2009

Benchmarking *and* Optimization *of the* North Carolina Ferry System

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I. BACKGROUND / INTRODUCTION

The North Carolina Department of Transportation operates the second largest state-owned ferry system in the United States. Its 21 ferry vessels serve seven routes, operate over 200 sailings daily, and transport more than 1.1 million vehicles and 2.5 million passengers annually. The North Carolina Ferry System (NCFS) is facing several challenges in recent years that have impacted the coastal communities. Recent U.S. Coast Guard regulations increasing the minimum crew size on vessels carrying over 149 passengers will require the NCFS to add 79 employees. Difficulty in finding additional funds and certified crew to meet these regulations, coupled with reductions in NCFS financial allocations from state budget cuts resulted in a reduced number of ferry sailings on some routes during the peak operations period in summer 2009.

> **"The North Carolina Ferry System is the second largest state-owned ferry system in the United States and transports more than 1.1 million vehicles and 2.5 million passengers annually."**

In addition, the NCFS experienced challenges from ferry service outages resulting from aging ferry vessels operating on some routes, a lack of stand-by ferry vessels in case of breakdowns, vessels out of service due to increased U.S. Coast Guard Certificate of Inspection requirements, unreliable support vessels that have exceeded their useful life, and a lack of certified welders and marine electricians to support the maintenance functions. The NCFS vessels also do not meet Environmental Protection Agency's (EPA) Tier 3 diesel emissions regulation and the NCFS will need to replace 110 diesel engines at a cost of $16 million.

However, these resource and operations challenges present an opportunity to analyze existing ferry operations, and to develop optimal scenarios to maximize the efficiency of the ferry system. The goal for this project was to analyze available data in order to provide the NCFS with recommendations to optimize its current resources, as well as to explore future opportunities.

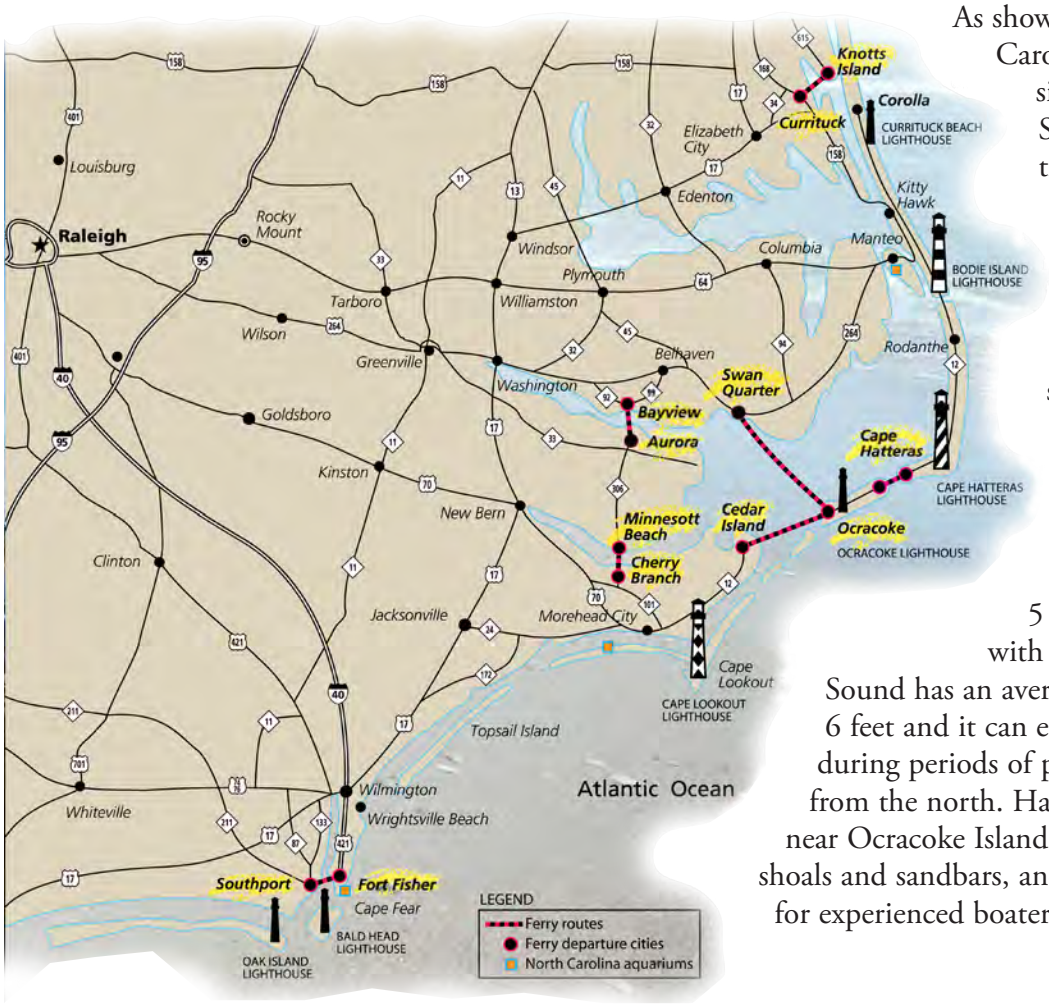
II. CURRENT STATE OF THE FERRY SYSTEM

The research team gathered information on various aspects of and impacts from, NCFS operations. First, some of the unique aspects of the NCFS are highlighted, followed by key findings from a survey of ferry passengers, concluding with a look at several economic dimensions of ferry operations in the state.

The North Carolina Ferry System

The NCFS meets several different types of travel needs in North Carolina's coastal communities, including daily work commutes, transportation to schools, and for recreational purposes. Ferries also serve in critical community service and public safety roles, providing emergency services to residents and visitors, offering a means of emergency evacuation, and sometime even rescuing distressed boaters. The NCFS is truly a part of fabric of our coastal communities.

Figure 1: Location of North Carolina Ferry Routes



As shown in **Figure 1**, North Carolina ferries operate over six bodies of water: Pamlico Sound, the Pamlico River, the Neuse River, Currituck Sound, the Cape Fear River, and Hatteras Inlet.

Pamlico Sound is the second largest estuary in the United States, with 80 miles of fetch in its north – south orientation. The Sound is shallow with water depths ranging from 5 to 20 feet and it is filled with shallow shoals. Currituck Sound has an average water depth of only 6 feet and it can easily become impassable during periods of prolonged strong winds from the north. Hatteras Inlet and the waters near Ocracoke Island are notorious for shifting shoals and sandbars, and are a challenge, even for experienced boaters, to navigate.

> *"The NCFS is truly a part of the fabric of our coastal communities."*

The operating schedule for each ferry route is oriented to meet local community needs. For example, the Currituck – Knotts Island ferry transports commuters, tourists, and school buses. Three bus-loads of 7th- through 12th - grade students are ferried from the island daily to attend schools on the mainland. On days when the ferry cannot operate due to insufficient water depth from wind-driven tides, the alternative route involves a two-hour bus ride through Virginia.

The Bayview – Aurora ferry transports many employees who work at the Potash Corporation of Saskatchewan (PCS) phosphate mine in Aurora, which operates continuously. The Cherry Branch – Minnesott Beach ferry provides a shorter travel route for many local residents to cross the Neuse River, including commuters to Marine Corps Air Station (MCAS) Cherry Point.

The Swan Quarter – Ocracoke ferry offers direct transportation for residents of Ocracoke Village to the Hyde County seat of Swan Quarter. The alternate driving route would take nearly four hours, and require traveling via the ferry from Ocracoke to Hatteras Island.

The Hatteras – Ocracoke ferry route is the busiest route in the Ferry System, transporting over 60,000 vehicles per month during the summer peak tourist season to visit Ocracoke Village. The economy of the village depends on the ability of visitors to access it via the ferry service.

A summary is shown in **Table 1.**

Table 1: North Carolina Ferry System Route Profiles

				Sailings per day		Annual Traffic[1]		
FERRY ROUTE	**DISTANCE (miles)**	**SAILING TIME**	**Number of VESSELS**	**PEAK**	**OFF-PEAK**	**VEHICLES**	**PASSENGERS**	**TOLL**
Currituck - Knotts Island	5.0	45 min.	1	12	12	29,490	89,438	No
Bayview - Aurora	3.5	30 min.	1	22	22	81,572	129,564	No
Cherry Branch - Minnesott Beach	2.0	20 min.	3	56	56	277,254	486,782	No
Swan Quarter - Ocracoke	30	2.5 hrs.	2	8	4	27,431	64,634	Yes[2]
Cedar Island - Ocracoke	26	2.25 hrs.	3	12	8	75,783	183,583	Yes[2]
Hatteras - Ocracoke	4.5	40 min.	9	63	31	353,192	951,491	No
Southport - Fort Fisher	4.0	35 min.	2	28	24	185,447	499,796	Yes[3]

[1] 2007-2008 fiscal year ferry traffic data

[2] passengers: $1; bicycles: $2; motorcycles: $10; vehicles less than 20' long: $15; vehicles 20' - 40' long: $30; vehicles 40' - 65' long: $45

[3] passengers: $1; bicycles: $3; motorcycles: $3; vehicles less than 20' long: $5; vehicles 20' - 40' long: $10; vehicles 40' - 65' long: $15

The role of the NCFS extends beyond simply providing marine transportation. On October 23, 2009, the captain on the *Silver Lake*, traveling on the Cedar Island – Ocracoke route, noticed an overturned 16-foot skiff. The five fishermen from that boat had been in the 60-degree water for nearly 90 minutes. Ferry crew members successfully rescued all five fishermen. In early November 2009, a storm surge generated by Tropical Storm Ida, over-washed Highway 12 north of Rodanthe, cutting highway access to southern Hatteras Island. The closure prompted the NCFS to operate emergency ferry runs from Rodanthe to Stumpy Point to provide a means of access between the impacted communities in Dare and Hyde Counties.

Table 2: North Carolina Ferry System Vessel Specifications

Vessel Name	Vehicle Capacity	Passenger Capacity	Length In FT.	Breadth in Ft.	Draft in Ft.	Gross Ton	Year Built	Vessel Age	Modifications
Hunt	17 (1)	149	159' -3"	40'-0"	5'-0"	462	1984	25	30' Midbody extended (1999)
Ocracoke	30	149	42'-0"	8'-6"	4'-0"	275	1990	19	
Kinnakeet	30	149	151'-9"	42'-0"	4'-0"	280	1989	20	
Chicamacomico	30	149	149'- 9"	42'-0"	4'-0"	275	1990	19	
Cape Point	30	149	151' -9"	42'-0"	4'-0"	275	1990	19	Bow & Hull extended (1989)
Frisco	30	149	149'- 9"	42'-0"	4'-0"	275	1990	19	
Roanoke	30	149	149' -9"	42'-0"	4'-0"	248	1993	16	
Thomas A. Baum	30	149	149' -9"	42'-0"	4'-0"	248	1995	14	Bow thruster added (2000)
Hyde	35	300	161'-0"	48'-0"	7'-5"	574	1977	32	
Floyd J. Lupton (2)	40	300	180'-0"	44'-0"	6'-0"	374	2000	9	
Neuse (2)	40	300	180'-0"	44'-0"	6'-0"	374	1998	11	
Fort Fisher (2)	40	300	180'-0"	44'-0"	6'-0"	374	2000	9	
Croatoan (2)	40	300	180'-0"	44'-0"	6'-0"	376	2003	6	
Stanford White (2)	40	300	180'-0"	44'-0"	6'-0"	372	2003	6	
Hatteras (2)	40	300	180'-0"	44'-0"	6'-0"	407	2006	3	
Southport (2)	40	300	180'-0"	44'-0"	6'-0"	374	1996	13	
Daniel Russell (3)	40	300	180'-0"	44'-0"	6'-0"	418	1993	16	
Carteret	50	300	220'-0"	50'-0"	6'-6"	771	1989	20	60' Midbody extended (1998)
Cedar Island	50	300	220'-0"	50'-0"	6'-6"	648	1994	15	
Silver Lake	50	300	220'-0"	48'-0"	6'-0"	688	1965	44	60' Midbody extended (1987)
Pamlico	50	300	220'-0"	48'-0"	6'-0"	734	1965	44	60' Midbody extended (1986)

(1) Vehicle capacity reduces to 4 when transporting 3 school buses during school-travel times

(2) Vessels with Voith-Schneider propulsion system or "double-ender" that enable embark/disembark without turning the vessel around

(3) "Double-ender" with conventioanl propeller engines

The NCFS's 21 vessels consist of five Sound Class vessels that serve the two longest ferry routes: Cedar Island – Ocracoke and Swan Quarter – Ocracoke. Nine River Class vessels serve four river crossings: (1) Currituck – Knotts Island, Bayview – Aurora; (2) Cherry Branch – Minnesott Beach; and (3) Southport – Fort Fisher. Eight vessels serve the Hatteras – Ocracoke route. Specifications of each of these vessels are summarized in **Table 2**.

The average age of NCFS vessels is 18 years. The *Silver Lake* and the *Pamlico* are the two oldest vessels, each being 44 years old. The newest vessel is the *Hatteras*, built in 2006. Vessels purchased since 1996 are equipped with a Voith-Schneider propulsion (VSP) system. With that system, propulsion is provided by a circular plate with an array of vertical blades that protrudes from the bottom of the ship. The VSP offers high maneuverability, aiding in terminal docking that allows vehicles to load and unload from both ends to reduce terminal dwell time.

The NCFS also operates ten support vessels responsible for maintaining the navigation channels at the thirteen ferry terminals, as well as maintaining the terminal and shipyard pilings and docks, and assisting disabled ferries. The tug *Albemarle*, the dredge *Carolina*, and the crane barge *Skyco* conduct the majority of the dredging operations. The *Skyco* entered service in September 2008 and is the first vessel built entirely in-house at the NCFS shipyard in Manns Harbor. The dredge *Carolina* (built in 1968) and the tug *Albemarle* (built in 1977) however are in poor shape and are high maintenance items. Both vessels have long list of upgrade and repair needs. These needs range from mechanical equipment to perform vessel missions to safety equipment to protect the vessel crew.

Table 2 also describes some of the vessel modifications that were required to meet increasing capacity demands. The most notable modifications are the 60-foot, mid-body extensions to the three Sound Class vessels to accommodate additional vehicles and passengers. The *Hunt* was also extended by 30 feet to transport school buses crossing Currituck Sound. These significant modifications were performed by the NCFS shipyard in Manns Harbor. In spite of these admirable efforts to meet demands for additional vehicle capacity, the aging vessels require frequent maintenance resulting in significant out-of-service periods. Vessels must also be taken out of service for U.S. Coast Guard's Certificate of Inspection (COI) twice every five years. Without a stand-by vessel, any breakdown incident results in a disruption to service.

The Manns Harbor shipyard is the largest state-owned and operated shipyard in the U.S. The shipyard is totally self-sufficient with its own electrical generating power plant and water system, and has the capabilities to work around the clock in any weather conditions. The shipyard is capable of conducting all maintenance, from basic dry docking to making any repairs required to meet U.S. Coast Guard regulations. The facility can also paint a vessel from top to bottom.

The NCFS's shipyard and the field maintenance facilities, however, are facing a critical shortage of skilled and certified shipyard workers. The number of NCFS vessels to be inspected has increased from nine to 21 vessels. The shipyard is having a difficult time attracting certified workers due to the high cost of living in coastal communities and competition with the Norfolk shipyard.

Key Findings from a Survey of Ferry Passengers

The research team conducted a survey of NCFS passengers to determine travelers' demographics, their assessments of the service they received, their willingness to pay for ferry service, as well as any suggestions for improving services. Passengers on the seven routes completed a total of 2,081 surveys in July 2009. The key findings from the survey are summarized as follows:

Respondents expressed a high overall satisfaction with their ferry experience. Overall, 72% were extremely satisfied with their experience, while another 25% were somewhat satisfied.

While passengers' primary concerns varied by route, the greatest concern on the majority of the routes was being able to board the intended departure (and not having to wait for a subsequent sailing).

- Survey respondents on five ferry routes (Bayview – Aurora; Currituck – Knotts Island; Fort Fisher – Southport; Cedar Island – Ocracoke; and Swan Quarter – Ocracoke) ranked boarding their intended departure as their primary concern. On average, 76% of those riders were extremely satisfied with their ability to board their intended departure.
- The number of scheduled trips was the primary concern of passengers on the Cherry Branch – Minnesott Beach route. Respondents were evenly divided in their satisfaction with the number of trips scheduled on that route.

> ***"72% [of surveyed ferry passengers] were extremely satisfied with their experience."***

- Hatteras – Ocracoke passengers' primary concern was the length of wait-time to board; however, 63% of those travelers were extremely satisfied with the length of their wait-time.

The frequency of use varies by route. On the Cherry Branch – Minnesott Beach and Bayview – Aurora routes, the largest category of users are daily passengers (36% and 45%, respectively); however, the majority of passengers on the remaining routes reported utilizing the ferry route only once or twice a year, with the surveys indicating such usage at the following percentages: Currituck – Knotts Island (60%); Hatteras – Ocracoke (87%); Southport – Fort Fisher (75%); Cedar Island – Ocracoke (89%); and Swan Quarter – Ocracoke (79%).

Other information from respondents showed that:

- The majority of travelers board the ferries in a vehicle less than 20-feet long (86%).
- The majority of travelers are able to board their intended departure (92%).
- Overall, (61%) of survey respondents used a ferry for tourism or recreational activities, with 22% making work-related trips.

Travelers believe that using the ferry saves costs compared to driving via an all-land route, with 70% of travelers estimating savings of more than $10 (per one-way trip) and 40% estimating savings of more than $25 (per one-way trip).

Passengers also believed that they realized significant travel-time savings from using a ferry versus driving by an all-land route, with 66% reporting they saved more than one hour per one-way trip and 38% reporting they saved more than two hours per one-way trip as compared to an all-driving route.

Responses were split nearly evenly between those who indicated they were willing to pay, and those who were *not* willing to pay for the service they received. The greatest percentage of travelers (63%) willing to pay for the service they received traveled the Hatteras – Ocracoke route, while the lowest percentage of travelers (45 %) who indicated a willingness to pay traveled the Minnesott Beach – Cherry Branch route

Finally, a majority of passengers who indicated a willingness to pay believed ferry travelers should pay for 25% of the costs to operate the service. When asked to choose among 0%, 25%, 50%, and 75% of operating costs, approximately one-third replied 0% (unwilling to pay), and one-third indicated 25%.

Critical Economic Dimensions of the North Carolina Ferry System

The NCFS provides mobility to coastal areas for local residents and visitors by transporting approximately one million vehicles each year (FY 2007-2008). This mobility supports tourism, provides access for residents to employment opportunities, and travel time savings to a variety of destinations.

Traveling on one of the NCFS routes offers many travelers a shorter travel option than if they were to drive the entire trip. The ferry option provides an opportunity to save both travel time and vehicle operating costs. The total travel time benefits to Ferry System travelers are calculated to be over $26 million per year, with a net positive impact of over $8 million per year when ferry operating costs are subtracted.

The access provided by the NCFS is critical in supporting tourism in the coastal areas of North Carolina. Although a more rigorous study is needed to determine a more precise estimate of the contribution from the ferries to tourism, the research team generated an estimate based on visitor travel patterns. The parameters used in estimating the ferries' contribution to tourism included: the annual vehicle count from the NCFS, the percentage of visitors responding to the survey conducted during this study, and an average amount spent by visitors per trip ($562).[1] Based on calculations of these parameters, the contribution of the NCFS operations to tourism in North Carolina is estimated to be approximately $325 million, as shown in **Table 3** (Page 9).

The research team estimates approximately 24% of NCFS trips are work-related, as a result of information compiled from the traveler survey. That the ferry system serves a major role in facilitating access to local employment opportunities for residents is demonstrated by its providing nearly a quarter of a million annual work trips.

[1] Fast Facts – 2008 Economic Impact of Tourism. North Carolina Division of Tourism, Film and Sports Development. North Carolina Department of Tourism. Raleigh, NC, 2009.

Table 3: Travel Time, Tourism, and Local Employment Contributions

FERRY ROUTE	TRAVEL TIME BENEFITS	VESSEL OPERATING COSTS	NET IMPACT (Benefit - Costs)	TOURISM EXPENDITURES SUPPORTED	ANNUAL WORK TRIPS SUPPORTED
Swan Quarter - Ocracoke	$ 1,358,000	$ 2,081,000	$ (723,000)	$ 6,584,000	720
Currituck - Knotts Island	$ 1,186,000	$ 2,274,000	$ (1,087,000)	$ 9,447,000	5,310
Cedar Island - Ocracoke	$ 8,405,000	$ 5,346,000	$ 3,059,000	$ 17,428,000	2,710
Bayview - Aurora	$ 3,438,000	$ 1,728,000	$ 1,710,000	$ 15,128,000	42,420
Southport - Fort Fisher	$ 3,227,000	$ 3,246,000	$ (19,000)	$ 71,913,000	37,090
Cherry Branch - Minnesott Beach	$ 8,716,000	$ 3,623,000	$ 5,093,000	$ 35,838,000	130,310
Hatteras - Ocracoke	N/A - No Alternative Driving Route			$ 168,720,000	17,660
TOTAL	***$ 26,330,000***	***$ 18,298,000***	***$ 8,033,000***	***$ 325,058,000***	***236,220***

III. PEER ANALYSIS

The NCFS faces some challenges similar to those faced by other ferry operators including:

- A lack of capacity during peak periods;
- Aging vessels and facilities that will need to be replaced and/or rehabilitated, and a lack of corresponding long-term capital funding;
- Projected increases in demand for services; and
- Impacts to operations, maintenance, and capital improvements from budget reductions.

The North Carolina Ferry System, however, also faces several unique challenges including:

- Operating in areas of extremely shallow water with shifting shoals;
- Operations on both river and sound waters; and
- Difficulty in attracting and retaining skilled employees who must work in an area with a high cost of living.

To compare the ferry operations in North Carolina with peers, the seven North Carolina ferry routes were first classified according to their characteristics as "River," "Hatteras," or "Sound" routes. Potential peers were then selected based on statistical and qualitative similarities. To the extent possible, public sector operators were selected to provide a more similar comparison with North Carolina routes. **Table 4** (Page 10) lists the selected ferry routes.

Key findings from the peer analysis include the following: With regard to vessels, those used by the North Carolina Ferry System generally have a shallower draft than those of other operators, reflecting the constraints imposed from operating in areas of limited water depth and subject to shoaling. Many operators, such as Washington State Ferries (WSF), and the Texas Department of Transportation, use only double-ended vessels to eliminate having to turn a vessel at terminals. The age of many North Carolina vessels is less than that of many peers; however, not all peer vessels operate in a saltwater environment.

With regard to operations, typical operating speeds are similar to the average speeds for peers, particularly for Sound Class vessel operations. Crossings times are similar to those for peers when looking at routes of similar length.

Table 4: Selected Peer Statistics

Route	Crossing Length (miles)	Crossing Time (minutes)	Annual Vehicles (2006)	Car (<20') Toll per Mile
"River" Crossings				
North Carolina Ferry System				
• Currituck—Knotts Island,	5	45	18,382	No toll
• Aurora—Bayview	3	30	74,143	No toll
• Cherry Branch—Minnesott Beach	1.75	20	262,929	No toll
• Southport—Fort Fisher	3	30	183,306	$1.67
Louisiana Department of Transportation & Development/ Crescent City Connection Division				
• New Orleans—Algiers, LA	0.5	7	152,949	$2.00
• New Orleans—Chalmette, LA	0.5	7	1,080,605	$2.00
• Gretna—New Orleans, LA	0.5	7	31,431	$2.00
Lake Champlain Transportation Company				
• Grand Isle, VT—Plattsburgh, NY	1.4	12	N.A.	$6.79
• Charlotte, VT—Essex, NY	2.3	25	N.A.	$4.13
Virginia Department of Transportation				
• Jamestown—Scotland, VA	2.2	18	997,430	No toll
Washington State Ferries				
• Point Defiance—Tahlequah, WA	1.5	15	405,000	$12.33
"Hatteras" Crossings				
North Carolina Ferry System				
• Hatteras—Ocracoke	4.25	40	342,461	No toll
Hornblower Marine Services, under contract to Alabama DOT				
• Dauphin Island—Fort Morgan, AL	4.2	45	10,653	$3.81
Delaware River and Bay Authority				
• Cape May, NJ—Lewes, DE	17	80	359,450	$1.74
Casco Bay Island Transit District/Casco Bay Lines				
• Portland—Peaks Island, ME	2.5	15	26,566	$13.60
Texas Department of Transportation				
• Galveston—Bolivar, TX	3	20	2,134,999	No toll
• Port Aransas, TX	0.25	5	1,084,654	No toll
Washington State Ferries				
• Port Townsend—Keystone, WA	4.3	30	370,000	$2.59
• Fauntleroy—Southworth, WA	4.4	35	560,000	$2.53
"Sound" Crossings				
North Carolina Ferry System				
• Cedar Island—Ocracoke	23	135	78,759	$0.65
• Ocracoke—Swan Quarter	26	150	22,710	$0.58
Inter-Island Ferry Authority				
• Ketchikan—Hollis, AK	36	180	15,105	$2.78
The Bridgeport & Port Jefferson Steamboat Company				
• Bridgeport, CT—Port Jefferson, NY	14	75	480,000	$3.64
Fishers Island Ferry District				
• New London, CT—Fishers Island, NY	8	45	46,782	$3.38
Cross Sound Ferry Services, Inc.				
• New London, CT—Orient Point, NY	18	80	N.A.	$2.61
Maine State Ferry Service				
• Rockland—Vinalhaven, ME	15	75	20,298	$1.65
Woods Hole, Martha's Vineyard and Nantucket Steamship Authority				
• Hyannis—Nantucket, MA	30	150		114,377
Chrarlevoix Country Transportation Authority				
• Charlevoix—St. James, Beaver Island, MI	28	130		6,409
Lake Champlain Transportation Company				
• Burlington, VT—Port Kent, NY	9.8	55		N.A

Vessel replacement costs at peer ferry systems have been relative high. For example, in December 2008, WSF contracted for the construction of a 64-car ferry priced at $65.5 million. On October 13, 2009, WSF awarded a contract to construct two additional 64-car ferries for a total of $114 million.[2] In 2007, the Virginia Department of Transportation (VDOT) spent approximately $12.5 million to operate four ferry services and to maintain seven vessels. The estimated cost to replace two of the Scotland – Jamestown, Virginia, ferries was estimated at $20 million per vessel.[3]

Many ferry systems' employees are unionized. All WSF employees except those in management positions are members of various unions.[4] The Woods Hole, Martha's Vineyard and Nantucket Steamship Authority workforce is nearly totally unionized, with eight bargaining units represented by four different unions.

Many peers charge vehicle tolls; however, state-run systems in Virginia and Texas do not. Toll rates, calculated on a per-mile basis, are generally lower on those North Carolina routes on which tolls are now charged, than on peers' routes. Best practices in use by peers that could be applied to the NCFS include:

- Application of service standards. For example, Level of Service (LOS) standards recommended for the Washington State Ferries are the percent of total sailings filled to capacity in May, August, and January on a route-by-route basis. British Columbia Ferries (BC Ferries) tracks on-time ferry departures and overloads.
- Surveys of customers on a regular basis to determine their satisfaction with the services they receive, and to highlight areas in which improvements are possible. BC Ferries utilizes a comprehensive survey that addresses customers' satisfaction with all aspects of service, from making the reservation, arrival at the departure terminal, the actual ferry trip, as well as perceptions on safety and overall value.

[2] From the Internet: http://www.wsdot.wa.gov/News/2009/08/7_wsdot-seeks-bids-for-ferries.htm

[3] Biennial Report on the Condition and Performance of Surface Infrastructure in the Commonwealth of Virginia, Virginia Department of Transportation, Richmond, September 2007, Page 12.

[4] From the Internet: http://www.wsdot.wa.gov/ferries/info_desk/faq/index.cfm?faq_id=19.

- Many ferry routes that charge a toll allow reservations, and some require reservations. On-line reservations are available at many peer ferry routes. Several ferry systems impose a fee if a reservation is cancelled, or require a minimum advance notice for a cancellation.
- Some tolled routes, particularly from the mainland to an island, require purchasing a round-trip ticket on the mainland, reducing infrastructure and personnel costs.
- Some ferry operators have imposed fuel surcharges to help maintain a more constant rate of revenue generation.
- Some ferry operators charge a fare for vehicle drivers/ passengers, in addition to a toll for their vehicle.


River Class

Several strategies have been adopted to deal with impacts from reductions in budgets. For example, the VDOT implemented $1.27 million in total ferry service reductions starting in July 2009. While the Jamestown-Scotland Ferry retained 24/7 operations, streamlined internal operations and security practices will save $1.1 million annually. Vehicle security screening will change from a 24/7 process to a condensed, alternating schedule.


Hatteras

The Portland – Peaks Island, Maine, ferry reduced part-time employee work hours during FY 2009 with savings of $13,500, and continued those reductions through FY 2010. The number of seasonal employees was also reduced, saving $28,200. Use of fixed-price fuel contracts saved $165,000 for boats and $1,250 for the terminal facility. Finally, mothballing two boats during the winter season provided $25,884 in fuel savings.

On March 12, 2009, as a result of low ridership and a lack of alternative operating funds, the Alaska Inter-Island Ferry Authority board cancelled operations of the Coffman Cove, Wrangell, and Petersburg's South Mitkof Terminal route until additional operating funds can be identified. Low ridership, declining populations in the region, and the recent economic downturn led to the decision to discontinue service on the route.

In summary, many U.S. ferry operations reduced operating expenses during 2009 by reducing the number of sailings in order to reduce the number of vessels and crew. For the tolled ferry routes, NCFS's cost per-mile is generally less than that of peers. The current NCFS toll-return is approximately 6% of the system's operating cost, whereas Washington State's goal is to recover 90% of the operating costs through tolling. Washington State's vessel replacement program is funded through legislative action including fund transfers from the Motor Vehicle and Multimodal Accounts, dedicated gas tax funding, bond proceeds, and federal funding. North Carolina does not have a vessel replacement program — funding is allocated through the NCDOT Transportation Improvement Plan.


Sound Class

IV. Current Opportunities

Several opportunities are available to optimize resources and increase the financial sustainability of the NCFS.

Optimization of Resources

Ferry operating schedules have been established based on historical precedents. The research team assessed the schedules to determine if the various routes were operating at an optimal efficiency. Using FY 2007-2008 ferry ridership data, the research team analyzed monthly, weekly and daily travel demands for the seven routes.

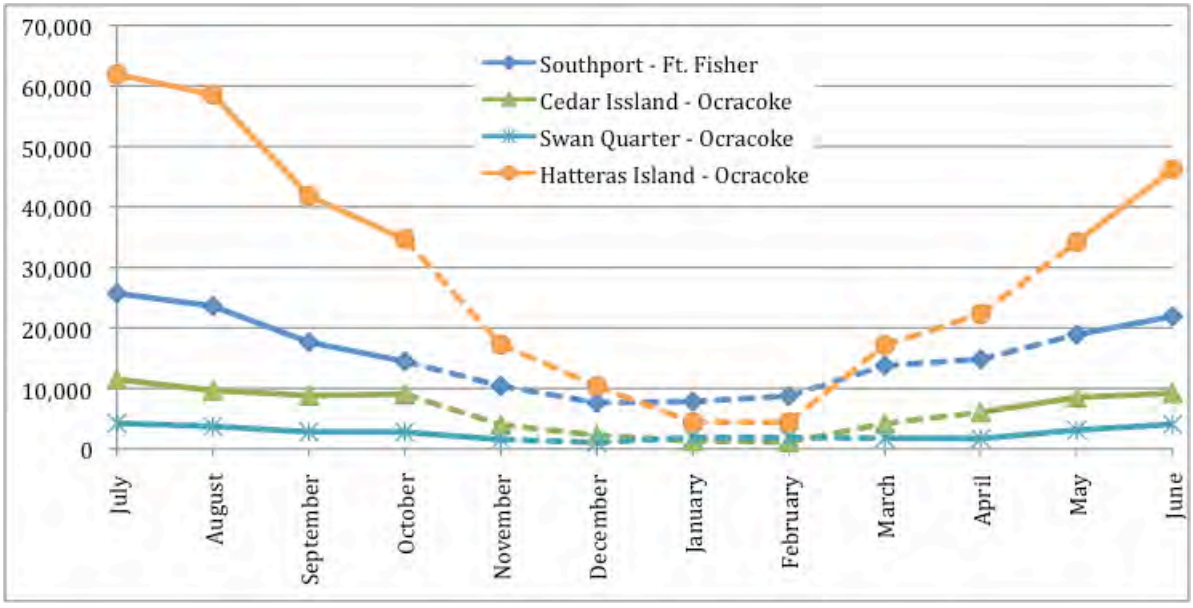
It is worthwhile noting that even though the NCDOT operates a ferry "system" involving 21 vessels, the ferry routes operate fairly independently from each other. This is a result of the seven ferry routes being located over a relatively great expanse of coastal North Carolina, and the routes having been established to meet distinct local needs. Therefore, there is little opportunity to optimize the overall ferry schedule to minimize the number of vessels without drastic system-wide service reductions.

The Swan Quarter – Ocracoke and Cedar Island – Ocracoke ferry routes share one common terminal at Ocracoke and might seem to be candidates for operation optimization. However, due to the long crossing times on those routes, the maximum working hours allowed by U.S. Coast Guard regulations, the limited overnight crew accommodations in Ocracoke, and constraints dictated by local needs, it is not possible to further optimize the fleet with the current mix of vessels.

Therefore, the research team focused its optimization efforts on studying seasonal, weekend/weekday, and daily demand variations. The findings are illustrated in the section below.

Four of the seven ferry routes exhibit pronounced seasonal ridership variations as a consequence of their heavy summer tourist ridership. That results in schedule changes with increased service to meet peak demands during the summer tourist season, and fewer sailings during the winter off-peak season. As shown in **Figure 2**, the four affected ferry routes are (1) Southport – Fort Fisher; (2) Cedar Island – Ocracoke; (3) Swan Quarter – Ocracoke; and (4) Hatteras – Ocracoke. The Hatteras – Ocracoke ferry route has the greatest seasonal variation, with more than a 90% decrease in ridership during January and February compared with that in July.

Figure 2: Monthly Ridership by Ferry Route



The dashed lines in **Figure 2** (Page 12) represent the period when ridership either falls below or rises above 50% of each route's peak ridership in July. Typically, ferry ridership begins to increase the week prior to Memorial Day weekend. At the end of the summer, ridership continues at relatively high levels beyond Labor Day through September, and then decreasing substantially in October.

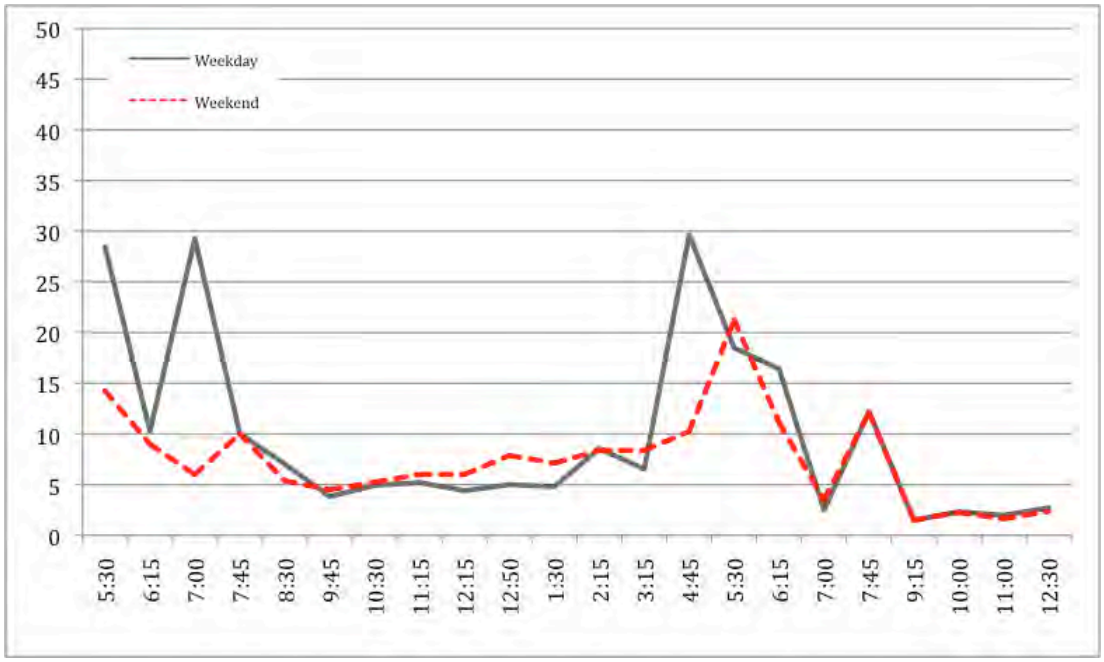
An analysis of monthly ridership, as shown in **Figure 2**, supports the NCFS's current practice of operating peak schedules during the period between Memorial Day weekend and Labor Day, and off-peak schedules during the winter.

The research team further analyzed ridership data for potential savings during the off-peak period on the three routes (Bayview – Aurora; Cherry Branch – Minnesott Beach; and Southport – Fort Fisher) that are heavily traveled by commuters to and from work. Potential savings could involve: (1) instituting abbreviated weekend sailing schedules due to less commuter traffic during weekends, (2) implementing additional schedule cut-backs during non-commuting time periods throughout the day. February 2008 ridership data was used because it best represents commuter traffic and is influenced the least by tourist travel.

The Bayview – Aurora ferry route operates from 5:30 a.m. to 12:30 a.m., making 22 sailings per day. The peak sailing demands align with the shift schedule at the Potash Corporation of Saskatchewan (PCS) facility in Aurora. Because PCS operates 24 hours per day, seven days per week, weekend demand is similar to weekday demand, with only slightly lower vehicle counts during peak periods of demand. According to a PCS spokesperson, this reduction in the workforce is attributable to fewer maintenance workers being at the facility during weekends.

As shown in **Figure 3**, the sailings with the lowest demand are those after 7:45 p.m. They are the most appropriate candidates for elimination. This finding coincides with the Ferry System's decision to eliminate sailings in order to reduce the number of vessel crews in 2009.

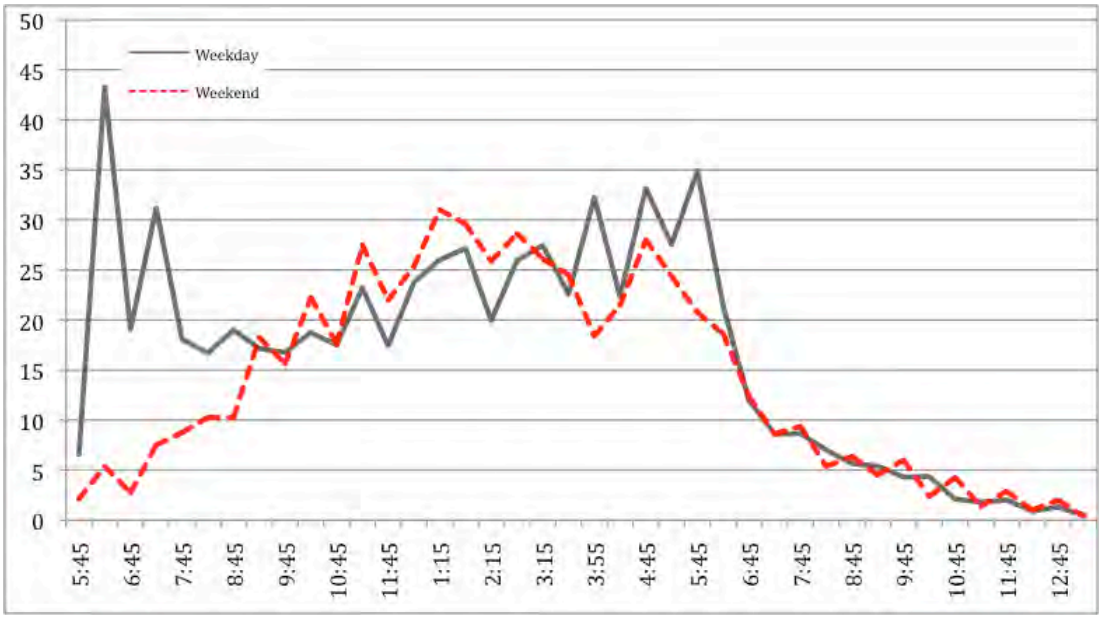
Figure 3: Bayview – Aurora Ferry Route Average Daily Traffic Count, February 2008



The Cherry Branch – Minnesott Beach route is the second most heavily used ferry route in the NCFS, transporting nearly 280,000 vehicles and 490,000 passengers annually. There is only a small difference in ridership between July and February for this route (13,000), reflecting a high proportion of travelers being commuters. The data in **Figure 4** shows high ridership during the morning commute period from 6:15 a.m. to 8:45 a.m., but demand is sustained at a relatively consistent level throughout the day, averaging 23 vehicles per sailing for both weekdays and weekends. Ridership drops off gradually after the 9:45 p.m. sailing.

During the summer of 2009, 32 sailings were eliminated on the Cherry Branch – Minnesott Beach route in order to operate with one less vessel crew and with only one instead of two vessels during part of the day. Because of the relative high demand throughout the day, if funding were available to hire an additional crew, we recommend that the majority of the sailings during that period be restored.

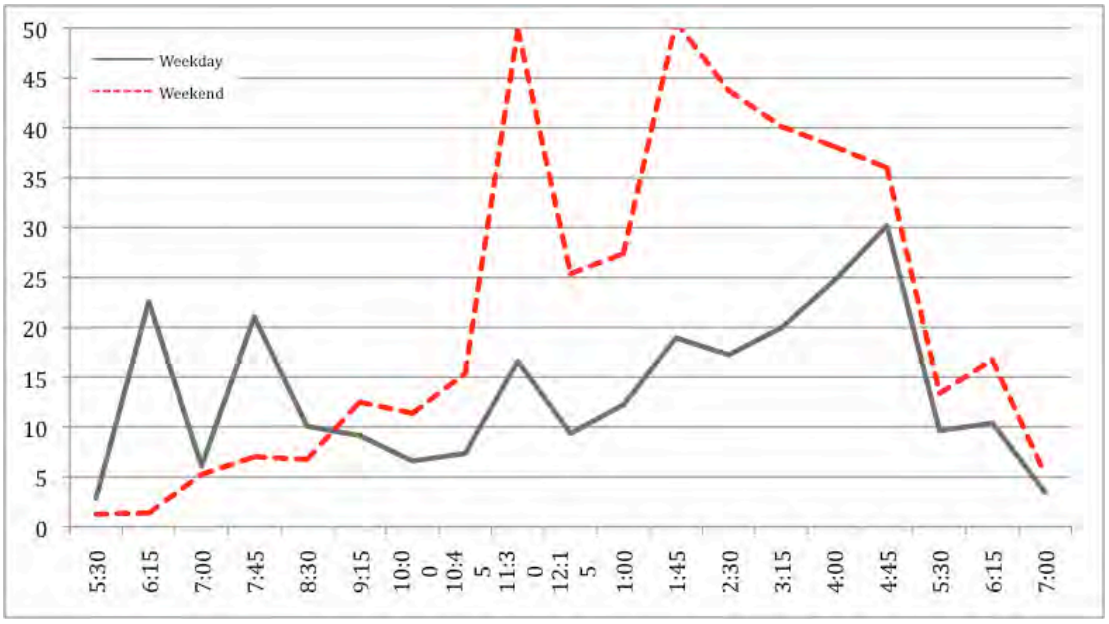
Figure 4: Cherry Branch – Minnesott Beach Ferry Route Average Daily Traffic Count, February 2008



The Southport – Fort Fisher ferry route exhibits differing demands between weekdays and weekends compared with other ferry routes heavily used by commuters. According to February 2008 data as shown in **Figure 5** (Page 15), weekend demands were higher than those on weekdays. There is the potential for achieving cost savings by eliminating the 5:30 a.m. and 6:15 a.m. weekend sailings; however, demand peaks on the 11:30 a.m. and 1:45 p.m. sailings during the weekend. These high demand periods reflect the accumulation of vehicles unable to board the intended sailing due to the reduction of four sailings during the off-peak season.

According to the preceding analyses, in responding to funding restrictions in 2009, the Ferry System did an excellent job identifying and taking advantage of opportunities to reduce sailings with minimal impacts to the level of service on most routes. The use of Memorial Day and Labor Day to distinguish between peak and off-peak sailing schedules is supported by this analysis. Few opportunities exist to eliminate early morning weekend sailings on the Minnesott Beach – Cherry Branch and Southport – Fort Fisher routes. However, ridership data support restoration of the mid-day weekend sailings on the Southport – Fort Fisher route. Ridership data also support restoration of a portion of both the weekday and weekend mid-day sailings on the Minnesott Beach – Cherry Branch route. Unfortunately, if those changes were to be implemented, that would add to the costs to operate those routes.

Figure 5: Southport – Fort Fisher Ferry Route Average Daily Traffic Count, February 2008



Financial Sustainability

This section first discusses the need for a stable long-range plan for ferry vessel replacement, including an exploration of potential revenues generated from a system-wide toll structure. It also provides information on tolling techniques and technologies, including discussions of potential tolling techniques that can help expedite the ferry boarding process, and manual versus electronic collection methods, and concludes with a potential application of tolling techniques and technologies to the seven NCFS routes.

Vessel Replacement

Since 1990, NCFS has introduced a new vessel, on average, every one to three years. The most recent addition to the ferry fleet was in 2006. The oldest vessels are *Silver Lake* and *Pamlico* which serve the two longest Sound crossing routes along with the vessels *Carteret* and *Cedar Island*. During the summer peak schedule, mechanical failures disrupt service because there is no stand-by vessel for the Sound crossing routes. Compounding this, an increased number of vessels (from the current nine to 21) will need to undergo USCG's Certificate of Inspection at a frequency of twice every five years. These factors lead the research team to believe that a vessel replacement program must become a part of NCFS's sustainable long-range plan.

There are a limited number of options facing the NCFS in order to implement a vessel replacement plan:

Status Quo – As described in previous sections of this report, the NCFS has done an admirable job maintaining operations and dealing with the demands of an aging fleet. If no action is taken to develop a long-term vessel replacement program, however, the research team believes that it will not be possible to continue to maintain the level of service to which ferry riders have grown accustomed. While the demand for ferry services shows no signs of significantly decreasing, any shortage of in-service vessels can potentially impact the schedules of several ferry routes, resulting in a decrease in the number of sailings.

Legislative Action – In 2009, $20 million was allocated from the Transportation Improvement Program for the purchase of a new ferry vessel. In order to maintain levels of service expected of the NCFS, it may be necessary for vessel replacement funding to be a regular feature of the North Carolina state budget.

Tolling – In terms of the financial sustainability and longevity of the NCFS, the adoption of a system-wide tolling structure to generate a Capital Replacement Fund for ferry vessels should be considered a viable option. Revenues generated by such a tolling structure could provide a reasonably stable long-term source of funding to ensure the timely replacement of the aging ferry fleet. The remaining portion of this section will examine various tolling structures as a means to generate Capital Replacement Funds.

Tolling

To examine how tolling might contribute to revenues that could be used to generate a Capital Replacement Fund, a modeling tool was developed that uses data from a variety of sources — historical ridership, system operations, and survey results — to generate potential toll structures that satisfy given conditions. As with all models, it is important to understand the assumptions used in creating the model and the limitations those assumptions may impose.

> **"... any strategy in developing a toll structure should strive for a reasonable compromise between optimal revenue generations and be simple to understand and practical to implement."**

Currently, a toll is not charged on four of the seven NCFS routes. If a system-wide tolling structure were to be adopted, travelers that have never paid a toll to ride a ferry on some routes would be required to do so. That would represent a major paradigm shift for the NCFS, the residents, commuters and tourists that use the ferries, and the North Carolina coastal community as a whole. It is important, therefore, to not underestimate anticipated impacts from adopting ferry tolls, and to carefully consider those impacts before implementing any change to the tolling structure.

It is the magnitude of this shift that presents the biggest challenge in modeling toll revenues for the NCFS. As stated previously, the NCFS is unique in many aspects, perhaps most notably in that the services it provides are currently provided either free of charge or at a greatly discounted price to travelers when compared to other ferry systems. Simply put, it is difficult to project how the public — whether a resident or tourist, commuter or school bus rider — will react to a system-wide adoption of tolls. And, although in the toll structure scenarios the revenue model assumes there will be a decrease in ferry demand due to increased tolls, at this point it is impossible to know exactly how large that reduction might be.

Setting a Toll Rate

Toll Revenue Model Assumptions

To examine the impact of various toll structures, the research team developed a toll revenue model. The model uses historical ridership data from FY 2005-06 through FY 2007-08 including average vehicle (all lengths) counts by month and by route. Tolling structures presented here assume all vehicles are less than 20-feet in length, which represents the overwhelming majority of ferry traffic.

In order to analyze toll revenue models, the concept of demand elasticity may be incorporated into the model. Simply put, demand elasticity means increased toll rates will result in a decreased demand. The price/demand characteristics of the NCFS with regard to tolling are not known at this point. Therefore, it is essential to clearly understand the implications of any elasticity assumptions. It is suspected that demand elasticity will vary widely among individual routes, largely dependent on passenger demographics. For instance, demand for the Hatteras – Ocracoke route, which is heavily oriented to tourists, would be expected to exhibit more inelastic behavior (less decrease in demand) than a route which primarily transports commuters. Once again, the adoption of tolls in a system in which the majority of travelers have always traveled free of charge is a fundamental systemic change that cannot be easily modeled. For the purpose of developing a toll structure for this study, an overall non-discretionary trip demand elasticity of -0.34 from a Washington State Ferries 2008 study[5] will be used.

All potential toll structures include the implementation of a monthly Commuter Pass. As in the existing toll structure for the three NCFS tolled routes, a Commuter Pass would provide a 100% discount per vehicle, per one-way trip. For the toll structure example presented here, the monthly cost of a Commuter Pass is set from $100 to $125. The effective annual toll discount from the Commuter Pass would be equivalent to one-way tolls of $2.40 to $3.00 for daily travelers (those making 500 one-way trips per year).

[5] Final Long-Range Plan, Washington State Ferries, December 2008, page 52.

System-wide Toll Structure Examples

Based on the assumptions described above, the tolling examples presented here can provide a template for estimating revenue generation for the entire ferry system. These examples are generated based on historical ridership data from FY 2005-06 through FY 2007-08 including average vehicle counts by month and by route. The simulation tool developed by the research team can also be used to examine revenue generation due to route specific demand elasticity, seasonal demand variations, vehicle length, and to provide guidance in negotiation of final toll rates.

The seven ferry routes have very different ridership and cost characteristics that could suggest the use of diverse toll rates. The research team believes any strategy in developing a toll structure should strive for a reasonable compromise between optimal revenue generation and simplicity of understanding, and practicality in implementation. To that end, the toll structure examples presented here will assume a "two-band" toll structure – one toll for the Sound routes and a different toll for all other routes.

The first example shown in **Table 6** is a two-banded toll structure: $10 for short crossings and $30 for long crossings. The Commuter Pass cost is $100 per month with a 100 percent discount. The projected annual revenue of $10.4 million assumes there will be no decrease in traffic demand. The projected annual revenue decreases to $8.45 million when demand elasticity is introduced in the calculations. Daily commuters averaging 500 one-way trips per year can expect an effective toll of $2.40 per one-way trip, assuming they purchase a Commuter Pass.

Table 6: Example 1 – Two-Band Toll Structure

CHERRY BRANCH – MINNESOTT BEACH	BAYVIEW – AURORA	CURRITUCK – KNOTTS ISLAND	HATTERAS – OCRACOKE	SOUTHPORT – FORT FISHER	CEDAR ISLAND – OCRACOKE	SWAN QUARTER – OCRACOKE
$10.00	$10.00	$10.00	$10.00	$10.00	$30.00	$30.00
Monthly Commuter Pass: $100 / 100% discount						
Projected Total Revenues: $10.4 million						
Projected Total Revenues — with Elasticity: $8.45 million						

The example shown in **Table 7** increases the toll from $10 to $12 for short crossings and from $30 to $50 for long crossings. The Commuter Pass cost is increased to $120 with no charge at the time of use. The projected annual revenue is $13.8 million, assuming there will be no decrease in traffic demand. The projected annual revenue with demand elasticity is $8.25 million, a decrease from the previous example due to the comparatively large increase in the Sound toll, which results in significantly decreased non-commuter demand for those routes. Daily commuters averaging 500 one-way trips per year would see an effective toll of $3.00 per one-way trip, assuming they purchase a Commuter Pass.

Table 7: Example 2 – Two-Band Toll Structure

CHERRY BRANCH – MINNESOTT BEACH	BAYVIEW – AURORA	CURRITUCK – KNOTTS ISLAND	HATTERAS – OCRACOKE	SOUTHPORT – FORT FISHER	CEDAR ISLAND – OCRACOKE	SWAN QUARTER – OCRACOKE
$12.00	$12.00	$12.00	$12.00	$12.00	$50.00	$50.00
Monthly Commuter Pass: $125 / 100% discount						
Projected Total Revenues: $13.8 million						
Projected Total Revenues — with Elasticity: $8.25 million						

Tables 6 and 7 illustrate possible tolling structures that have the potential to generate revenues for a Capital Replacement Fund to support a vessel replacement program for the NCFS. These toll structures minimize impacts to daily commuters while providing sufficient revenues to replace one vessel every other year. It is important to reiterate that the demand characteristics for each route are unknown and demand elasticity will likely be different than what was used in these examples. It will be necessary to index tolls to inflation to maintain similar purchasing power in future years.

Tolling Techniques and Technologies

The current NCFS toll collection at the Swan Quarter – Ocracoke and Cedar Island – Ocracoke routes is accomplished on-site or by an online reservation system. The Southport – Fort Fisher route toll is collected on-site at the terminals. The current tolling methods have worked well for those three routes; however, there will be significant increases in labor costs and traffic queuing at some terminals if all routes are tolled. On the Currituck – Knotts Island route, due to the low traffic volume, costs from manning an on-site tolling facility similar to those on the Southport – Fort Fisher route may result in so little revenue that it would not be feasible to impose a toll on that route. On-site tolling at the Hatteras terminal will further exacerbate queuing congestion spill-overs to Highway 12 during the peak season, and an online reservation system may not be utilized by most "day-trippers" visiting Ocracoke Village. Because of these concerns, this section describes various tolling techniques and technologies for consideration on a case-by-case basis by the Ferry System.

> **". . . the NCFS should collaborate with the North Carolina Turnpike Authority to adopt seamless tolling system that serves both the highway and ferry users. This will be the nation's first multi-modal tolling system."**

Given the variations among the seven NCFS routes, a "one size fits all" approach is not appropriate for the application of tolling techniques/technologies. The number of variations, however, should be minimized to the extent possible in order to facilitate operations, maintenance, and oversight of the applications. In addition, the NCFS should collaborate with the North Carolina Turnpike Authority to adopt a seamless tolling system that serves both highway and ferry users. This would be the nation's first such multi-modal tolling system.

Different techniques could be applied to several categories of routes, as outlined below.

Potential applications for relatively low volume ferry routes including Knotts-Island – Currituck; Swan Quarter – Ocracoke; Cedar Island – Ocracoke; and Bayview – Aurora:

- Manual toll collection with attendants at terminals, and some self-service kiosks;
- Round-trip ticketing with tolls collected only at one end of a route, and electronic ticketing (on-line ticket purchasing similar to buying an airline ticket).

Potential applications for medium volume routes including Cherry Branch – Minnesott Beach and Southport – Fort Fisher:

- A combination of manual (attendants at terminals, and self-service kiosks) and electronic toll collection (electronic toll readers with in-vehicle transponders)
- Electronic ticketing, which could be linked to a reservations process.

Potential applications for the high-volume Hatteras – Ocracoke route:

- Electronic toll collection (electronic toll readers with in-vehicle transponders;
- Electronic license plate readers;
- Attendants at only a few lanes, primarily to monitor electronic equipment;
- Electronic ticketing, which could be linked to a reservations process.

V. Future Options

Several potential options for changes to ferry operations in the longer term include the use of public transportation on Ocracoke Island, implementation of a high-speed ferry, and a new vessel construction approach that meets the Ferry System's vessel replacement needs while benefiting North Carolina's economy.

Public Transportation

To help meet increased travel demands, public transportation can be used in conjunction with ferry transportation to provide a multi-modal transportation system that would allow some travelers to avoid using their car. As such, public transportation offers a means to increase ferry route capacity by shifting some ferry travelers from driving aboard to walking aboard, allowing ferry vessels to carry more people.

A study conducted by the KFH Group, Inc., in 2005[5], outlined items the would need to be addressed if any future public transportation venture were to be successful on Ocracoke Island:

- **Parking** – the lack of space for vehicle parking at the Hatteras ferry terminal would require a parking facility to be located at a remote location with a shuttle to the ferry terminal. This would involve an additional transfer that would discourage riders. A parking facility would also need to successfully address an environmental review process.
- **Operations** – vehicles would operate on narrow, congested streets within Ocracoke village, and the lack of space for pull-outs would compromise riders' safety when boarding and alighting vehicles.
- **Seasonal demand** – the need for operations for only a few months would under utilize vehicles. That low vehicle productivity could result in a lack of interest by private contractors or increase the cost of such an operation.
- **Funding** – there are many challenges in developing partnerships/agreements among potential federal (National Park Service), state (NCDOT), and local (county and municipal) funding agencies.

Alternate Ferry Vessel Designs

In conjunction with developing a sustainable financial plan to fund future vessel replacements, the research team conducted a preliminary exploration of modern ferry vessel designs. Two potential opportunities are implementations of a high-speed auto/passenger ferry and use of composite materials in the vessel superstructure.

High-speed auto/passenger ferries have been in service for nearly two decades. In the U.S., the *Lake Express* vessel that traverses Lake Michigan is currently the sole high-speed auto/passenger ferry. Initiated in June 2004, it links Milwaukee, Wisconsin, and Muskegon, Michigan, with a 2.5-hour crossing time between terminals.

The first auto/passenger ferry in North America was *The CAT*, launched in 2002; however, that vessel was pulled from service in December 2009 due to low travel demand. Connecting Maine and Nova Scotia, Canada, it was nearly twice as large as the *Lake Express*, and carried 775 passengers and 250 vehicles.

There was an increase in the number of high-speed auto/passenger ferries following the European economic unification, and there are currently approximately 100 such vessels in operation. Greece has had a high concentration of such ferries since 1996.

The major difference from traditional ferry vessels is that high-speed auto/passenger boats are twin-hulled catamarans. This design reduces vessel weight and draft while maintaining stability. The capital cost of a high-speed auto/passenger ferry is estimated to be three times that of a traditional ferry. The operating cost per hour

[5] "Ocracoke Island Public Transit Implementation Study: Final Report," KFH Group, Inc., Bethesda, Maryland; June 10, 2005, prepared for the North Carolina Department of Transportation and Hyde County (N.C.) Transit.

is estimated to be twice that of a traditional ferry.[6] The potential cost savings from use of a high-speed ferry include a reduced cost per sailing due to a shorter sailing time and the potential for a smaller fleet size to meet a given schedule.

Use of a high speed ferry would be feasible only on the two longest routes that cross Pamlico Sound. A high-speed ferry could reduce the sailing time from 2.5 hours to less than one hour. During the off-peak season, with slight schedule adjustments, it would be feasible to operate the Swan Quarter – Cedar Island – Ocracoke system with a single high-speed ferry vessel instead of three traditional ferry vessels. During the peak-season, it would require more drastic schedule adjustments, and three high-speed ferries would be needed to operate the peak-season schedule.

An obstacle to introducing a high-speed ferry to the NCFS is the onshore dock ramp configuration for vehicles to embark/disembark from the vessels. The current configuration is designed specifically for mono-hull vessels. It is not known if the current docking configurations at Ocracoke, Cedar Island, and Swan Quarter could be retrofitted to accept both a high speed catamaran and the traditional mono-hull vessels.

The second alternative vessel design studied by the research team is the use of composite materials for a vessel superstructure (the above deck portion of the vessel).

"Potential exists for North Carolina to tap into its own workforce of skilled boat builders to construct ferry vessels...."

The use of a composite superstructure was explored first by the Swedish ship-building industry. The goal of using lightweight building materials was to improve operating efficiency, increase speed, reduce fuel costs, and provide greater stability and carrying capacity. The primary benefit of a composite superstructure for the NCFS would be a lighter vessel with greater vehicle carrying capacity without increasing the vessel's draft. Such vessels could help the NCFS to sustain the current level of service and to meet future demand challenges.

The first composite ferry vessel in the U.S. is currently under construction for Kitsap Transit in the State of Washington. The passenger-only vessel will serve the Bremerton to Seattle route. The vessel will be 77 feet in length, and capable of transporting 118 passengers at speeds of 33 to 38 miles per hour. The goal for this specific application of a composite superstructure is to create an ultra low-wake vessel to minimize environmental impacts. The estimated cost of the vessel is $5.3 million.

There are two challenges to designing and constructing a ferry with a composite superstructure for the NCFS. First, the U.S. Coast Guard does not have standards in place regulating composite superstructures. Use of a composite superstructure in vessels is approved on a case-by-case base. Second, traditional commercial vessel builders in the U.S. may not have the workforce with the necessary skills to work with composite materials, as the vast majority of commercial vessels are built of steel. The use of composite materials, however, prevails in the recreational boat-building industry. There are approximately 100 recreational boat builders in North Carolina that sell $500 to $600 million dollars worth of boats per year, making that industry a major contributor to the state's economy.

Given the Ferry System's desire to develop a sustainable vessel replacement program for the next 30 years, coupled with an interest in composite superstructure vessels to improve operating efficiency, it could make economic sense for North Carolina to tap into its own workforce of skilled boat builders to construct ferry vessels and to elevate the state's boat-building capabilities to a new level.

[6] "Maryland – Virginia Ferry Feasibility Study" for Somerset County, the City of Crisfield, Northumberland County, and the Northern Neck Planning District Commission, PB Consultant, Inc., 2004

VI. Summary of Findings

The NCFS is doing an exceptional job operating 21 vessels on seven unique routes serving North Carolina coastal communities. In addition to transporting commuters and tourists, the Ferry System serves critical community service and public safety roles, provides emergency services to residents and visitors, offer a means of emergency evacuation, and sometimes even rescues distressed boaters. The reduction in services during the summer of 2009 impacted some communities more severely than others. There will be significant impacts to these communities if additional service reductions take place.

Coastal community residents and visitors have a high overall satisfaction with the Ferry System's services. The number of sailings per day ranked high on travelers' concerns for routes with heavy commuter use, especially those that experienced cuts during the summer of 2009. Responses were split nearly evenly between those who indicated they were willing to pay, and those not willing to pay for the service they received. A majority of passengers who indicated a willingness to pay believed ferry travelers should pay for 25% of the cost to operate the service.

The aging vessels — especially those crossing Pamlico Sound — cause frequent service interruptions due to breakdowns and the lack of stand-by vessels. In addition, key support vessels have passed their usefulness, and at least one has failed a U.S. Coast Guard inspection.

The NCFS needs to develop a vessel replacement program in order to replace ten vessels by 2020. This can be accomplished through either North Carolina General Assembly appropriations or through expanded tolling. Without such a vessel replacement program, reduction or elimination of current services will occur as a result of missed sailings due to increased Coast Guard inspection frequency, lack of stand-by vessels to substitute for vessels undergoing inspection, and for those experiencing a mechanical breakdown. The impacts to the shipyard workforce need to be properly evaluated in order to meet the maintenance demands.

An opportunity exists to collaborate with the North Carolina Turnpike Authority to adopt a seamless tolling system that serves both North Carolina highway and ferry travelers. There is no suitable one-size-fits-all tolling technique or technology — each ferry route will require a different solution. The Hatteras – Ocracoke route may require adoption of a hybrid ferry/public transit model to meet unique local needs.

Future opportunities such as high-speed ferry vessels and composite superstructure ferry vessels are relatively new in the U.S. North Carolina, a state with a rich history of in boat-building can leverage this opportunity to benefit the state's economy, improve ferry services, and continue to provide mobility in the coastal region.

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