanded, at least in those areas served by transit.
- Think about charging some kind of parking fee, for example at beach access lots. (Such revenues might be used to help subsidize transit service to the beach.) Residents of the Outer Banks could be given permits that would allow them to use the beach access lots for free or at a low-cost. (Obviously, charging a fee at such lots would cause some people to look for parking on nearby streets or residential neighborhoods. This probably occurs already. However, such spillover effects would increase and effective enforcement of no-parking areas would have to take place in order to minimize such impacts.)
- Establish policies in regard to rental properties that set maximum as well as minimum parking space standards. (For example, one of the participants at the Corolla community meeting mentioned that the rental industry (in the Corolla area?) has published guidelines for one car per bedroom with a maximum of five cars per building.
- Create park-n-ride lots where parking is free and people can then take a shuttle bus to beach areas or other points of high traffic congestion.

It is recognized that parking management is a controversial topic on the Outer Banks, as it is in most communities. However, it should be considered as one possible element of a more comprehensive program aimed at alleviating traffic congestion. It is therefore recommended that a detailed study be conducted of possible parking management strategies that would make sense for the area.

A recent study in San Francisco offers some possible lessons for the Outer Banks. Although quite different, both San Francisco and the Outer Banks share some common transportation problems—constrained geography and serious traffic congestion. In an article about the study in the San Francisco Examiner, Jim Chappell, President of the San Francisco Planning and Urban Research Association, was quoted as saying: “San Francisco is not getting any bigger. If we want our city to grow and prosper, we need to

figure out ways to get more people here, not cars.” The study recommended, among other things, the imposition of parking maximums instead of minimums at residential developments that have good transit service.⁷

Rental Turnover Days

A survey in 2004 found that rental turnover days on the Outer Banks are as follows:

- Saturdays 65%
- Sundays 34%
- Fridays 1%

Based on the results of the survey, it was estimated that the rental industry alone puts about 2000 vehicles on the road for cottage cleaning purposes on turnover days.

The subcommittee of the Transportation Task Force that is addressing this issue should continue its work to explore whether a better balance could be achieved in the turnover days. To the extent that a significant amount of Saturday turnover could be shifted to Sunday or Friday, this could have a substantial positive impact on the traffic congestion that occurs on Saturdays.

Educational Programs

If visitors could be persuaded to bring fewer cars to the Outer Banks, this could result in a significant reduction in traffic. For example, based on the approximately 12,000 rental homes on the Outer Banks, if each would involve one less vehicle, NCDOT has stated that this could have a noticeable impact on vehicle trips, especially on Saturdays.

Rental agencies and hotels could provide information that encourages visitors to bring fewer vehicles, e.g. information about available transit services. The Outer Banks Visitors Bureau could put similar information on its website. More carpooling could be encouraged while on the Outer Banks. In addition, information could be provided that would describe the times and places where serious traffic congestion occurs and the best way to avoid them.

Land Use

Another strategy for reducing trip demand is to use land use planning and zoning to encourage the kinds of development that encourage more use of non-automobile travel. One example is to allow and encourage mixed-use development in selected areas. Mixed-use development typically involves a combination of land uses in a particular area, e.g. retail, hotels, condominiums and parking decks. To the extent that visitors don't need to get in their cars to reach stores or restaurants, vehicle traffic is reduced.

Of course, this approach can be controversial. A proposed 11-building mixed-use development in Carolina Beach, NC has generated a great deal of local controversy, in particular because the proposal includes three 130-foot tall buildings that many believe would change the area's laid-back, middle class character and start turning it into another

⁷ Marisa Lagos, *Study: If There is Parking, They Will Come*, The San Francisco Examiner, July 28, 2005.

Myrtle Beach.⁸ However, it doesn't have to be either/or—either laid-back or Myrtle Beach. A reasonable middle ground ought to be possible, particularly if it is limited to certain areas.

Organizational/Institutional

The Outer Banks is a very special area in a larger geographic region that has widely varying needs and priorities. It spans three counties, many towns and villages, several National Park Service/National Seashore/Wildlife Refuge areas and facilities, and over 100 miles of wonderful ocean beaches. Its character and needs are often quite different than those found on the mainland of each of the three counties. As the Outer Banks continues to develop and to attract more visitors, its transportation needs and problems are going to greatly increase unless they are aggressively managed.

Each of the counties currently has a limited public transportation system, each system serving mainly riders with limited mobility due to age or disability. Currituck County is part of the five-county Inter-County Public Transportation Authority--ICPTA (in addition to Currituck, the other member counties are Camden, Chowan, Pasquotank, and Perquimans). It operates 26 vehicles. Dare County Transit operates a small system with seven vans. Hyde County Transit operates six vans. Each of them is limited to public transportation—not highways, and not bicycle or pedestrian (or water) transportation.

In order to provide a better focus on Outer Banks transportation issues, it is recommended that the formation of a Transportation Management Association (TMA) be considered. This kind of organization is typically formed as a non-profit agency and includes members from both the private and public sectors. The advantages of a TMA are that it can be established for a specific geographic area (that may not conform to existing governmental boundaries), it can address multi-modal transportation issues (e.g. highways, transit, and bicycle/pedestrian), and it encourages collaboration between multiple private and public stakeholders. Moreover, TMAs usually have a small staff that brings day-to-day attention and continuity to the issues. A more detailed description of TMAs is included as Appendix 10. (Incidentally, the Outer Banks Transportation Task Force would seem to provide a good starting point or model for forming a TMA.) The boundaries of a TMA would be matter for local determination but could include the entire Outer Banks portion of the three-county area.

Another alternative for Dare County to consider is joining a multi-county regional transportation system. One possibility would be to look into joining the existing five-county ICPTA system. Another possibility would be to consider forming a new regional system, an approach being encouraged by NCDOT/PTD's current "regionalization" effort. For example, Dare and Hyde Counties might together create a new two-county authority. Alternatively, a four-county system might be created that would include Dare, Hyde, Tyrrell and Washington Counties.

⁸ Steve Hartsoe, *Plan Splits Town*, News and Observer (Associated Press), February 25, 2005.

Creating a TMA or joining a larger regional system should not be considered mutually exclusive. They each serve different purposes. One of the benefits of a regional system is that it could provide access to additional state and federal funding. However, a larger regional authority would not be apt to have the same priorities as an organization focused specifically on the Outer Banks. In addition, a regional authority would be limited to providing public transportation services, not addressing multi-modal transportation issues.

APPENDICES

Appendix 1--Outer Banks Transportation Task Force Members

The Transportation Task Force is made up of a number of Outer Banks individuals who represent a variety of community and business interests. The members are listed below.

Designated Seats	Task Force Member	Email Address
Town of Manteo	Kermit Skinner , Manteo Town Manager	skinner@townofmanteo.com
Town of Nags Head	Anna Sadler , Nags Head Commissioner	anna@brindleyandbrindley.com
Town of Kill Devil Hills	Ray Davis , Kill Devil Hills Police Chief	rldavi@kdhnc.com
Town of Killy Hawk	Gary McGee , Kitty Hawk Town Manager, or designee	bgmceel@charter.net
Town of Southern Shores	Carl Classen , Southern Shores Town Manager	cclassen@southernshores-nc.gov
Town of Duck	Christopher Layton , Duck Town Manager	clayton@townofduck.com
Dare County Board of Commissioners	Cheryl Byrd , Dare Co. Commissioner	bvrd@beachlink.com
Outer Banks Visitors Bureau	Sammy Moore , Dare County Tourism Board	sammvsl@charterinternet.com
Outer Banks Chamber of Commerce	Jody Crosswhite , Outer Banks Chamber of Commerce	forbescandies@msn.com
Outer Banks Association of Realtors	Kevin Schwartz , Outer Banks Association of Realtors	kevinschwartzobx@earthlink.net
Outer Banks Restaurant Association	Randy Carlisle , OBX Hotel/Motel Association	randy.carlisle@hotelsobx.com
Currituck County Board of Commissioners	Dan Scanlon , Currituck County Manager	dscanlon@co.currituck.nc.us
Roanoke Island Business Association	Pat Morrissey , Roanoke Island Business Association	patemorrissev@aol.com
At Large Business Member #1	Ralph Buxton , Business Community Representative	ralph@khsports.com
At Large Business Member #2	Sandy Morrison , Business Community Representative	sandybeachtours@earthlink.net
At Large Business Member #3	Lori London , Outer Banks Association of Realtors	lori@vacationouterbanks.com
At Large Business Member #4	Debbie Moore , Business Community Representative	dfmoore@tangeroutlet.com
Public At Large Member #1	Nancy Bellantine , Outer Banks Pathways	njbellantine@earthlink.net
Public At Large Member #2	Danny Couch , Hatteras Island Citizen Representative	dccouch@pinn.net
Currituck County Chamber of Commerce	Willow Winterling , Currituck Chamber of Commerce	willow@maxminn.net
Build the Bridge Initiative	Gwen Cruickshanks , Build the Bridge, Save our Roads	gwenllvn@earthlink.net
	Jerry Reveling , Colington Island Homeowners Association	
	Buck Thornton , Business Community Representative	

Appendix 2--Summary of Community Meeting Results

From Mon. March 7 - Weds. March 9th, the Outer Banks Transportation Task Force and the ITRE/NCSU team conducted a series of five community meetings that were held throughout the Outer Banks in order to obtain community input on perceived transportation problems in the area. Approximately 100 people attended the meetings which were held in Southern Shores, Buxton, Manteo, Corolla and Nags Head. The meetings had two primary objectives: 1) to identify and rank key transportation problems on the Outer Banks; and, 2) to begin developing potential solutions.

To accomplish these objectives, a three step process was used at the meetings:

1. Participants were asked to describe transportation problems at the Outer Banks. The problems were listed on flip charts at the front of the room.
2. Participants were then asked to rank the problems using a multi-voting process. (Each participant was given five “sticky dots” to use in voting for what they considered to be the most important problems. A participant could cast all five votes for one problem, one vote for each of five problems, or some combination thereof). Not all problems listed received votes.
3. Finally, in the time remaining, participants were asked to brainstorm possible solutions to the top-ranked problems.

Problems

The following table summarizes the ranking of the problems:

	So. Shores	Buxton	Manteo	Corolla	Nags Head	Total
Problem Category	# Votes	# Votes	# Votes	# Votes	# Votes	# Votes
Highway design and congestion issues	59	9	16	11	46	141
More bicycle and pedestrian facilities are needed	27	21	5	16	4	73
Inadequate traffic signage and information	15	8	0	2	16	41
Local vs. through trips, speeding, shortcutting, lack of alternative routes	21	5	11	0	0	37
Lack of public transportation alternatives	8	0	4	7	8	27
Need for better maintenance of transportation facilities	7	10	0	10	0	27
Traffic signal problems	5	0	5	5	5	20
Workforce transportation problems	5	0	4	2	5	16
Truck-related problems	9	0	1	1	4	15
Misc.	5	3	10	12	7	37

It should be noted that at the Southern Shores meeting more than 50 votes were received in favor of building the Mid-Currituck bridge. However, this particular transportation issue is the subject of another, more extensive study, not this one.

The problem categories are described in more detail below:

- *Highway design and congestion issues*--traffic congestion problems (esp. on Saturday in Currituck County); congestion and confusion at the intersection of NC 12/US 158 in Southern Shores; an excessive number of curb cuts (entrances/exits to the main roads); a need for traffic “calming” in towns from Whalebone to Hatteras on NC 12; the Midway intersection on Roanoke Island; the unsafe center turn lane on US 158; the need for additional left-turn lanes and right-turn deceleration lanes; and, the creeping width of some driveways.
- *More bicycle and pedestrian facilities are needed*—additional bicycle and pedestrian facilities are desired; also, the safety and maintenance of these facilities needs to be improved.
- *Inadequate traffic signage and information*--difficulty in “way finding”, esp. for first time visitors; a need for larger, more easily readable street signs; improved and additional mile-marker signs; more advance warning signs for major points of interest; better highway illumination.
- *Local vs. through trips, speeding, shortcutting, lack of alternative routes*--conflicts between local and through traffic; speeding through villages; use of local streets as shortcuts to avoid highway congestion; lack of alternative routes to some attractions/businesses.
- *Lack of public transportation alternatives to the use of private autos*--a lack of public transportation to locations on the island and to points on the mainland.
- *Need for better maintenance of transportation facilities*—improved highway drainage to avoid standing water after storms; better clearing of highways and shared-use bicycle and pedestrian paths after normal storms (vs. major storms such as hurricanes).
- *Traffic signal problems*—e.g., poor traffic signal coordination on US 158.
- *Workforce transportation*—many employees have difficulty reaching employment locations.
- *Truck-related problems*—speeding; use of left lanes at traffic lights on US 158 (slowing down all traffic accelerating from stop lights); conflicts and delays from service vehicles using or parking on or near roads during peak traffic times.

The *Miscellaneous* category includes such reported problems as:

- Long, narrow commercial strips that force people to drive more to reach stores, etc.
- Stoplight enforcement needs to be increased.
- Poor design of beach parking creates traffic problems.
- Lack of coordination between NC DOT and the U.S. Park Service regarding the repair of storm-related breaches in the dunes.

- “No planning.”
- Road flooding/overwash, esp. at Pea Island (where the road is below sea level).
- Lack of use of water transportation as a transportation resource (e.g. water taxis).
- Lack of dollars for needed transportation improvements.
- Lack of efforts to get people out of cars, e.g. through ridesharing.
- Development patterns (and the Outer Banks geography) encourage people to bring and drive cars. Development is continuing—residential, commercial and tourist attractions.
- Insufficient coordination between storm water and transportation planning.

Potential Solutions

Potential solutions brainstormed by the meeting participants are summarized below, grouped, to the extent possible, according to the major problem categories identified above. (In brainstorming, all ideas are listed. There is no attempt to evaluate them as either good, bad or indifferent.)

Highway design and congestion issues

Redesign 12/158 intersection (in Southern Shores)

- Signals at intersection should be rethought
- Extended left-turn lights for northeast-bound Southern Shores traffic (Hatteras Island traffic passing through Kitty Hawk tends to be west-bound until noon Saturdays—10AM checkout time—and east-bound thereafter)
- Dedicated turn lane with anti-swap barrier on Saturday afternoon and evening (lane swapping in the turn lane aggravates the congestion)
- Use of current left-turn lane on NC 12S as a through lane
- Left turn on NC 12 south for beach road narrows the road to one lane effectively
- Having 2 lanes south and 2 lanes to 158 west would help flow
- Eliminate NC 12 south connection to eliminate 2nd traffic light
- Change signage that is confusing
- The turn into Crown gas station blocks traffic—prohibit southbound traffic on NC 12 from turning left into Crown and onto beach road
- DOT is studying a grade separation/flyover

158 center lane problem

- Grass median with center turn lanes at strategic locations
- Use 3/2 split in traffic—changeable direction for center lane
- Median should include storm water swales (or drains underneath?)
- Dedicated left arrows for u-turns
- Roundabouts

158 deceleration lanes for right turns

- See hospital, OBX Mall for examples
- More important for intersections without traffic lights than intersections with them
- Villa Dunes is one location that needs one

158 curb cuts—too many

- Create a service road in right-of-way parallel to 158 (as in Virginia Beach)
- Reduce number, close some cuts
- No left turns (3 rights to make a left)

Midway Intersection (Roanoke Island)

- Lower speed limit to 45 (from 55)
- Lower speeds on Virginia Dare bridge, post warning on bridge re: Midway traffic light
- Roundabout study (“serious study”); study additional “calming” methods
- Cloverleaf (grade-separated)
- “Peel off lane” separation for right turn from Manteo (Bus 64E) to Mann’s Harbor (64 W)
- Better directional, informational signs in advance of intersection, e.g. alerting motorists of Manteo activities (esp. needed for CVS-related traffic)
- Right turn traffic into Manteo does not need to stop but often does; need signs to tell motorists to “keep moving”
- Move Twiford Rd. to align with Justice Center entrance; add new light

Rental turnover days create congestion (now about 65% on Sat., 34% on Sun., 1% on Friday)

- Change turnover dates (more on Fri/Sun, less on Sat) (this may create a staffing issue--hard to get cleaners to come on Friday when they have a weekday job, or on Sunday when they have church)
- Survey businesses re vacation schedules (i.e. find out how many businesses would allow a Friday vacation start)
- Shorter vacations?

Whalebone to Hatteras area

- Plan NC 12 for passing and turning traffic; need big picture, perhaps with outside expert assistance
- Define passing areas better in towns
- Offer incentives to developers to encourage cooperation
- Center turn lanes needed in villages at specific locations (e.g. Comfort Inn and Red Drum area in Buxton); could cause problems with businesses that have limited parking along roads
- Business parking should be outside of right-of-way
- Improve design standards to encourage good road behavior
- Organize community committee to promote implementation of design—there is power in numbers
- Traffic “calming”, e.g. “bulb-outs”, in appropriate areas, or narrowing the road visually to reduce speeds

Southern Shores to Corolla area

- More left turn lanes on NC 12--add left turn lanes, particularly in S. Shores where houses front on NC 12 (there are 492 left turn opportunities on 12 to the Currituck line)
- Limit left turns to certain hours

- Duck is 3 lanes—extend? (dangerous?)
- Rotaries to reverse direction
- Signs to encourage “better behavior”

More bicycle and pedestrian facilities are needed

- Build more facilities
- Identify them—routes not marked; need signs on Wright Brothers bikeway
- Provide bike maps
- Better, more durable surface—concrete, not asphalt
- Lights needed, perhaps solar powered—safety at night
- More bike paths in Colington area would help
- Get homeowners involved (perhaps with dollars from Homeowners Assocs.?)
- Scenic Byways group should get involved
- Need special tax—TIF district (Tax Increment Financing)
- Do before/after sketches to illustrate changes that could take place
- Ask planning board (Dare County) to include bicycle facility requirements in development plan approval process
- Establish bike routes (not just paths)—community transportation system; get concepts across to community and develop community spirit
- Paint bike symbol on bike route surface
- Address as part of storm water management actions; look at storm drains when investigating bike routes/paths
- Buxton and Hatteras Village need to deal with drainage before building bike path
- Develop new path on Airport Road (Roanoke Island), but off the road (utilizing private property as much as possible)
- “White” bikes (public bikes made available to the public)
- Lack of access to beach from Roanoke Island due to unsafe crossing of Baum Bridge
- Duck—relocate bike paths to Sound?
- No path in Corolla, other locations (6-mile gap in Corolla)
- Widen at specific locations in Duck area, add road crossings
- Separate bikes from pedestrians—a painted line to separate, or develop separate paths for bikes and pedestrians as in Minneapolis
- Recognize that avid cyclists prefer roads to paths and won’t change
- Pedestrian overpasses on 158
- Whalebone to Hatteras: develop bicycle/hiking paths through each town, connecting secondary roads by bike paths as a continuous trail separated from NC 12

Inadequate traffic signage and information

- ¼ mile markers
- Larger signs
- Better, more visible building addresses/numbers
- Big diagram/map of 12/158 options at end of bridge (Wright Memorial)
- Need some kind of warning sign or signal on the Wright Memorial Bridge to warn motorists that there is a traffic light about 200 hundred yards ahead

- Mile markers at every intersection (e.g. 6.2, 6.3)
- Make numbers, mile markers consistent at all locations (Kitty Hawk, KDH, Nags Head have common street numbering system; S. Shores not included)
- Message board on mainland side of Wright Memorial bridge to alert tourists to turn left at NC 12
- Bigger, better signs at intersections
- Mile markers at 1/10 mile intervals
- Consistency between mile markers on NC 12 and US 158
- Less sign clutter
- Overhead street names across 158 intersections (on traffic light booms) (could these also contain mile marker info?)

Note: According to a meeting participant, DOT has appropriated \$ for new mile marker signs on U.S. 158 and NC 12 from Wright Memorial Bridge to Whalebone—will be larger and more uniform re locations

Local vs. through trips, speeding, shortcutting, lack of alternative routes

Shortcutting on Dogwood (in Southern Shores)

- MapQuest directions suggest Dogwood shortcut—get them to change (attempts to work with MapQuest were said to have been unsuccessful--very difficult to contact them)
- Speed bumps
- Sat. only--no left turns from main roads onto Dogwood
- If 12/158 intersections were fixed, then traffic wouldn't use back roads
- Lights to north to control flow; sensors
- Close Dogwood to through traffic
- Have a police checkpoint on Dogwood (done a few times but blocks local traffic as well as short-cutters)
- Need new bridge

Speeding—Whalebone to Hatteras area

- Enforcement inconsistent—need more presence of state troopers
- Better warnings at entrance to towns, at speed changes
- Better town entry designs/signs—“history,” “welcome”
- Traffic calming in towns
- Have each subdivision put up a sign

Airport Road, etc (on Roanoke Island)

- Develop connecting road(s)—Etheridge Rd to connect 64 and airport; go around perimeter of airport from UPS to airport
- Create alternate “back routes” for local traffic, let tourists use 64
- Separate commercial connection from 64
- Educate public re: benefits of additional connections
- Expand use of road classification system (primary, secondary, etc.)
- Lower speed limit on Airport Road to 25 MPH on the curve approaching the Aquarium; erect a warning sign “Reduce Speed Ahead”

Buxton/Frisco area

- Develop, widen and signpost the Buxton back road as a bypass route for transit, ferry and EMT traffic with appropriate interchanges on NC 12.
- By 2020, develop an *Open Ponds Parkway* from the Lighthouse to Billy Mitchell airstrip on US land as an alternative, scenic bypass for traffic.

Lack of public transportation alternatives to the use of private autos

- Corolla-style small area systems seem to work well
- Make it easy with frequent, visible service
- Wright Bros. Centennial Celebration transportation worked well—analyze how that was done
- Well-designed stops with sidewalks, good access
- Transit is needed from this area to off the island
- Trolley system for local movement (trolleys must be accessible to disabled)
- Jitneys using 8-9 passenger vans—greater frequency
- Bus/public transportation to other destinations (Eliz. City, Columbia, Norfolk)
- Trolley with tour guide (“park your car and forget it”)
- Can Gray Line, etc. be induced to serve Outer Banks?
- Park-n-ride lots
- Routes short enough to keep on schedule; operate in loops
- What about bike and kayak racks on buses?

Need for better maintenance of transportation facilities

Whalebone to Hatteras area

- Use native plants/vegetation at side of roads that won't die
- Lobby for additional \$ for storm maintenance from non-major storms (separate from regular maintenance budget)
- Use DOT road sweepers more regularly
- Better signs re: passing on right; also paint on road surface
- Include traffic rules, etc. in rental flyers (“rules of road”)
- Keep trash cans in correct locations—if left on shoulders they get blown around (realty companies should be responsible?)

Traffic signal problems

- Traffic lights need to be linked at all locations
- Create traffic control center that could override computer-controlled signals (from Arch St? to Whalebone, signals are interconnected and programmed by a controller in Raleigh)
- Longer greens for 158 side streets, esp. Colington/Ocean Bay Blvd.
- Provide a walk cycle to allow a longer time for pedestrians to get across 158 without getting trapped midway
- Grandy has two lights that create backups—these need to be better synchronized
- Need to get delay between red and green on cross-traffic signals

Workforce transportation problems

- Employers' bus service (looked at before, from Eliz. City, but employers balked at high costs)
- Provide public transportation, more bike paths

Truck-related problems

- Restrict trucks to right lanes only; consider fines
- Crack down on speeding trucks (sand trucks paid by the load; this encourages speeding) (Sand trucks primarily an off-season problem—will cease in April, resume in November)
- Designate and enforce truck routes
- Encourage night time vs. daytime deliveries
- Provide incentives to shift delivery times (Dare County has rescheduled garbage pickup on NC 12 to start shift at 3AM)
- Study/educate vendors to shift delivery schedules
- Stagger work hours, flex schedules

Misc.

Water Transportation

- Water taxi—Manteo to Kitty Hawk, Kill Devil Hills, Duck
- Also stops at Roanoke Island attractions—Festival Park, Gardens, etc.
- General use
- Floating stores
- Provision for putting bicycles on water taxis

Lack of Rideshare/Transportation Demand Management (TDM)

- Encourage/coordinate carpools (e.g. an Internet “ride board”)
- Rideshare service
- More vans—grant program to encourage formation
- Passenger ferries (businesses that were once surveyed were willing to furnish transportation between workplace and dock)

Continued Growth/Development:

- Better planning
- Reduce # of cars brought to area
- Limit parking, enforce rules (coordinate with rental industry)—will require changes to local ordinances (rental industry in Corolla area has voluntarily published guidelines for 1 car/bedroom with a max of 5 cars/building)
- Corolla has no on-street parking in most of community—has been a problem with parking of RVs overnight

Lack of Planning/Policy Development Coordination—NCDOT and Local Governments

- Public exposure of situation—report
- Task Force to request meeting with key actors/stakeholders

- Get DOT to change mindset, structure (DOT regards itself as the expert, is reluctant to work with locals)
- Better communication with DOT—get local input, share with locals
- Meet/communicate more with Stan White (Board of Transportation member)
- Get local governments to coordinate local plans and standards—common approach. Get on mayors', managers' agendas.
- Develop local public pressure; utilize the media
- Get local/DOT consensus on thoroughfare plan--last adopted/approved in 1972 (or 1974?)
- Provide matching \$ for plans/implementation (grants, etc.) in order to lure DOT to table
- Insist on DOT transparency
- Open books on all information

Other

- Get more info on funding--what's available, how to get it, etc.
- Think about intermodal ways to move people and do it in a fun way, e.g. Okracoke Ferry is unusual and part of the attraction of going there
- Bridge on 158 over intracoastal waterway in Currituck has reflectorized markings; Baum Bridge does not. Request has been made to NCDOT but to no avail.
- Better air service/linkage to airports (charter flights to Billy Mitchell, Manteo; vans to airport); have realty companies operate shuttles to major airports
- Local airports need runway expansion; upgrade Manteo airport and/or extend Billy Mitchell runway by 1000 feet to accommodate small commercial commuter planes and "sports charters"
- Education: use local cable TV/public access TV, radio, flyers in realty company materials
- Encourage more highway "adoptions" to improve cleanup
- Speed limit on 158--DOT won't lower; get DOT to stop considering it as a throughway
- Create remote parking on west end of Roanoke Island; provide EZ Pass/Trolley option--(require visitors to buy a \$50 EZ pass (a day?), or to park there and take trolley (free for residents)
- More education/outreach to public
- Dare/Currituck Counties to study/address public transportation (Currituck County has occupancy tax surplus that might be used for this?)
- Develop a free Rideshare/Safe-ride program for kids and pedestrians, especially for Avon, Waves-Salvo, with cooperation from bars, restaurants and entertainment providers (kids, cyclists and pedestrians on NC 12 snarl traffic and create safety problems, especially at dusk and after restaurants and evening entertainment ends)

Appendix 3--Outer Banks Transportation Symposium

RAMADA INN—KILL DEVIL HILLS

OCTOBER 12, 2005

SUMMARY

GENERAL SESSION

The following comments and questions were made following the general, large group presentation by the study team.

1. Colington Road area—no transit solutions/routes were proposed for that area, which is relatively distant from the loops proposed to operate on US 158. Why is this, and is any transit service proposed for that area? Cheryl Byrd responded that NCDOT is currently conducting a study of that area. The study team responded that that concern was not voiced in the March 2005 meetings, or was not ranked by meeting participants as a high priority issue.
2. Trolley hours of service—how were the recommended service hours (6 am – 10 pm) derived, and why are those hours proposed? It was explained that there was a need to start service prior to the opening times of businesses, in order to transport employees to their jobs, and a desire to run into the evening in order to provide employees with transportation back home, as well as to provide transportation home for visitors who dine at area restaurants.
3. Incident management—the recommendations do not address any strategies for this. There can be huge delays on the bridges during Saturday turnovers, and any accident or incident can add substantially to those delays. Why was this not addressed? The study team responded that that concern was not voiced in the March 2005 meetings, or was not ranked by meeting participants as a high priority issue.
4. Trolleys—speed limits in the Virginia Beach area are lower than in the Outer Banks, particularly on US 158, and there have been problems maintaining schedules in Virginia Beach. Won't there be problems here with stacking of buses? Also, experience from the First Flight Centennial Celebration showed that businesses along bus corridors lost business from patrons whose buses ran from park-and-ride lots directly to the Wright Memorial grounds without any stops en route. Is it likely that businesses along the trolley routes will share similar experiences from patrons of the trolleys?
5. Will there be delays to traffic, particularly on NC 12 from trolleys stopping to board/deboard passengers at beach stops? The study team responded that that is a concern that will need to be addressed as more detailed investigation of transit routes is conducted.
6. Have any surveys been done on area transportation patterns as part of this study? The study team responded that the project budget and scope did not include that activity, but that surveys could be conducted as part of future work.
7. Has the study team been in contact with NCDOT staff about this study? Study team members mentioned interaction has taken place with Miriam Perry and Charles Glover of the Public Transportation Division, Division of Bicycle and Pedestrian Transportation staff, and Congestion Management Unit staff, and with local Division staff.

8. No mention was made of local funding for the bus. Won't that be required, and if so, at what level? The study team responded that discussions are being conducted with Public Transportation Division staff about funding, and that some local funds will be required. The Transportation Task Force and other groups will need to address that question in the future.
9. Doesn't the Tourism Bureau mitigate adverse impacts from tourism in the area? Not necessarily, particularly with regard to transportation problems.
10. What are the Right of Way (ROW) requirements to make US 158 into a Superstreet? Is the current ROW adequate? The study team responded that the current ROW is 150 feet, which should accommodate a Superstreet.
11. Some areas of US 158 have curb-and-gutter construction, and other areas have drainage swales running parallel to the shoulders. Can drainage swales still be accommodated with a Superstreet, or would that require curb-and-gutter construction? The study team responded that drainage swales could be placed in the median, but it would be likely that curb-and-gutter construction would be required.
12. Why do the proposed trolley loop routes run counterclockwise? It would appear that this will require trolleys to make left turns, whereas a clockwise route would result in right turns, which would involve less delay. Also, it was suggested that if a through Corolla to Manteo route were to operate, vehicles on that route could collect passengers from the loop routes at selected transfer points, and that the through route would be more convenient for Corolla and Duck travelers. This participant also questioned if Colington Road residents would have to drive to a trolley stop on US 158. The study team responded that counterclockwise operation would facilitate access to major trip generators/destinations along US 158, many of which are located on the west side of that highway, and to the hotels, condos and beach access areas on the east side of NC 12. Additional study of serving residents of the Colington Road area may be required.
13. One participant remarked that he rode the bus during the First Flight Centennial Celebration, and that there were never more than eight passengers on the vehicle at any time. He wondered if there would be sufficient ridership to warrant trolley operation. The response was that while there may have been periods with relatively little ridership, there were also periods of operation at full vehicle capacity, and that fluctuations in ridership levels are a normal part of any transit operation.

SMALL GROUP BREAKOUTS

Public Transportation

In general, participants in the public transportation small group breakout sessions were in favor of the proposed trolley bus service. Several participants emphasized that whatever service is provided, it should be "done right." However, it was recognized that there are many issues that need to be worked out as more detailed planning for the transit service proceeds, e.g. what are the exact streets that will be used, what hours will the buses operate, where will buses stop, how far will it be in between stops, will buses stop "on demand," where will the transfer points between routes be, etc.? As one participant noted, "the devil is in the details."

Highlights of the comments made, questions asked and issues raised are highlighted below.

Routes

- It was believed that the four proposed routes will capture the areas of high tourist activity.
- Colington Road/Ocean Bay Blvd. may be a bad location for the proposed transfer point for the northern and southern loop routes. The intersection with US 158 is highly congested at many times of the day.
- Places on US 158 and NC 12 will have to be available for the buses to pull off. Otherwise traffic will back up.
- Concerns were raised about the distance between stops. They will need to be conveniently located—people won't walk a long distance to get to them.
- A question was raised about whether the buses would stop at locations other than stops. (It was pointed out that in many similar services buses will often stop “on demand” to let people on or off—assuming that it can be done safely.)
- It was pointed out that people using the buses to get to beach access locations will take extra time to load/unload beach paraphernalia.
- One participant provided a detailed route proposal that involved a system of 12 trolley buses operating between Southern Shores and Whalebone Junction—six providing express/short hop loops, four providing longer loops, and two providing express service on a single long loop from one end to the other.

Service Levels

- Some comments were expressed about 30 minutes being too long to wait between buses. More frequent service would be more convenient and would attract more riders. (It was pointed out that more frequent service is also more expensive; for example, service every 15 minutes would cost twice as much as every 30 minutes. A balance has to be struck between convenience, the number of riders, and the amount of funding available. In addition, it was pointed out that if schedules are readily available, riders can plan to get to the stop just before the bus arrives and therefore not have to wait long.)
- Service frequency might be adjusted. Rather than 30 minute intervals all day, service might be more frequent during periods of high usage, and less frequent at off-peak times.
- Bus schedules must be clear and readily available so that riders understand and can plan for the 30-minute service intervals.

Service Hours

- One participant suggested that the target markets needed to be studied in more detail. For example, it may be that employees don't need to ride as early as 6 AM, or may need service after the proposed 10 PM quitting time.
- This might also apply to seasonality—more hours of service might be needed in June, July and August, less hours in May and September.

Vehicles

- The proposed use of trolley buses was well received.
- One suggestion was to use smaller 15-passenger vans that would operate more frequently as a way of reducing costs and increasing convenience (and also facilitating making turns into bus stop locations, etc.). (It was pointed out that most of the cost of providing service is the driver, not the vehicle.)

- The buses should be able to accommodate bicycles, surfboards and beach equipment (coolers, beach chairs, etc.).

Target Markets

- Several participants pointed out the importance of clearly determining what riders are to be served. (It was pointed out that the primary rider target is tourists, followed by seasonal employees and residents without access to cars.)
- One participant suggested that if tourists are the primary target market, perhaps they should pay for the service.

Fares/Funding

- In response to a question about funding, it was mentioned that funding for vehicles and other capital equipment is typically funded by 80% federal funds, 10% state, and 10% local.
- The proposed service of four routes would likely cost about \$500,000 annually to operate if operated by a private contractor. This could come from a combination of federal, state and local funds (including fares). Discussions about funding are currently being held with officials from the NC DOT Public Transportation Division.
- A decision has not yet been made as to whether fares will be charged, or if so, how much they would be. (Fare revenue would reduce the amount of local public funding needed.)

Parking

- It was pointed out that an abundance of free parking will not give people an incentive to use the transit service.
- Because beach parking is limited, transit service is needed.
- Park-and-ride facilities could be useful in combination with bus service to congested areas. There might be a charge for the parking and parkers could then ride the bus for free.

Other

- Service hours, frequencies and/or routes can be adjusted as experience is gained on how many riders are using the service, where they are getting on and off, and at what times.
- It will be important that adequate education and information about the service be provided.
- Alternative fuels/vehicles should be explored (e.g. biodiesel fuel, or hybrid-electric vehicles).
- Transit service will provide an alternative to drinking and driving.
- Water taxi service should be considered between Roanoke Island and Bodie Island. However, there are no obvious terminal points on Bodie Island.
- It will be important to get the commitment of all the governments involved.

Bicycle and Pedestrian

Two breakout sessions were held to allow discussion of current conditions for bicyclists and pedestrians in the northern Outer Banks, identify areas of high need and to brainstorm on ways to make the area more conducive for walking and bicycling.

Approximately 20 people attended both sessions with good representation from communities throughout the area. Lively, free-flow discussion took place in each session.

Four main topics of discussion evolved – 1) the identification of specific locations of high usage / high need; 2) the conflicts between user groups at both on-road locations (bicyclists and pedestrians vs. motorists) and off-road locations (bicyclists vs. pedestrians and other users); 3) funding the planning and construction of projects and the processes for applying for these funds; and, 4) facility construction standards and guidelines. Each topic is discussed more fully below.

High Use / High Need Locations

In general, it was noted that more facilities should be built to meet current and future needs and to create a complete system of facilities throughout the region. The need to accommodate tourists is well-recognized, but attention must be given to residents' needs and the needs of a special sub-group of foreign workers (mostly students) who come to the area and do not typically have access to motorized transportation. The following specific locations were identified as needing bicycle and/or pedestrian improvements and are listed below from north to south:

Duck

- Improvements/upgrades to existing facilities along NC 12
- Development of a soundside boardwalk pedestrian facility through the Town of Southern Shores
- Better crossings of NC 12 for pedestrians
- Better signage on NC 12 to warn motorists of the presence of pedestrians in crosswalks
- Consider pedestrian overpass on NC 12

Kitty Hawk

- Implement regular removal of sand and/or retention of dune to keep wide paved shoulder on NC 12 clear for use by bicyclists

Kill Devil Hills / Colington

- Widen and straighten Colington Road to improve safety of bicyclists currently using the road

Manteo

- Upgrade existing facilities along US Business 64 to meet standards

Nags Head

- Consider building a pedestrian overpass over US 158 in Nags Head
- Upgrade facilities to meet national and state standards

Hatteras Island

- Provide safe places for families to bicycle and walk
- Designate bicycle routes on interior village streets
- Build sidewalks

User Group Conflicts

Overview of pedestrian conflicts

Because there are few existing sidewalks in the region, pedestrians are forced to walk in the road or along the wide paved shoulders built for bicycle usage, which creates conflicts with both motorists and bicyclists. Marked and/or signalized crossings that favor pedestrians are also lacking, especially in the US 158 corridor, making it difficult to cross from residential areas on the west side of US 158 to beach areas on the east side, and from residential areas on the east side of US 158 to commercial areas on the west side. Discussion centered on the planning for and provision of more pedestrian facilities to reduce conflicts, enhance access, improve safety and encourage walking instead of driving.

Recently, the Town of Southern Shores installed a series of three marked, but not signalized, mid-block crosswalks within an approximately one-mile section of NC 12. Unfortunately, motorists generally do not stop for pedestrians in these locations despite the fact that the NC Motor Vehicle Laws require motorists to do so. Several ideas were put forward to mitigate this problem. Awareness of the law could be enhanced by installing signs at the northern and southern approaches to the crosswalks stating that pedestrians legally have the right-of way. Speed limits could possibly be reduced to 35 mph within the area, especially during the summer months.

A network of off-road shared-use facilities has been built in the region. In some cases, the facility was not built to the AASHTO and NCDOT standard minimum width of 10 feet. This narrow width causes user conflicts between pedestrians and bicyclists. Some bicyclists, especially the more avid ones, choose to ride in the road. This then causes irritation and/or conflicts with motorists who believe that bicyclists should use the off-road facility. Bicyclists are not required to do so as bicycles are legally considered “vehicles” and have a right to ride on the road. The area of conflict where this is especially troublesome is in Duck. Discussion focused on the obvious solution - bring the facilities up to standard. Funding and right of way are issues that would have to be resolved. Another suggestion was to raise awareness/enforce the laws.

Overview of bicyclist conflicts

Conflicts between bicyclists and motorists are most prevalent along roadways where bicycle improvements have not been built, where traffic volumes are high and where roads are narrow. Specific areas that were noted in the breakout sessions included Southern Shores, the US 158 corridor and Hatteras Island. Issues raised are as follows:

- The municipal streets in Southern Shores are very narrow, making it difficult for bicyclists and motorists to share the road. Widening the roads is not a good option as this would require taking additional right-of-way which most residents would not favor.
- It was generally agreed that US 158 is not a good corridor for bicycle travel due to the high volumes of traffic and lack of bicycle accommodations and some felt that bicycling should not be encouraged there.
- Although there is a wide paved shoulder provided for bicyclists along most of NC 12 on Hatteras Island, local residents do not typically bike there. Motorists

frequently use the paved shoulder to pass cars waiting to make a left turn. It was reported that people have been killed as a result of this behavior, resulting in residents no longer bicycling along this roadway.

Funding for Bicycle and Pedestrian and Bicycle Facilities

There were many questions raised regarding the availability of funds to build new facilities and upgrade existing facilities. In particular, participants wanted to know more about how to seek DOT funds. In addition, a question was raised as to whether funds were available to develop plans for bicycle and pedestrian facilities. Clearly, municipal officials and citizens alike need more guidance on these issues.

State and Federal Guidelines for Constructing Bicycle and Pedestrian Facilities

There were also a number of questions related to the standards that apply to the provision of bicycle and pedestrian facilities and why they are important. Some guidance on these issues is desirable.

Traffic Solutions

The traffic breakout sessions were well attended. The discussions were lively and many people participated. Overall, the reaction to the ideas presented by the team was positive. Many people during the breakout sessions were asking for clarification on the ideas presented, particularly the Superstreet. During the sessions there seemed to be roughly equal interest in NC-12 through Duck, the US-158 and SR-1493 intersection, and US-158 corridor, while there was likely less interest in the Midway intersection. The summary below begins with the ideas offered for short term improvements and then presents the ideas offered for each of the four emphasis areas.

Short-Term Ideas

- A median on US-158 seems very popular.
- Provide better incident management.
- Provide stronger access management to minimize the number of full access sidestreets and driveways on major streets.
- Require exclusive left turn lanes on all new driveways and side streets on US-158.
- Stage all construction to avoid the Outer Banks' heavy tourist season if possible.

NC-12 Through Duck

- Roundabouts on either end of town could be attractive and functional for the next ten years or so.
- Bulb-outs to accommodate left-turning traffic could be placed on NC-12 through the Southern Shores area as well.
- The NCDOT will need a good set of traffic control devices to educate motorists on how to use a Superstreet (applies to other Superstreet ideas as well).

US-158, SR-1493, and NC-12 Intersection Ideas

- SR-1493 should bridge over US-158 to better fit the terrain and to allow easier crossing of US-158 by pedestrians and bicyclists.
- A cul-de-sac could be installed on NC-12 south of its intersection with SR-1493.

- The right turn from SB SR-1493 to WB US-158 should be made as far to the east as possible, since some of that traffic weaves quickly across US-158 to get to the Home Depot and other developments.
- A signal at Byrd Street (serving the Medical Center just south of the SR-1493 intersection) could provide good access from US-158 to and from NC-12 south of the main intersection.

US-158 Corridor Ideas

- Drainage will be an issue as US-158 is rebuilt.
- Many people in Nags Head prefer US-158 to have a more rural cross-section, with shoulders instead of curbs.
- Three stages were proposed: 1) install median with some one-way openings, 2) convert most of corridor to four-lane Superstreet using bulb-outs to keep median smaller, and 3) full six-lane Superstreet.

Midway Intersection Ideas

- Provide better warning devices (signs, flashers, etc.) on eastbound US-64 at end of new bridge approaching Midway intersection.

Transportation Demand Management (TDM)

Transportation Management Association (TMA)

- A TMA-type of organization is needed to promote cooperative efforts and to coordinate among various stakeholders.
- TMA members might be better chosen not as representatives from local municipalities, but to represent various areas of public and private interests.
- Determining how to fund a TMA will be a challenge.
- Care needs to be taken to see that new people are included on such an organization, and that only the “same old people” who have been/are active in the Outer Banks aren’t put on as members of that type of organization. Service organizations need to be involved in addition to/instead of local government representatives.
- The area needs to look into the future, and consider how a transportation authority at either the county level or at a regional level could help change transportation in the Outer Banks.
- There is a need for a full-time agency and staff to look at and to work with traffic statistics.

Mobility

- Foreign guest workers are a necessary component of the local economy, but can’t easily get around the area. Many guest workers come from places in which good public transportation is operated, and is taken for granted. They are very surprised when they get to the Outer Banks and discover how difficult it is to get around without a car.

How to Restrict Demand

- Place a premium on bringing cars.
- Allow only some predetermined number of cars per rental unit, and require procurement (purchase?) of a permit for any additional vehicles.

- Reduce the number of parking spaces available at rental houses, and publicize the number of available spaces, so visitors will know in advance of their trip what is expected. However, any limits to the number of vehicles should be phrased in a positive manner, to avoid discouraging visitors from choosing the Outer Banks as their destination. Perhaps a reduction in cars could be phrased as part of a message emphasizing the environmental friendliness of the Outer Banks, and that would promote the area as being “green.”

Shifting the Rental Turnover Schedule

- Arrival/departure dates/times and rain are the biggest causes of transportation problems. Since the private sector is largely responsible for establishing turnover dates/times, the private sector should share responsibility for solving the ensuing transportation problems, and should be actively involved in a Transportation Management Association.
- Incentives are needed to help shift rental turnovers from Saturday to Friday and Sunday. Without some form of incentives, turnover will continue at current levels on Saturdays. Incentives could also be used to hasten the shift.
- Information needs to be compiled on turnover days in order to better understand visitors’ abilities/desires to change their arrival/departure schedules.

Shared Use Parking

- It is a good idea, and can help to reduce the total number of parking spaces.
- If it is implemented, it will require effective local enforcement of regulations, to avoid problems with use of parking facilities by “outsiders” such as renters who need additional parking spaces to those available at their rental unit, and who are not patronizing the businesses.
- Shared-use parking should be encouraged, but will require agreements to be signed by all participating business owners/developers. Nags Head has had an example of this at Satterfield Landing, where offices and a bowling alley share parking. It has worked well at that location. Education on the mechanics of shared-use parking is needed.

Limiting Parking at Beach Accesses

- Use of shuttles from park-and-ride lots is a better solution than imposing parking restrictions at beach access parking areas.
- Conduct surveys at beach access lots to determine who is using the lots, from where they came, how they got there, etc. to better understand parking patterns.
- More beach access points are needed.
- Limiting parking by imposing a charge for parking at beach access lots would be cost prohibitive to many local residents (and to some visitors, particularly day-trippers from the area), who park in those lots to fish.

Mixed-Use Development

- Mixed-use development has been used in some areas, and could be applied to the area, but likely on a parcel-by-parcel basis due to the high level of development already in place.
- Mixed-use development will be difficult to apply in the Outer Banks due to local geographic conditions. The islands are linear, and development will likely occupy a

linear space, not a more square space, which would lend itself more easily to mixed-use development.

Traveler Information:

- Travel tips should be available via the Internet.
- Duck has travel information available via radio at 530 am.
- Visitors need education, both before making their trip and once they are at the Outer Banks.

Incident Management

- An incident management program is needed to help clear vehicle accidents/incidents more quickly, particularly on turnover days, to alleviate traffic congestion. An accident on the Wright Memorial Bridge quickly ties up all traffic and adds greatly to turnover day backups.

Appendix 4--Outer Banks Ground Transportation Resources

Limos, Shuttles and Tours in the Outer Banks

- **Buxton Under the Sun**
(252) 995-6047.
- **The Connection**
(252) 449-2777.
Door-to-door van service by reservation between the Outer Banks of North Carolina and the Norfolk, Virginia airport, bus station, and train station. Discounts available. Special events, weddings.
www.calltheconnection.com
- **Island Hopper Shuttle**
(252)995-6771.
- **Island Limousine**
(800) 828-LIMO(5466), (252) 441-LIMO(5466).
Norfolk International shared ride Airport Shuttle or Private Sedan transfers. Professionally chauffeur-driven, Stretch Limousines, for all occasions.
- **Karat Limo Service**
(252) 473-9827.
- **Sandy Beach Tours**
(252) 441-9800. Kill Devil Hills.
Executive Coach, Luxury Bus or Passenger Shuttles. Group events, weddings and tour transportation.
www.sandybeachtours.com
www.instantmoviesonline.com/show.php?id=750

Taxi Companies in the Outer Banks

- **Bayside Cab**
(252)480-1300.
- **Beach Cab**
(252) 441-2500, (800) 441-2503.
Lowest, metered rates available. Guaranteed lowest price to & from Norfolk & local airports, sedan service available.
- **Coastal Cab Company**
(252) 449-8787
- **Manteo Cab Company**
(252) 473-6500
- **Outer Banks Taxi**
(252) 207-2737.

Car Rental Companies in the Outer Banks

- **ABCO Auto Rental**
(252) 473-4508. 1088 Hwy. 64, Manteo.
- **B & R Rent-A-Car**
(252) 473-2141.
- **Enterprise Rent-A-Car**
(252) 480-1838. 1818 N. Croatan Hwy., Kill Devil Hills.
- **Outer Banks Chrysler-Dodge-Jeep**
(252) 441-1146. MP 5.5, Route 158 Bypass, Kill Devil Hills.
Rental PT Cruisers, Jeeps, Cars, Minivans. Sales, Service Rentals.
www.outerbanksjeep.com

Appendix 5--Bicycle Facilities on the Outer Banks

The Outer Banks region is one of the prime cycling destinations in North Carolina. To improve the safety of bicyclists and motorists in the area, the North Carolina Department of Transportation (NCDOT), in partnership with Outer Banks municipalities and tourism agencies, has built an extensive system of bicycle facilities over the past ten years. These facilities include multi-use paths, wide-paved shoulders, side paths, wide curb lanes and bicycle-safe bridge accommodations. In addition, several bicycle routes have been designated and a Dare County Bicycle Map that shows the location of the all current improvements has been published. Private developers have also built special bicycle accommodations throughout the area. In combination, these improvements serve to create a more bicycle-friendly environment for the Outer Banks region. The various types of facilities, as well as information on current and planned improvements, are described below.

High levels of visitation by bicyclists and a corresponding positive impact on the economy were identified in a 2003 study entitled *The Economic Impact of Investments in Bicycle Facilities; a Case Study of the North Carolina Outer Banks*. This study revealed that of the four million annual visitors to this region, 17%, or 680,000, bicycle while there. Expenditures by those who choose the region because of bicycling or who stay extra days to bicycle infuse \$60 million into the economy annually. Indications are that visitors and residents alike have a favorable impression of the bicycling environment and, more specifically, the bicycle facilities. The study also revealed a high level of support for the expenditure of state and federal dollars to expand and improve bicycle facilities in the region.

Bicycle Facility Types and Locations – Existing, Funded, and Proposed

Wide Paved Shoulders consist of four to six feet of additional pavement on each side of the road, separated from the travel lane by a white stripe.

Existing locations:

- NC 12 from Corolla to the northern Dare County line;
- NC 12 through Duck; NC 12 from Kitty Hawk to Nags Head (Whalebone Junction);
- Kitty Hawk Road from The Woods Road to NC 12;
- The non-curb and gutter sections of US 158 from Kitty Hawk to Nags Head (Whalebone Junction);
- US 64 from the intersection with US 264 to the intersection with NC 12 south;
- NC 12 from one mile north of Rodanthe to the Hatteras ferry landing;
- along Lighthouse Road in Buxton.

Funded Projects:

- A North Carolina Moving Ahead project to build wide paved shoulders along NC 12 from Whalebone Junction to just north of the Oregon Inlet Bridge is currently scheduled for Fiscal Year 2007.

Multi-Use Paths are typically built on a separate alignment, away from the roadway, but may also be within a highway right-of-way. The standard width for these facilities is eight to ten feet; they are typically paved with asphalt. Multi-use paths are shared with pedestrians.

Existing Locations:

- Kitty Hawk
 - Along the west side of The Woods Road;
 - Between Moore Shore Road and Windgrass Circle;
- Kill Devil Hills
 - Along the perimeter of the Wright Brothers National Memorial property from 1st Street, along Colington Road and Ocean Bay Boulevard to NC 12;
 - Along both sides of Veterans Drive to the schools.

Funded Projects:

- The Town of Kitty Hawk has received an NCDOT Enhancement Project to build a multi-use path along Twiford Street, to be completed in 2006.

Proposed Projects:

- The Town of Kitty Hawk has proposed projects along the following roads:
 - Along the south side of US 158 from Barlow Road to Cypress Knee Trail
 - Along Greenville Lane, Covered Bridge Road, Ridge Road and Cemetery Road from The Woods road to Twiford Street
 - Along W. Kitty Hawk Road from Twiford Street to The Woods Road
 - Along Cypress Knee Trail from US 158 to W. Eckner Street

Sidepaths run parallel to a road, on only one side, with minimal separation from the travel lane and may be concrete or asphalt. They are typically five to eight feet wide. Because bicyclists may be riding against traffic on these facilities, extra care is required at intersections and driveways as drivers may not be looking for cyclists approaching from both directions. These facilities are shared with pedestrians.

Existing Locations:

- Town of Duck
 - On the east side of NC 12 from the Currituck County line to just north of Duck
 - Just south of Duck on the east side of NC 12 to Southern Shores

- Southern Shores
 - On the west side of NC 12 to the intersection with US 158
 - On the north side of US 158, from NC 12 to the Wright Memorial Bridge
 - Along Juniper and Spindrift Trails
- Nags Head
 - On the east side of NC 12 from the Kill Devil Hills line to Whalebone Junction
 - Along the entire length of Old Oregon Inlet Road (SR 1243), on the east side
- Manteo
 - Along Business 64 from the US 64/264 intersection to the William B. Umstead Bridge

Wide Curb Lanes have been provided in areas where other special bicycle facilities cannot be built due to right-of-way constraints. Wide curb lanes, sometimes called wide outside lanes, are typically fourteen feet wide and provide adequate width for bicyclists and motor vehicles to operate in the same lane.

Existing Locations:

- Along the curb and gutter sections on US 158 south from Kitty Hawk to Nags Head (Whalebone Junction)

Bridge Improvements include three to six foot shoulders and 54” bridge railings as standard bicycle-safe accommodations.

Existing Locations:

- Virginia Dare Memorial Bridge (US 64/264)
- Washington Baum Bridge (US 64/264)
- Melvin Daniels Bridge (US 64/264)
- The northern span of the Wright Memorial Bridge (US 158).

Proposed:

- Bicycle accommodations will be recommended for inclusion on all new and reconstructed bridges on the state-maintained system

Designated Bicycle Routes

In addition to the specific bicycle facilities described above, three bicycle routes have been designated in the area:

Route 1 - Wright Brothers Bikeway

This 16-mile north/south route connects the most heavily populated areas of the Outer Banks from Kitty Hawk to Nags Head (Whalebone Junction). The route is designated along a combination of roads that include special bicycle facilities, lightly-traveled residential streets and multi-use paths. Many historic sites, recreation areas, beach access

locations, shops and restaurants lie along the route or can be accessed from intersecting streets.

Route 2 – Mountains to Sea

This 725-mile cross-state Bicycling Highways route begins in Murphy, in the westernmost corner of the state, and terminates in Nags Head on NC 12. It enters Dare County from Hyde County along US 264 and connects Stumpy Point, Manns Harbor, Manteo and Nags Head. This route is for more experienced cyclists.

Route 3 - The Ten Mile Loop

This route is located in Kill Devil Hills and Kitty Hawk and is suited for more casual cyclists. The route connects residential areas with both the ocean and the sound side of the island. It runs concurrently with Route 1 (see above), the Wright Brothers Memorial Bikeway on two sides and provides access to the Wright Brothers National Memorial and several beach access locations. In addition, the route passes the Kill Devil Hills Town Hall and is connected via a bike path to the elementary, middle and high schools that are located on Veterans Drive.

Appendix 6--State Transportation Improvement Program—2006-2012

Selected Outer Banks Projects--Currituck and Dare Counties

(Note: all schedules subject to availability of funds.)

CURRITUCK COUNTY

Type Project	Location	ID No.	Description	Length (Mi)	Total Est. Cost (000s)	Prior Yrs. Cost (000s)	Work Type	Funding Source	Cost Estimates (000s)	Schedule (Fiscal Years)
Rural	New Route	R-2576	Mid-Currituck Bridge, Coinjock to Corolla. New structure over Currituck Sound and upgrade approaches. (Strategic Highway Corridor Project)	9.9	\$117,957	\$2,657	Planning/Design Right-of-Way Construction Construction	T T T	\$5,000 \$73,534 \$36,766	In progress SFY 09 SFY 11 Post Years

DARE COUNTY

Type Project	Location	ID No.	Description	Length (Mi)	Total Est. Cost (000s)	Prior Yrs. Cost (000s)	Work Type	Funding Source	Cost Estimates (000s)	Schedule (Fiscal Years)
Rural	US 158	R-3419	NC 12/US 64-264 to Putter Lane. Widen to seven lanes within existing right-of-way. (Strategic Highway Corridor Project)	14.6	\$38,500		Right-of-Way Construction	NHS NHS	\$500 \$38,000	Unfunded project
Rural	US 158	R-4457	Southern Shores, US 158 at NC 12. Convert existing at-grade intersection to an interchange.		\$320	\$320	Planning/Design <i>Programmed for Planning and Environmental Study only.</i>			In progress
Rural	NC 12	R-3116	Ocracoke to South Terminal of Oregon Inlet Bridge. Planning and environmental studies for maintaining roadway.	64.0	\$9,144	\$6,394	Engineering <i>Joint NCDOT-US Corps of Engineers study underway.</i>	S	\$2750	SFY 06 07 08
Rural	NC 12	R-3116D	North of Rodanthe to south of Pea Island Refuge. Relocate route to protect from sand and ocean overwash.		\$1,775	\$275	Planning/Design Right-of-Way Construction	NHS	\$1,500	In progress In acquisition FFY 07

Type Project	Location	ID No.	Description	Length (Mi)	Total Est. Cost (000s)	Prior Yrs. Cost (000s)	Work Type	Funding Source	Cost Estimates (000s)	Schedule (Fiscal Years)
Rural	NC 12	R-4070B	Buxton to Avon. Planning and environmental studies for maintaining roadway.		\$1,000	\$1,000	<i>Programmed for Planning and Environmental Study only.</i>			
Rural	Various	M-389	Stormwater pilot program, Dare, New Hanover and Brunswick Counties. Develop new and innovative technologies and filtering mechanisms to “clean up” discharges from NCDOT maintained outfalls and outlets.		\$15,000	\$15,000				In progress
Urban	NC 12	U-2917	Kitty Hawk, in the vicinity of SR 1206. Roadway improvements.		\$42,420	\$320	Right-of-Way Construction	STP STP	\$31,100 \$11,000	Unfunded project
Urban	Manteo	U-3815	US 64-264-NC 345. Construct fly-over at Virginia Dare Road.		\$8,358	\$200	Planning/Design Mitigation Right-of-Way Construction	NHS NHS NHS	\$1,858 \$2,800 \$3,500	In progress FFY 08 FFY 08 FFY 10
Federal Bridge	NC 12	B-2500	Oregon Inlet. Replace Bridge No. 11.		\$192,607	\$8,607	Right-of-Way Construction	NHS NHS	\$4,000 \$180,000	FFY 07 FFY 08
Bicycle-Pedestrian	Kill Devil Hills	E-4701	NC 12, southern town limit to East First Street. Extend width of paved shoulder to six feet for bicycle safety.	2.2	\$425	\$425				Under construction
Enhancement	NC 12 and US 70	S-4004	Develop corridor management plan for the Outer Banks		\$60	\$60				In progress
Hazard Elimination	Kill Devil Hills	SI-4703	US 158 at Baum Street. Install traffic signal.		\$100	\$100				Under construction

Key to funding sources:

- NHS: National Highway System
- STP: Surface Transportation Program
- T: Highway Trust Fund
- S: State Construction

SFY = State Fiscal Year
FFY = Federal Fiscal Year

Source: NCDOT STIP--Division 1 (August 2005)

Appendix 7--Case Study Summary Matrix

Nine case studies were selected for analysis as part of this study. They are (in alphabetical order):

1. Bar Harbor, ME
2. Biloxi, MS
3. Cape Cod, MA
4. Clearwater Beach, FL
5. Gatlinburg, TN
6. Jersey Shore, NJ
7. Lake Tahoe, CA
8. Ocean City, MD
9. Virginia Beach, VA

The following three tables summarize the findings:

1. Table 1 provides general overview information for each case study.
2. Table 2 summarizes various transportation solutions developed in each area.
3. Table 3 focuses more narrowly on transit solutions.

A separate supplementary report is available that provides more complete information about each case study.

Table 1: Case Study Overview

Site	Geographic Characteristics	Access to Area	Population Characteristics	Tourist Information	Transportation Problems	Transportation Solutions (see Table 2 for more details)	Institutional Solutions
Bar Harbor, ME	<ul style="list-style-type: none"> Island off coast of Maine, mostly forests, some villages Approx. 100 sq miles 	<ul style="list-style-type: none"> One highway bridge High-speed Ferry to Nova Scotia, the CAT Bangor Int'l. Airport 	<ul style="list-style-type: none"> Approx. 11,000 on island, 4,820 in Bar Harbor Population density of Bar Harbor 114 per square mile 	<ul style="list-style-type: none"> 3.0 mil/yr, mostly May-Sept. Nat. Park, summer cottages More than 3,500 hotel rooms 	<ul style="list-style-type: none"> Overcrowding during peak season 	<ul style="list-style-type: none"> Island Explorer Shuttle 45 miles of bike trails/ carriage roads 	<ul style="list-style-type: none"> Downeast Transportation (Island Explorer) – public/private cooperative
Biloxi, MS	<ul style="list-style-type: none"> Southern coast, Gulf of Mexico Approx. 26 miles of beachfront (manmade) 	<ul style="list-style-type: none"> 36-mile Hwy US 90 Interstate 110 & 10 Gulfport-Biloxi International Airport 	<ul style="list-style-type: none"> Approx. 190,000, in Biloxi 50,644 Population density 1,331 persons per square mile 	<ul style="list-style-type: none"> 10-12 mil/yr Casinos—area accounts for 48% of all visitors to MS 	<ul style="list-style-type: none"> One road, Hwy US 90 handles all local and visitor traffic Development continues despite congestion 	<ul style="list-style-type: none"> Trolley bus service 4 Park and Ride facilities Private Shuttles 	<ul style="list-style-type: none"> Coast Transit Authority
Cape Cod, MA	<ul style="list-style-type: none"> Peninsula (technically an island) extending into the Atlantic Ocean Approx. 560 miles of coastline, 30 miles of beachfront 	<ul style="list-style-type: none"> Two 4-lane highway bridges US 6, “Mid-Cape Highway” Ferry from Boston and Plymouth Air service between Boston and Provincetown 	<ul style="list-style-type: none"> Approx 229,000 in Barnstable Co. Population density 577 people per square mile 	<ul style="list-style-type: none"> 4.7 mil/yr 35% own homes, 30% stay in hotels or bed and breakfasts 	<ul style="list-style-type: none"> One road, US-6, is main artery Commuters to and from Cape Only 2 bridges to mainland Urban development continues, and tourism is increasing 	<ul style="list-style-type: none"> Fixed route buses Paratransit Flex Route Shuttles Park and Ride Bike trails and rentals High-speed ferries TDM⁹ intensive businesses Transportation hub 	<ul style="list-style-type: none"> Cape Cod Commission Cape Cod Regional Transit Authority

⁹ TDM- Transportation Demand Management

Site	Geographic Characteristics	Access to Area	Population Characteristics	Tourist Information	Transportation Problems	Transportation Solutions (see Table 2 for more details)	Institutional Solutions
Clearwater Beach, FL	<ul style="list-style-type: none"> Barrier island chain off coast of major urban development (Clearwater, St. Petersburg, Tampa) Approx. 30 miles of beachfront 	<ul style="list-style-type: none"> Hwy 60, Hwy 699 Three airports 	<ul style="list-style-type: none"> Approx. 27,000 permanent residents 	<ul style="list-style-type: none"> 4.5 mil/yr 	<ul style="list-style-type: none"> Little available land Continued development 	<ul style="list-style-type: none"> Trolleys Fixed route buses 13 parking lots Widened roads for bikes Proposed monorail 	<ul style="list-style-type: none"> Pinellas Suncoast Transit Authority
Gatlinburg, TN	Mountainous terrain with several small towns along major highway corridor (24 miles)	Hwy 441, 6-lane corridor through mountains	<ul style="list-style-type: none"> Approx. 71,000 in Sevier Co., 3,000 in Gatlinburg Population density approx. 120 persons per square mile 	<ul style="list-style-type: none"> During peak season, over 75,000 vehicles use HWY 441 per day, 41,000 during non-peak season 	<ul style="list-style-type: none"> Single highway (24 miles) serves all lodging, entertainment, etc. from Gatlinburg to Sevierville 	<ul style="list-style-type: none"> Municipal trolleys Parking lots New arterial roadway, HWY 449 underway Proposed BRT¹⁰ 	
Jersey Shore, NJ	20-mile peninsula plus 18-mile barrier island	<ul style="list-style-type: none"> One main highway along island Several bridges to peninsula, one bridge to barrier island 	<ul style="list-style-type: none"> 24,000 in Upper Shore towns, 511,000 total in Ocean County 	<ul style="list-style-type: none"> Approx. 240,000 during parts of peak season 	<ul style="list-style-type: none"> Expected urban sprawl with in next 10 years 	<ul style="list-style-type: none"> Commuter rail Ocean Ride Transit Bike trails Metered parking Bridge and highway improvements 	

¹⁰ BRT- Bus Rapid Transit, a bus transit system that operates with limited stops and exclusive lanes or roadways of operation

Site	Geographic Characteristics	Access to Area	Population Characteristics	Tourist Information	Transportation Problems	Transportation Solutions (see Table 2 for more details)	Institutional Solutions
Lake Tahoe, CA	<ul style="list-style-type: none"> • Large lake, isolated from urban development • Year-round tourist destination • More than 30 high altitude beaches 	<ul style="list-style-type: none"> • Multiple highways • Three airports 	<ul style="list-style-type: none"> • Approx. 23,000 in South Lake Tahoe, 2,000 persons per square mile, • 13,000 in Truckee, 394 persons per square mile • 54% vacation home residents 	<ul style="list-style-type: none"> • 2 mil/yr 	<ul style="list-style-type: none"> • Road construction is limited due to seasonal changes in weather; during summer tourists prevent construction 	<ul style="list-style-type: none"> • Expanded bike trails • Nifty Fifty Trolley • BlueGo “Umbrella” system • Flex route • Park and Ride • Private ski shuttles 	<ul style="list-style-type: none"> • Lake Tahoe Public Utilities District • TART¹¹ • BlueGo
Ocean City, MD	<ul style="list-style-type: none"> • Two barrier islands; one is host to a bustling tourist industry, another is a national park • Approx. 10 miles of beach front 	<ul style="list-style-type: none"> • US 90, northern portion • US 50, southern portion 	<ul style="list-style-type: none"> • Approx. 7,000 permanent residents • Population density 604 persons per square mile 	<ul style="list-style-type: none"> • 3.3 mil/yr, almost half during peak season 	<ul style="list-style-type: none"> • One north-south arterial road • Two bridges on and off of island 	<ul style="list-style-type: none"> • Fixed-route bus • Boardwalk Tram • Park and Ride lots w/ shuttles • Bike trails to State Park • Pay parking (metered) on streets 	<ul style="list-style-type: none"> • Ocean City Transit
Virginia Beach, VA	<ul style="list-style-type: none"> • Mainland beach, just north of the Outer Banks. • Approx. 35 miles of shoreline 	<ul style="list-style-type: none"> • Many highways • Norfolk International Airport • Amtrak 	<ul style="list-style-type: none"> • Approx. 425,000 • Population density 1,712 persons per square mile 	<ul style="list-style-type: none"> • 2.7 mil/yr 	<ul style="list-style-type: none"> • Traffic congestion due to high-density urban area and large no. of tourists 	<ul style="list-style-type: none"> • Trolley buses • Fixed-route buses • Pay parking lots • HOV lanes • Bike trail to boardwalk and state park • BRT (planned) 	<ul style="list-style-type: none"> • Hampton Roads Transit System

¹¹ TART- Tahoe Area Regional Transportation

Site	Geographic Characteristics	Access to Area	Population Characteristics	Tourist Information	Transportation Problems	Transportation Solutions (see Table 2 for more details)	Institutional Solutions
<u>For reference:</u> OBX	<ul style="list-style-type: none"> • Barrier island chain, approx. 90 miles of shoreline. • Some islands uninhabited 	<ul style="list-style-type: none"> • US 158 • US 64 • NC Ferry System 	<ul style="list-style-type: none"> • Approx. 32,000 year round residents • Population density approx. 81 people per square mile. 	<ul style="list-style-type: none"> • Approx. 7 mil/yr 	<ul style="list-style-type: none"> • Two highways leading on and off the islands with many vacationers • Ferry Service required to access Ocracoke Island 	<ul style="list-style-type: none"> • Many bicycle paths and lanes 	<ul style="list-style-type: none"> • Outer Banks Transportation Task Force

Table 2: Transportation Solutions

Site	Transit (more details in Table 3)	Bicycle-Pedestrian	Transportation Demand Management (TDM)	Highway-Traffic Engineering	Other (e.g. water transportation)
Bar Harbor, ME	Fixed route shuttle, Island Explorer	45 miles of bike trails on carriage roads in Acadia Nat. Park	Various options being studied	Proposed widening, grade-separation, or toll on major entry point to the island	Ferries available to Nova Scotia
Biloxi, MS	Fixed route buses			Four Park and Ride facilities (private shuttles and trolley service)	
Cape Cod, MA	<ul style="list-style-type: none"> Fixed route buses Paratransit Flex Route Shuttle High-speed ferry 	<ul style="list-style-type: none"> Marked bike trails Bike-to-Work Week Bike Rentals 	<ul style="list-style-type: none"> Local Businesses encouraged to be TDM intensive, i.e. carpool, vanpool, etc. 	<ul style="list-style-type: none"> Recent widening of major arterial with plans to widen another Seven Park and Ride lots 	<ul style="list-style-type: none"> Ferries to Boston and Plymouth (and to Martha's Vineyard and Nantucket) Transportation hub
Clearwater Beach, FL	<ul style="list-style-type: none"> Trolleys Fixed Route Buses 	<ul style="list-style-type: none"> Wider roadways to accommodate bicycles and pedestrians 		13 Park and Ride facilities	<ul style="list-style-type: none"> Proposed monorail
Gatlinburg, TN	<ul style="list-style-type: none"> Trolley buses Planned BRT 			<ul style="list-style-type: none"> Park and Ride lots (no shuttles) New arterial road under construction 	
Jersey Shore, NJ	<ul style="list-style-type: none"> Limited transit service Passenger train service 	<ul style="list-style-type: none"> 14 mile trail being developed 		<ul style="list-style-type: none"> Bridges repaired to improve traffic flow Sidewalks planned 	
Lake Tahoe, CA	<ul style="list-style-type: none"> BlueGo umbrella system Nifty Fifty Trolley Flex Route Private Shuttles 	<ul style="list-style-type: none"> Expanded bike trails Shared roads 		<ul style="list-style-type: none"> Park and Ride 	Planned water transit to reduce travel time across the lake
Ocean City, MD	<ul style="list-style-type: none"> Fixed route bus Boardwalk Tram 	<ul style="list-style-type: none"> Bike trail parallel to boardwalk and state park 		<ul style="list-style-type: none"> Park and Ride lots w/ shuttles 	

Site	Transit (more details in Table 3)	Bicycle-Pedestrian	Transportation Demand Management (TDM)	Highway-Traffic Engineering	Other (e.g. water transportation)
Virginia Beach, VA	<ul style="list-style-type: none"> • Trolley buses • Fixed Route buses • Planned BRT system 		<ul style="list-style-type: none"> • HOV¹² lanes 	<ul style="list-style-type: none"> • Park and Ride lots 	

¹² HOV- High Occupancy Vehicle

Table 3: Transit Information

Site	Transit Service(s)	Months, days and hours of service.	Ridership (# and type)	Fares	Vehicles (# and type)	Financial (cost, recovery ratio, funding sources, etc.)
Bar Harbor, ME	<ul style="list-style-type: none"> Island Explorer (IE) Shuttle, 8 routes providing access to hotels, campgrounds, and Acadia Nat. Park 	<ul style="list-style-type: none"> June 23- October 10 Hours vary among routes, ~ 7AM – 10PM 	<ul style="list-style-type: none"> 340,000 (2003) Approx. ¼ of riders are residents Riders used IE for hiking and sightseeing 	<ul style="list-style-type: none"> Free \$20 entry fee into Acadia National Park 	<ul style="list-style-type: none"> 17 propane-powered shuttles 	<ul style="list-style-type: none"> Public and private contributions (inc. Acadia Nat. Park, DOT's, locals, and L.L. Bean)
Biloxi, MS	<ul style="list-style-type: none"> Six bus lines and one trolley line operated by the Coast Transit Authority Private shuttles from area casinos 	<ul style="list-style-type: none"> Daily Service Hours vary among routes, ~ 6AM-10PM Some routes end in mid-afternoon 		<ul style="list-style-type: none"> \$1- adults \$.50 - seniors \$.75 - children \$5 daily pass \$30 monthly pass 	<ul style="list-style-type: none"> Hybrid-electric fuel efficient buses and replica antique trolleys 	<ul style="list-style-type: none"> System-generated revenue Cities of Gulfport, Biloxi, and Ocean Springs County, State, Federal
Cape Cod, MA	<ul style="list-style-type: none"> Nine fixed route shuttles Demand-response “b-bus” shuttles Planned Flex-Route (2006) to serve Outer Cape Hy-Line Cruises ferry service 	<ul style="list-style-type: none"> Mon-Sat, Sun Fixed route service 7 day “b-bus” service 7-day 6AM-10AM, 2PM-6PM Flex Route (summer), 6-day 6AM-10AM, 2PM-6PM (winter) 	<ul style="list-style-type: none"> Open to all residents and visitors “b-bus” serves approx. 225,000 annually 	<ul style="list-style-type: none"> \$1-\$3.50 Fixed route fare Half price for youth, disabled, and seniors “b-bus”, \$2.50 – adults, \$1.50 – disabled, children, seniors \$.10 per mile traveled on “b-bus” 	<ul style="list-style-type: none"> 33 vehicles in “b-bus” fleet 5 propane mini-buses for shuttle service Hy-Line fleet of water jet catamarans 	<ul style="list-style-type: none"> National Park Service (shuttles) Federal and State grants for technologies (AVL, ITS, etc.)

Site	Transit Service(s)	Months, days and hours of service.	Ridership (# and type)	Fares	Vehicles (# and type)	Financial (cost, recovery ratio, funding sources, etc.)
Clearwater Beach, FL	<ul style="list-style-type: none"> One beach trolley route (Suncoast Beach) “Jolley Trolley” service, operated by Clearwater Beach 	<ul style="list-style-type: none"> Suncoast Trolley—7 days/week, 5AM-10PM (until 12AM on Fri/Sat). Jolley Trolley—7 days/week, starting at 10AM. 	<ul style="list-style-type: none"> 400,000 annually on Suncoast Beach Trolley 161,000 annually on the “Jolley Trolley” 	Suncoast Trolley: <ul style="list-style-type: none"> \$1.25 – adult \$.75 – student \$.60 - seniors “Jolley Trolley”: <ul style="list-style-type: none"> \$1.00 adult \$.50 seniors, disabled 	<ul style="list-style-type: none"> Trolleys: 20, mainland included 	<ul style="list-style-type: none"> Federal and State grants (13%) Passenger fares (21%) Advertising and miscellaneous revenues (3%) Taxes (63%)
Gatlinburg, TN	<ul style="list-style-type: none"> Sevierville Fun Time Trolley (SFTT) Gatlinburg Mass Transit (Trolley) (GMT) 	SFTT: <ul style="list-style-type: none"> 8:30AM – Midnight, daily Mar.-Oct. 10:00AM-10:00PM daily, Nov-Dec. GMT: <ul style="list-style-type: none"> Mon-Sun 8AM – 12AM Apr - Oct., Sun – Th, 10AM - 6PM, Fri-Sat 10AM 10PM, Nov-March 	<ul style="list-style-type: none"> SFTT- 665,000 annually GMT – 668,000 annually 	<ul style="list-style-type: none"> SFTT- \$.25-.50 GMT- \$.25-\$2.00 	<ul style="list-style-type: none"> SFTT- Electric-propane hybrids GMT- 11 large trolleys, 8 small trolleys 	<ul style="list-style-type: none"> SFTT- \$1.5 million in grants to convert to hybrid fuel vehicles GMT- \$750,000 annually, 50% Farebox revenue, 50% FTA funding
Jersey Shore, NJ	<ul style="list-style-type: none"> One fixed route service by Ocean Ride 	<ul style="list-style-type: none"> 10AM-3PM, Mondays 		<ul style="list-style-type: none"> \$.50, half-price for students and disabled 		

Site	Transit Service(s)	Months, days and hours of service.	Ridership (# and type)	Fares	Vehicles (# and type)	Financial (cost, recovery ratio, funding sources, etc.)
Lake Tahoe, CA	<ul style="list-style-type: none"> BlueGo umbrella system connecting private and public transit, shuttles and trolleys TART- (Tahoe Area Regional Transportation) shuttles “Nifty Fifty” trolley Flex Route 	<ul style="list-style-type: none"> BlueGo-7 days/week Nifty Fifty trolley: 10 AM-10 PM, mid-June- Labor Day Flex Route (1/2 mile deviation): 7:15AM- 7:15 PM 		<ul style="list-style-type: none"> Nifty Fifty: \$1.00-\$3.00, \$3.00 transfers to North Shore Trolley BlueGo Paratransit: \$3.00 TART: \$3.00 	<ul style="list-style-type: none"> BlueGo System provides kiosks for locating vehicles via GPS, and planning trips via computer network 	
Ocean City, MD	<ul style="list-style-type: none"> Coastal Highway Transit Bus Demand-response paratransit Boardwalk tram Shuttle from Park and Ride 	<ul style="list-style-type: none"> Bus- 24hr/day, 7 days/wk service Boardwalk tram available 7 days/wk during summer 		<ul style="list-style-type: none"> Coastal Highway Transit Bus: \$2.00 all day pass Boardwalk Tram: \$2.50, one-way 		
Virginia Beach, VA	<ul style="list-style-type: none"> Fixed-route buses “Boomerang” bus service VB Wave Trolley Demand-response 	<ul style="list-style-type: none"> “Boomerang”- June 18th- Sept 2nd, 7 days/week VB WAVE: 3 Routes – May-October, 8 am – 2 am, 15 minute intervals 	<ul style="list-style-type: none"> In 2003, 353,000 on VB Wave Trolley (3,350/day in summer) 	<ul style="list-style-type: none"> “Boomerang”- Free VB Wave Trolley- \$1 Paratransit- \$3/ride, passbooks available 	<ul style="list-style-type: none"> 31 Trolleys 	<ul style="list-style-type: none"> “Boomerang” shuttle provided by VDOT Other services: 30% farebox revenue, 30% federal, 20% state, 20% local

Appendix 8--Overview of AASHTO Guidelines for Bicycle Facilities

Design of new bicycle facilities, as well as improvements to existing facilities, is an ongoing process that should be consistent with a comprehensive plan considering the different bicycle users, existing conditions and community goals. A wide range of facility improvements can enhance bicycle transportation. An improvement can be simple and involve minimal design considerations (e.g., changing drainage grate inlets) or it can be more extensive (e.g., providing a shared use path). Improvements such as bicycle lanes depend on the roadway's design. On the other hand, shared use paths are located on independent alignments; consequently, their design depends on many factors, including right-of-way, available funding, topography and expected use.

Facility types and standard AASHTO guidelines are noted below.

Wide Paved Shoulders

Paved shoulders should be at least 1.2 m (4 feet) wide to accommodate bicycle travel. The measurement of usable shoulder width should not include the width of a gutter pan, unless the pan width is 1.2 m (4 feet) or greater. Shoulder width of 1.5 m (5 feet) is recommended from the face of guardrail, curb or other roadside barriers. It is desirable to increase the width of shoulders where higher bicycle usage is expected. Additional shoulder width is also desirable if motor vehicle speeds exceed 80 km/h (50 mph). Rumble strips or raised pavement markers, where installed to discourage or warn motorists they are driving on the shoulder, are not recommended where shoulders are used by bicyclists.

Wide Curb Lanes

Wide curb lanes for bicycle use are usually preferred where shoulders are not provided, such as in restrictive urban areas. In general, 4.2 m (14 feet) of usable lane width is the recommended width for shared use in a wide curb lane. Usable width normally would be from edge stripe to lane stripe or from the longitudinal joint of the gutter pan to lane stripe (the gutter pan should not be included as usable width).

Bike Lanes

Bike lanes can be incorporated into a roadway when it is desirable to delineate available road space for preferential use by bicyclists and motorists, and to provide for more predictable movements by each. Bike lanes should be one-way facilities and carry bike traffic in the same direction as adjacent motor vehicle traffic. Two-way bike lanes on one side of the roadway are not recommended when they result in bicycles riding against the flow of motor vehicle traffic.

The recommended width of a bike lane is 1.5 m (5 feet) from the face of a curb or guardrail to the bike lane stripe. The width of the gutter pan should not be included in the measurement of the rideable or usable surface. For roadways with no curb and gutter, the minimum width of a bike lane should be 1.2 m (4 feet). If parking is permitted, the bike lane should be placed between the parking area and the travel lane and have a minimum width of 1.5 m (5 feet).

Where parking is permitted but a parking stripe or stalls are not utilized, the shared area should be a minimum of 3.3 m (11 feet) without a curb face and 3.6 m (12 feet) adjacent to a curb face.

Since bicyclists usually tend to ride a distance of 0.8-1.0 m (32-40 inches) from a curb face, it is very important that the pavement surface in this zone be smooth and free of structures. Drain inlets and utility covers that extend into this area may cause bicyclists to swerve, and have the effect of reducing the usable width of the lane. Where these structures exist, the bike lane width may need to be adjusted accordingly.

A bike lane should be delineated from the motor vehicle travel lanes with a 150-mm (6-inch) solid white line. Bike lanes should be provided with adequate drainage to prevent ponding, washouts, debris accumulation and other potentially hazardous situations for bicyclists. The drainage grates should be bicycle-safe.

Signed Shared Roadways

Signed shared roadways are those that have been identified by signing as preferred bike routes. Signing of shared roadways indicates to cyclists that there are particular advantages to using these routes compared to alternate routes. The following criteria should be considered prior to signing a route:

- a. The route provides through and direct travel in bicycle-demand corridors.
- b. The route connects discontinuous segments of shared use paths, bike lanes and/or other bike routes.
- c. An effort has been made to adjust traffic control devices (e.g., stop signs, signals) to give greater priority to bicyclists on the route, as opposed to alternative streets. This could include placement of bicycle-sensitive detectors where bicyclists are expected to stop.
- d. Street parking has been removed or restricted in areas of critical width to provide improved safety.
- e. A smooth surface has been provided (e.g., adjust utility covers to grade, install bicycle-safe drainage grates, fill potholes, etc.)
- f. Maintenance of the route will be sufficient to prevent accumulation of debris (e.g., regular street sweeping).
- g. Wider curb lanes are provided compared to parallel roads.

Shared Use Paths

Shared use paths are facilities on exclusive right-of-way and with minimal cross flow by motor vehicles. Shared use paths are sometimes referred to as trails; however, in many states the term *trail* means an unimproved recreational facility. Care should be taken in using these terms interchangeably. Where shared use paths are called trails, they should meet all design criteria for shared use paths to be designated as bicycle facilities. Users may include but are not limited to: bicyclists, in-line skaters, roller skaters, wheelchair users (both non-motorized and motorized) and pedestrians, including walkers, runners, people with baby strollers, people walking dogs, etc. These facilities are most commonly designed for two-way travel.

Shared use paths should be thought of as a complementary system of off-road transportation routes for bicyclists and others that serves as a necessary extension to the roadway network.

Shared use paths should not be used to preclude on-road bicycle facilities, but rather to supplement a system of on-road bike lanes, wide outside lanes, paved shoulders and bike routes.

Separation Between Shared Use Paths and Roadways

When two-way shared use paths are located immediately adjacent to a roadway, some operational problems are likely to occur. In some cases, paths along highways for short sections are permissible, given an appropriate level of separation between facilities. Some problems with paths located immediately adjacent to roadways are as follows:

1. Unless separated, they require one direction of bicycle traffic to ride against motor vehicle traffic, contrary to normal rules of the road.
2. When the path ends, bicyclists going against traffic will tend to continue to travel on the wrong side of the street. Likewise, bicyclists approaching a shared use path often travel on the wrong side of the street in getting to the path. Wrong-way travel by bicyclists is a major cause of bicycle/automobile crashes and should be discouraged at every opportunity.
3. At intersections, motorists entering or crossing the roadway often will not notice bicyclists approaching from their right, as they are not expecting contra-flow vehicles. Motorists turning to exit the roadway may likewise fail to notice the bicyclist. Even bicyclists coming from the left often go unnoticed, especially when sight distances are limited.
4. Signs posted for roadway users are backwards for contra-flow bike traffic; therefore these cyclists are unable to read the information without stopping and turning around.
5. When the available right-of-way is too narrow to accommodate all highway and shared use path features, it may be prudent to consider a reduction of the existing or proposed widths of the various highway (and bikeway) cross-sectional elements (i.e., lane and shoulder widths, etc.). However, any reduction to less than AASHTO *Green Book* (or other applicable) design criteria must be supported by a documented engineering analysis.
6. Many bicyclists will use the roadway instead of the shared use path because they have found the roadway to be more convenient, better maintained, or safer. Bicyclists using the roadway may be harassed by some motorists who feel that in all cases bicyclists should be on the adjacent path.
7. Although the shared use path should be given the same priority through intersections as the parallel highway, motorists falsely expect bicyclists to stop or yield at all cross-streets and driveways. Efforts to require or encourage bicyclists to yield or stop at each cross-street and driveway are inappropriate and frequently ignored by bicyclists.
8. Stopped cross-street motor vehicle traffic or vehicles exiting side streets or driveways may block the path crossing.
9. Because of the proximity of motor vehicle traffic to opposing bicycle traffic, barriers are often necessary to keep motor vehicles out of shared use paths and bicyclists out of traffic lanes. These barriers can represent an obstruction to bicyclists and motorists, can complicate maintenance of the facility, and can cause other problems as well.

For the above reasons, other types of bikeways are likely to be better suited to accommodate bicycle traffic along highway corridors, depending upon traffic conditions. When two-way

shared use paths are located adjacent to a roadway, wide separation between a shared use path and the adjacent highway is desirable to demonstrate to both the bicyclist and the motorist that the path functions as an independent facility for bicyclists and others. When this is not possible and the distance between the edge of the shoulder and the shared use path is less than 1.5 m (5 feet), a suitable physical barrier is recommended.

Width and Clearance

Under most conditions, a recommended paved width for a two-directional shared use path is 3.0 m (10 feet). In rare instances, a reduced width of 2.4 m (8 feet) can be adequate. This reduced width should be used only where the following conditions prevail: 1) bicycle traffic is expected to be low, even on peak days or during peak hours, 2) pedestrian use of the facility is not expected to be more than occasional, 3) there will be good horizontal and vertical alignment providing safe and frequent passing opportunities, and 4) during normal maintenance activities the path will not be subjected to maintenance vehicle loading conditions that would cause pavement edge damage. Under certain conditions it may be necessary or desirable to increase the width of a shared use path to 3.6 m (12 feet), or even 4.2 m (14 feet), due to substantial use by bicycles, joggers, skaters and pedestrians, use by large maintenance vehicles, and/or steep grades.

A minimum 0.6-m (2-foot) wide graded area with a maximum 1:6 slope should be maintained adjacent to both sides of the path; however, 0.9 m (3 feet) or more is desirable to provide clearance from trees, poles, walls, fences, guardrails or other lateral obstructions.

Grade

Grades on shared use paths should be kept to a minimum, especially on long inclines. Grades greater than 5 percent are undesirable because the ascents are difficult for many bicyclists to climb and the descents cause some bicyclists to exceed the speeds at which they are competent or comfortable.

Signing and Marking

Adequate signing and marking are essential on shared use paths, especially to alert bicyclists to potential conflicts and to convey regulatory messages to both bicyclists and motorists at highway intersections. In addition, guide signing, such as to indicate directions, destinations, distances, route numbers and names of crossing streets, should be used in the same manner as on highways. In general, uniform application of traffic control devices, as described in the MUTCD, provides minimum traffic control measures which should be applied.

A designer should consider a 100-mm (4-inch) wide yellow center line stripe to separate opposite directions of travel. This stripe should be broken where adequate passing sight distance exists, and solid in other locations, or where passing by bicycles should be discouraged. This may be particularly beneficial in the following circumstances: 1) for heavy volumes of bicycles and/or other users, 2) on curves with restricted sight distance, and 3) on unlighted paths where nighttime riding is expected. White edge lines can also be very beneficial where bicycle traffic is expected during early evening hours.

Pavement markings at a crossing should accomplish two things: channel path users to cross at a clearly defined location and provide a clear message to motorists that this particular section of the road must be shared with other users.

For the path user, stop signs, stop bar pavement markings, yield signs, caution signs or other devices should be used as applicable.

For a roadway user, a clear message must be presented in a location where it will be seen by that user. Traditional treatments have included the bicycle crossing sign (WII-I), the pedestrian crossing sign (WIIA-2), the pedestrian crosswalk lines [double 150-mm (6-inch) lines spaced not less than 1.8 m (6 feet) apart], or flashing yellow lights at the crosswalk.

Drainage

The recommended minimum pavement cross slope of 2 percent adequately provides for drainage. Sloping in one direction instead of crowning is preferred and usually simplifies the drainage and surface construction. A smooth surface is essential to prevent water ponding and ice formation.

Undesirability of Sidewalks as Shared Use Paths

Utilizing or providing a sidewalk as a shared use path is unsatisfactory for a variety of reasons. Sidewalks are typically designed for pedestrian speeds and maneuverability and are not safe for high speed bicycle use. Conflicts are common between pedestrians traveling at low speeds (exiting stores, parked cars, etc.) and bicyclists, as are conflicts with fixed objects (e.g., parking meters, utility poles, sign posts, bus benches, trees, fire hydrants, mail boxes, etc.) Walkers, joggers, skateboarders and roller skaters can, and often do, change their speed and direction almost instantaneously, leaving bicyclists insufficient reaction time to avoid collisions.

Designating Sidewalks as Signed Bikeways

In general, the designated use of sidewalks (as a signed shared facility) for bicycle travel is unsatisfactory. It is important to recognize that the development of extremely wide sidewalks does not necessarily add to the safety of sidewalk bicycle travel, since wide sidewalks encourage higher speed bicycle use and increase potential for conflicts with motor vehicles at intersections as well as with pedestrians and fixed objects.

Sidewalk bikeways should be considered only under certain limited circumstances, such as:

- To provide bikeway continuity along a high speed or heavily traveled roadway having inadequate space for bicyclists, and uninterrupted by driveways and intersections for long distances.
- On long, narrow bridges. In such cases, ramps should be installed at the sidewalk approaches. If approach bikeways are two-way, sidewalk facilities also should be two-way.

In general, bicyclists should not be encouraged through signing to ride facilities that are not designed to accommodate bicycle travel.

Excerpted from the 1999 AASHTO “Guide for the Development of Bicycle Facilities”, Chapter 2. Design, pg. 15-23.

Appendix 9--Pedestrian Facility Design Guidelines

Sidewalks and Walkways

Sidewalks and walkways are “pedestrian lanes” that provide people with space to travel within the public right-of-way that is separated from roadway vehicles. Sidewalks are associated with significant reductions in pedestrian collisions with motor vehicles. Such facilities also improve mobility for pedestrians and provide access for all types of pedestrian travel. Walkways should be part of every new and renovated facility and every effort should be made to retrofit streets that currently do not have sidewalks.

While sidewalks are typically made of concrete, less expensive walkways may be constructed of asphalt, crushed stone, or other materials if they are properly maintained and accessible. Both FHWA and the Institute of Transportation Engineers (ITE) recommend a minimum width of 1.5 m (5 ft) for a sidewalk or walkway, which allows two people to pass comfortably or to walk side-by-side. Wider sidewalks should be installed near schools, at transit stops, in downtown areas, or anywhere high concentrations of pedestrians exist. Sidewalks should be continuous along both sides of a street and they should be fully accessible to all pedestrians, including those in wheelchairs. A buffer zone of 1.2 to 1.8 m (4 to 6 ft) is desirable and should be provided to separate pedestrians from the street. The buffer zone will vary according to the street type.

Street Furniture/Walking Environment

Sidewalks should be continuous and should be part of a system that provides access to goods, services, transit, and homes. Sidewalks and walkways should be kept clear of poles, signposts, newspaper racks, and other obstacles that could block the path, obscure a driver’s view or pedestrian visibility, or become a tripping hazard. Benches, water fountains, bicycle parking racks, and other street furniture should be carefully placed to create an unobstructed path for pedestrians.

Marked Crosswalks and Enhancements

Marked crosswalks indicate optimal or preferred locations for pedestrians to cross and help designate right-of-way for motorists to yield to pedestrians. Crosswalks are often installed at signalized intersections and other selected locations. Various crosswalk marking patterns are given in the Manual on Uniform Traffic Control Devices (published by the Federal Highway Administration). Marked crosswalks are desirable at some high pedestrian volume locations (often in conjunction with other measures) to guide pedestrians along a preferred walking path. In some cases, they can be raised and should often be installed in conjunction with other enhancements that physically reinforce crosswalks and reduce vehicle speeds. It is also sometimes useful to supplement crosswalk markings with warning signs for motorists. At some locations, signs can get “lost” in visual clutter, so care must be taken in placement.

Pedestrians are sensitive to out-of-the-way travel, and reasonable accommodation should be made to make crossings both convenient and safe at locations with adequate visibility.

It is important to ensure that crosswalk markings are visible to motorists, particularly at night. Crosswalks should not be slippery, create tripping hazards, or be difficult to traverse by those with diminished mobility or visual capabilities. Granite and cobblestones are examples of materials that are aesthetically pleasing, but may become slippery when wet or be difficult to cross by pedestrians who are blind or using wheelchairs. One of the best materials for marking crosswalks is inlay tape, which is installed on new or repaved streets. It is highly reflective, long-lasting, and slip-resistant, and does not require a high level of maintenance. Although initially more costly than paint, both inlay tape and thermoplastic are more cost-effective in the long run.

Curb Ramps

Curb ramps provide access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcars, bicycles, and also for pedestrians with mobility impairments who have trouble stepping up and down high curbs. Curb ramps must be installed at all intersections and midblock locations where pedestrian crossings exist, as mandated by federal legislation (1973 Rehabilitation Act and ADA 1990). Curb ramps must have a slope of no more than 1:12 (must not exceed 25.4 mm/0.3 m (1 in/ft) or a maximum grade of 8.33 percent), and a maximum slope on any side flares of 1:10.

Where feasible, separate curb ramps for each crosswalk at an intersection should be provided rather than having a single ramp at a corner for both crosswalks. This provides improved orientation for visually impaired pedestrians. Similarly, tactile warnings will alert pedestrians to the sidewalk/street edge. All newly constructed and altered roadway projects must include curb ramps. In addition, all agencies should upgrade existing facilities.

-Excerpted from the Federal Highway Administration's
Pedestrian and Bicycle Information Center,
www.walkinginfo.or/de/curb1.cfm?codename=a&CM_maingroup=Pedestrian%20Facility%20Design

Appendix 10--Transportation Management Associations

Due to the unique nature of the Outer Banks and its specific kinds of transportation problems, it is proposed that the formation of a Transportation Management Association (TMA) be considered for the area. Such an organization would allow a focus on the specific transportation problems on the Outer Banks, and would provide an excellent forum for its many different stakeholders—private, public and non-profit.

About 140 TMAs have been formed throughout the country over the last few decades. In general, they are created to deal with specific transportation problems in an area such as traffic congestion that is affecting local employers. Ways of addressing the congestion often take the form of transportation demand strategies such as encouraging the use of ridesharing or vanpooling by employees.

TMAs are somewhat difficult to characterize because they have taken a variety of forms depending on the local situation and the specific nature of the transportation problems that they are addressing. One good definition of a TMA is as follows:

“A Transportation Management Association is an organized group applying carefully selected approaches to facilitating the movement of people and goods within an area. TMAs are often legally constituted and frequently led by the private sector in partnership with the public sector to solve transportation problems.”

Although some TMAs are informal in nature, most are incorporated as non-profit organizations. Their geographic scope ranges from regional to specialized activity centers. The table below summarizes the varying geographic areas served:

Scope of Service Area	Percent of TMAs
Regional	19%
Suburban	11%
Corridor	21%
Central business district	15%
Citywide	6%
Specialized activity center	14%
Other	14%

Similarly, TMAs have a variety of missions. In 2003, 68 percent of TMAs cited improved travel, mobility, accessibility, or reduction in traffic congestion as their central purposes. Some TMAs focus on policy leadership and advocacy, others focus on providing services such as ridesharing coordination or shuttles/transit operations.

Members of TMAs frequently include business representatives, developers, government agencies, property owners and non-profit organizations. Most TMAs (92 percent)

employ staff, often more than 3 persons (44 percent). In terms of financing, TMAs finance their operations from a variety of income sources including: member dues; fees for services and service contracts; federal, state and local grants; developer funding agreements; and, in-kind donations.

An excellent handbook is available that provides a step-by-step guide for creating a TMA—see the citation below.

Sources:

- *TMA Handbook: A Guide to Successful Transportation Management Associations*, Center for Transportation Research, University of South Florida, Tampa, 2001.
- Sara J. Hendricks, *Results of 2003 Transportation Management Association Survey*, Transportation Research Record, No. 1864, TRB, National Research Council, Wash. D.C., 2004.